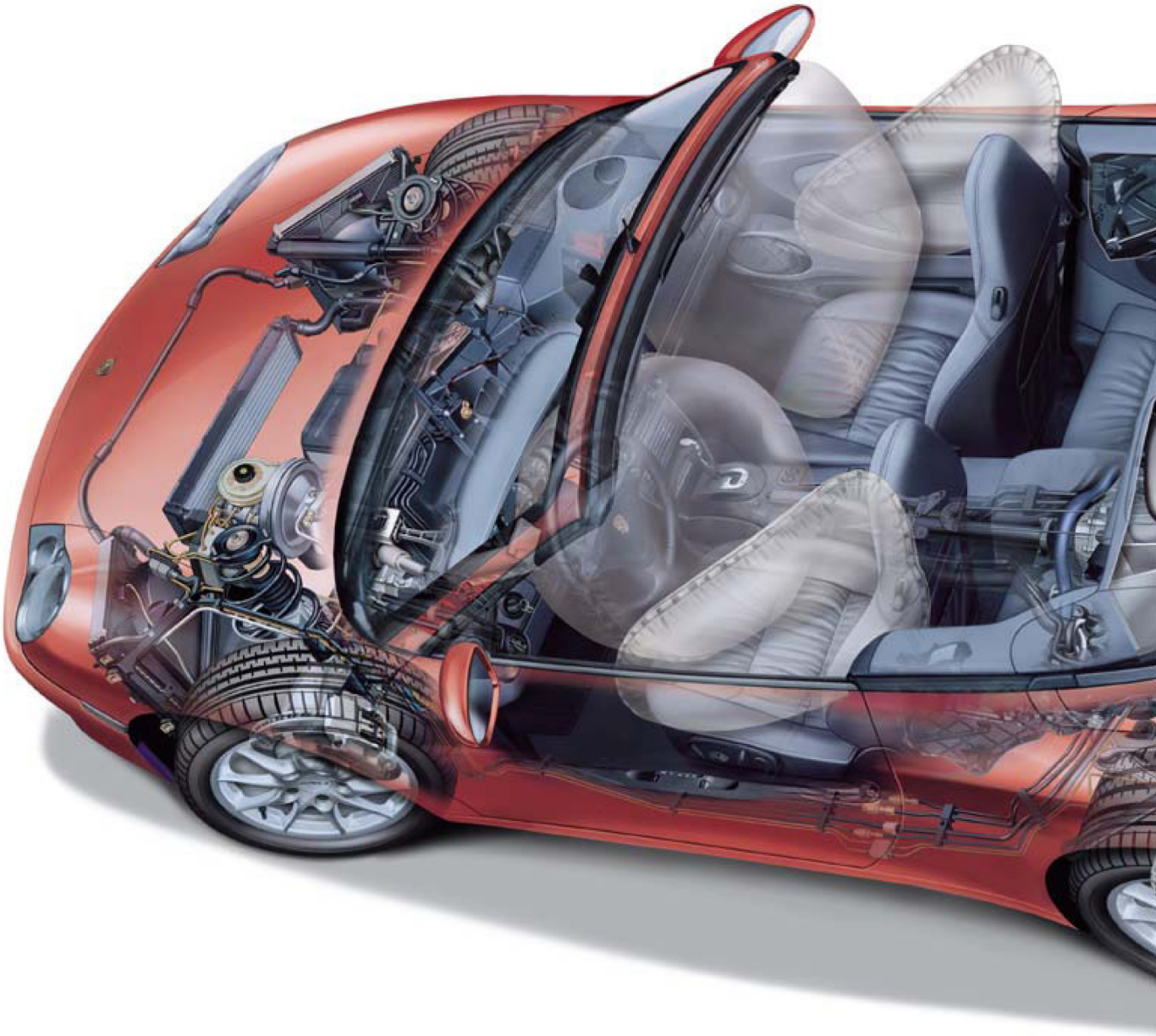


Workshop Manual

928

DR. ING. h. c. F. PORSCHE Aktiengesellschaft

Structure of the Workshop Manual

This Workshop Manual describes all of the important operations for which special instructions are required to ensure proper completion.This manual is essential for shop foremen and mechanics who need this information to keep the vehicles in safe operating condition. The basic safety rules, of course, also apply to all repairs on vehicles, without exception.

Breakdown of the Workshop Manual

1. Overview of repair groups
2. Record sheet for supplements
3. List of contents
4. Technical data
5. Repair groups

Breakdown of the repair groups

1. Table of tightening torques
2. Special tools required
3. Exploded diagrams
4. Legends for the exploded diagrams
5. Notes on assembly/application of special tools
6. Diagnosis for the repair groups

The Workshop Manual will be updated regularly by means of supplements which must be filed immediately to maintain the usefulness of the manual. Appropriate entries must be made in the record sheet to prove that the manual is complete.

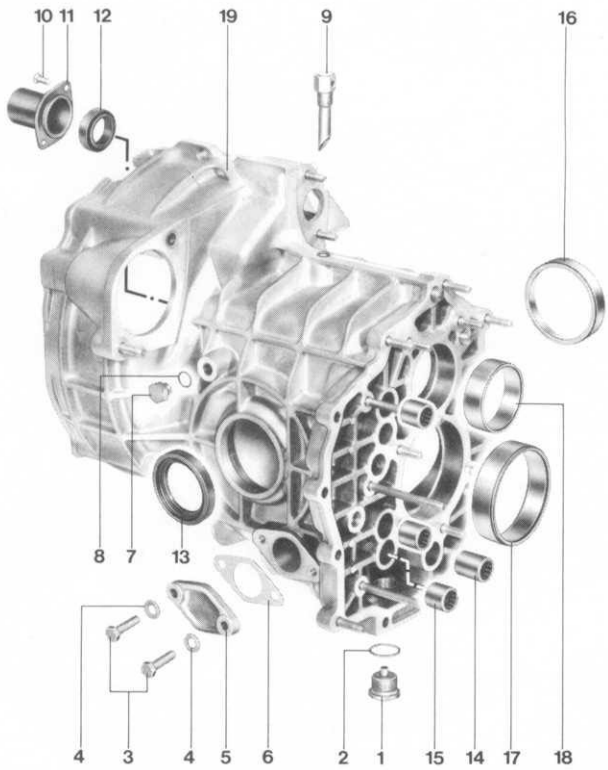
The content of this Workshop Manual will be supplemented with Technical Information Bulletins, which will be integrated into the manual from time to time.

Descriptions of design and function can be found in the service training course reference material.

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Layout of the exploded diagram

Disassembling and assembling transmission



G No	Description	Qty.	H Note when: Removing	Installing
1	Screw plug	1		Clean, tighten with 30 Nm
2	Sealing ring	1		Replace
3	Hexagon head screw	2		Tighten with 23 Nm (17 ftlb)
4	Washer	2		
5	Flange	1		
6	Seal	1		Replace
7	Screw plug	1		Tighten with 23 Nm (17 ftlb)
8	Sealing ring	1		Replace
9	Breather	1		Tighten with 35 Nm (26 ftlb). Observe installation position
10	Fillister head screw	2		Tighten with 10 Nm (7 ftlb)
11	Guide tube	1		
12	Rotary shaft seal	1		Only install after assembling the gear set (also refer to Page 34-113)
13	Rotary shaft seal	1		Drive into position with Special Tool 9252. Pack space between sealing lips with Klüber Silubrin Grease S
14	Spherical sleeve	1	Pull out with a suitable internal puller (e.g. Schrem 14-20)	Press in with Special Tool 9254

A - Repair group, numbers
B - Repair groups, text
C - Type of vehicle to repaired
D - Page number
E - Operation
F - Impressum, supplement number, year of printing
G - Diagram item number in the order of disassembling
H - Special notes to be observed when installing or removing

The notes on assembly/application of special tools which are given after the exploded diagram are always arranged in the order of text → diagram.

This workshop manual describes all of the important operations for which special instructions are required to assure proper completion. This manual is essential for the shop foremen and mechanics, who need this information to keep the vehicles in a safe operating condition. The basic safety rules, of course, also apply to repairs on vehicles without exception.

The information is grouped according to repair numbers which are identical to the first two digits of the repair time and warranty code.

The repair group index, an alphabetical index and the register table are quick guides to find information in the manual.

Descriptions of design and function can be found in the service training course reference material.

This workshop manual will be kept up to date with workshop bulletins, which will be made part of the manual from time to time. We recommend that these workshop bulletins be filed in the special folder provided for this purpose.

SUPPLEMENT TO 928 REPAIR MANUAL
(XVIII)

Information Sheet - Extension of the 928 Repair Manual to 7 Volumes

Overview of Repair Manual Volumes:

Volume	I	= Drive Unit
Volume	I - A	= Drive Unit
Volume	II	= Drive Train
Volume	III	= Drive Train
Volume	IV	= Chassis, Heating, Air Conditioning
Volume	V	= Bodywork, Car Electrics
Volume	VI	= Car Electrics (Circuit Diagrams)
Volume	VII	= Car Electrics (Circuit Diagrams, '88 Models Onward)

Please file the pages in the volumes of the Repair Manual as follows:

1. Please file pages 20 - 1 to 28 - 71 of the original Volume I - Drive Unit in the new Volume I-A - Drive Unit.

2. The new Volume VII Car Electrics (Circuit Diagrams, '88 Models Onward) contains pages 97 - 281 to 97 - 305.

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NEW INTERNATIONAL UNIT SYSTEM

The "Legislation Concerning Units of Measurement" was passed in the Federal Republic of Germany on July 5, 1970. The new units have to be applied in official and business transactions by the end of the allocated transition period on December 31, 1977 (some even earlier).

The new units are derived from the international system of basic units.

Basic Units

Factor	Unit	
	Name	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric strength of current	Ampere	A
Temperature	Kelvin	K
Intensity of light	Candela	cd
Substance quantity	Mol	mol

Decimal multiples and parts of units can be made by adding prefixes in front of the unit symbols.

Prefixes

Power of ten	Prefix	Prefix Symbol
10^{12}	Tera	T
10^{9}	Giga	G
10^{6}	Mega	M
10^{3}	Kilo	k
10^{2}	Hecto	h
10	Deka	da
10^{-1}	Deci	d
10^{-2}	Centi	c
10^{-3}	Milli	m
10^{-6}	Micro	µ
10^{-9}	Nano	n
10^{-12}	Pico	p

Examples:

1. Unit m (meter). By adding prefix k (kilo) we have km (kilometer = 1,000 m).

2. Unit s (second). By adding prefix m (milli) we have ms (millisecond = 1/1000 s).

The following list is a survey of important units used frequently in motor vehicle repair operations.

List of Units

Factor	Basic Unit	Other Acceptable Units	Remarks
Length	m	µm, mm, cm, dm, km etc.	No longer acceptable: µ for 0.001 mm
			0.001 mm = 1 µm
Area	m^2	mm^2, cm^2, dm^2 etc.	No longer acceptable: qm, qmm, qcm etc.
Volume	m^3	mm^3, cm^3, dm^3 etc. l, ml, cl etc.	No longer acceptable: cbm, cmm, ccm etc., ltr., Ltr.
			1 l = 1 dm^3
Plane angle	rad (radiant)	° (degree) ' (minute) " (second)	1 rad = 1 m/m 1° = π/180 rad 1° = 60' 1' = 60"
			" not acceptable for inch
Solid angle	sr (steradiant)	m^2/m^2	1 sr = 1 m^2/m^2
Mass	kg	g, mg, dag etc. t, kt, Mt etc.	No longer acceptable: pound, hundredweight, double-hundredweight
			1 t = 1000 kg
			Weight is given in kg

Factor	Basic Unit	Other Acceptable Units	Remarks
Density	kg/m^3	kg/dm^3, kg/l, g/cm^3 etc.	No longer acceptable: specific weight
Time	s	min (minute) h (hour) d (day) a (year)	3h = 3 hours 3^h = 3 o'clock For time data, e.g. $3^h40^m20^s$ min can be abbreviated in m
			No longer acceptable: Sec., sec., hr.
Volumetric flow (flow rate)	m^3/s	cm^3/min 1/s, 1/h etc.	
Frequency	Hz (Hertz)	kHz, MHz etc.	1 Hz = 1/s
Speed of revolvement	1/s s^{-1}	1/min min^{-1}	No longer acceptable: U/min, Upm
Speed of travel	m/s	km/h	
Acceleration	m/s^2		g (acceleration of fall) $g \approx 9.81\ m/s^2$
Force	N (Newton)	kN, MN etc.	No longer acceptable: p, kp, Mp, dyn
			1 N = 1 kg m/s^2 1 kp - 9 81 N ≈ 10 N
Pressure	N/m^2 Pa (Pascal)	bar, mbar etc.	No longer acceptable: kp/cm^2, atm, at, ata, atü, atu, mmHg, Torr, mWs
			Pressure or vacuum must be specified, e.g.: 2 atü ≈ 2 bar pressure = 3 bar 0,4 atu ≈ 0.4 vacuum = 6 bar 5 ata ≈ 5 bar

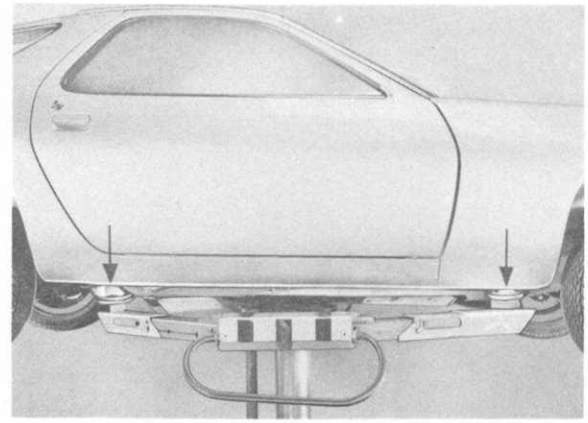
Factor	Basic Unit	Other Acceptable Units	Remarks
			1 N/m^2 = 1 Pa 1 mbar = 100 Pa 1 bar ≈ 1 kp/cm^2 = 1 at 1 bar = 750 Torr
Mechanical stress (strength)	N/m^2	N/m^2	No longer acceptable: kp/cm^2, kp/mm^2
Dynamic viscosity	Pa s	mPa s, µPa s	No longer acceptable: P (Poise), cP, kg s/m^2, dyn s/cm^2
			1 Pa s = 10 P ≈ 0.1 kg s/m^2
Kinematic viscosity	m^2/s	cm^2/s, mm^2/s	No longer acceptable: St (Stokes), cSt, E (Engler degree)
	1		1 cm^2/s = 1 St
Torque	Nm	Ncm, Nmm	No longer acceptable: kpm, kpcm, etc.
			1 Nm ≈ 0.1 kpm 1 Nm = 1 kgm^2/s^2
Work, energy, heat quantity	J (Joule)	mJ, kJ etc. Nm, kWh, Ws	No longer acceptable: kpm, erg, cal, kcal, PSh, We (thermal unit)
			1 J = 1 Nm = 1 Ws 1 J ≈ 0.1 kpm 1 cal = 1 WE ≈ 4.19 J 1 PSh ≈ 0.736 kWh
Specific fuel consumption	kg/kWh	g/kWh, kg/J	No longer acceptable: g/PSh, kg/PSh
Power	W (watt)	mW, kW etc.	No longer acceptable: PS
			1 PS ≈ 0.736 kW

Factor	Basic Unit	Other Acceptable Units	Remarks
Weight coefficient	kg/W	kg/kW	No longer acceptable: kg/PS
Temperature	K (Kelvin)	°C	No longer acceptable: °K (degrees Kelvin), grd. (temperature difference)
			1° C = 1 K
Electric current strength	A (ampere)	µA, mA etc.	
Electric voltage	V (volt)	µV, mV, etc.	1 V = 1 W/A
Electric resistance	Ω (Ohm)	mΩ , kΩ etc.	1Ω = 1 V/A
Electric charge, electrical quantity	C (Coulomb)	Ah, As	1 C = 1 As
Electric capacitance	F (Farad)	pF, µF, mF	1 F = 1 C/V
Sound level	phon	dB (decibel)	
Light flux	lm (Lumen)		1 lm = 1 cd sr
Light intensity	lx (Lux)		1 lx = 1 lm/m^2

LIFTING CAR

1. Lifting with hoist

Only use lift points shown.

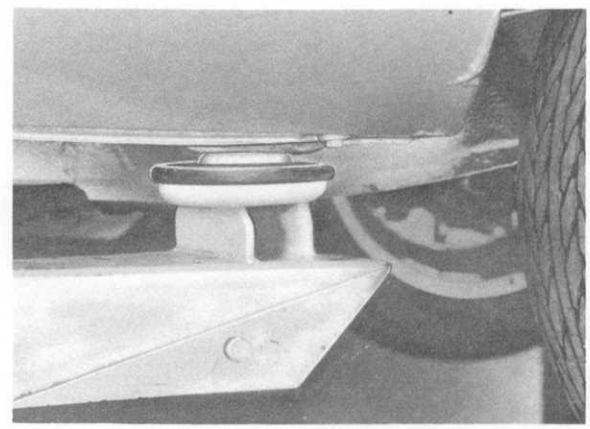


Caution

When driving car on hoist platform, make sure that there is sufficient space between hoist and car.

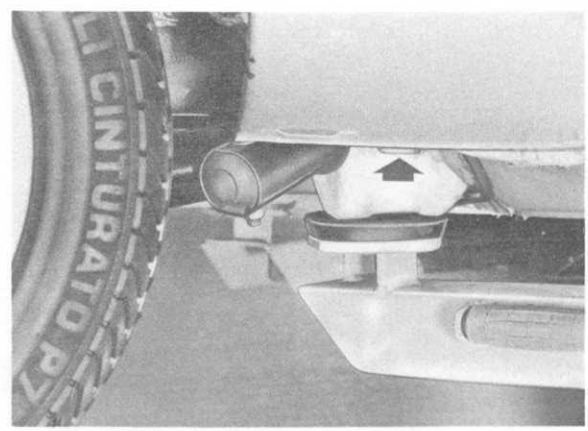
Front

On car jack pick-up point.



Rear

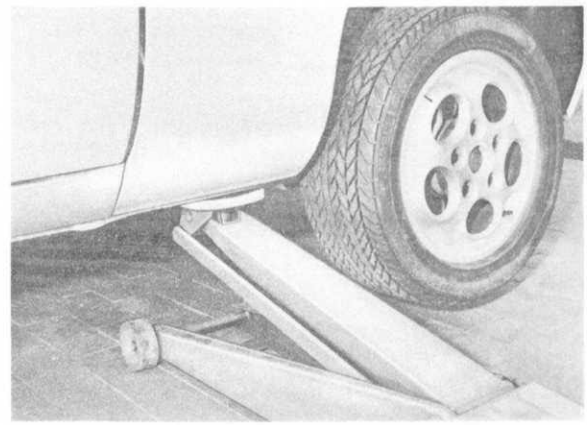
On rear axle control arm bracket.



2. Lifting with floor jack

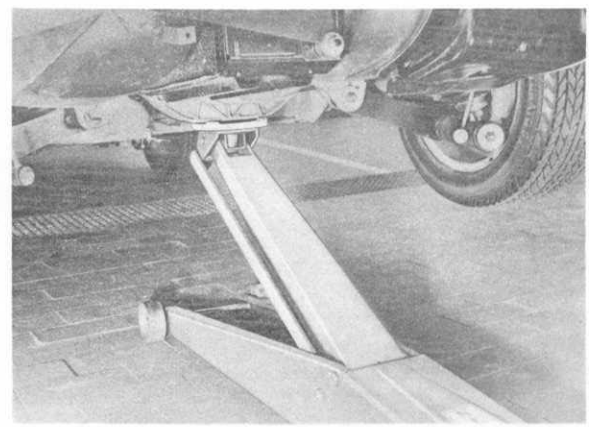
Side

Front or rear on pick-up points for car jack. Use an appropriate piece of wood between jack lifting plate and pick-up point.



Rear

On cross member for rear axle control arm.



Note

Never raise car on engine oil pan or transmission, since this could cause serious damage.

TECHNICAL DATA

(Adjusting specifications and wear limits are listed in each individual repair group.)

Note: USA values in brackets.

Engine

Internal engin code		M 28/03 w/man. trans. M 28/04 w/auto. trans.
No. of cylinders		8
Bore	mm/in.	95.0/3.74
Stroke	mm/in.	78.9/3.11
Displacement (actual)	$cm^3/in.^3$	4474/272.97
Compression ratio		8.5 : 1
Max. engine power, DIN 70020	kW/HP	169/230
Net power, SAE J 245	kW/HP	164/219
at engine speed	rpm	5250
Max. torque, DIN 70020	Nm/kpm	343/35.0
Net torque, SAE J 245	Nm/ft lbs	333/245
at engine speed	rpm	3600
Max. specific power output,		
DIN 70020	kW/l / HP/l	40/54
SAE J 245	kW/l / HP/l	38/51
Engine speed limit (by electronic cut-off of fuel pumps)		6300 ± 200
Engine weight (dry)	kg/lb	260/573

Engine Design

Type	8 cylinder, 4 stroke, internal combustion V-engine
Crankcase	Two-piece, cast light alloy, without cylinder liners
Crankshaft	Forged steel, 5 bearings
Connecting rods	Forged sintered steel
Pistons	Cast ligth alloy, chrome plated or iron coated bearing surfaces

Camshaft		Cast steel, runs in camshaft housing without bearing shells
Camshaft drive		Toothed belt and tensioning roller
Cylinder head		Aluminum
Valve arrangement		1 intake, 1 exhaust, overhead, in-line
Valve train		By overhead camshaft and hydraulic cam followers
Timing (1 mm lift, zero valve clearance)	Int. opens	8° ATDC
	Int. closes	55° ABDC
	Exh. opens	38° BBDC
	Exh. closes	2° BTDC
Valve clearance		Automatic hydraulic adjustment
Engine Cooling		Closed cooling system, mechanical fan with viscous coupling (electric fan and thermo switch for air conditioning)
Engine Lubrication		Pressure lubricating system with sickle type pump
Oil filter		Full flow
Oil pressure at 5000 rpm		Approx. 5 bar at 80 to 100° C/176 to 212° F oil temperature
Oil pressure indication		Indicator lamp and pressure gage
Oil consumption	1/1000 km qt/600 mi.	Approx. 1.5
Exhaust System		Double pipes up to catalytic converter, intermediate and main mufflers
Emission control		EGR, air pump
Heating		Warm water heater with heat exchanger and blower
Fuel System		CIS (continuous) fuel injection
Fuel supply		2 elec. delivery pumps, connected in series

Fuel octane requirement	RON/MON/CLC	91/84/87
Electrical System		
Battery voltage	V	12
Battery capacity	Ah	66
Battery capacity (optional)	Ah	88
Alternator output	A/W	90/1260
Ignition (breakerless)		Transitorized/coil ignition
Firing order		1 - 3 - 7 - 2 - 6 - 5 - 4 - 8
Basic ignition setting		31° BTDC at 3000 rpm with vacuum hose disconnected
Spark plugs		Bosch W 145 T 30 Beru 145/14/3 A
Spark plug gap	mm/in.	0.7 + 0.1/0.028 + 0.004
Transmission		Rear-mounted (5-speed manual transmission) combined with final drive. Connected to front-mounted engine/clutch by central tube.
Clutch		Double disc, diaphragm spring dry clutch
Pressure plate		MFZ 2/215 Ks ph
Body Type		Coupe with integral steel body, 2 doors, rear lid and retractable headlights. Aluminum hood, doors and bolted front fenders. (sliding roof optional)

Dimensions			(at total permissible weight)
Length		mm/in.	4462/175.67
Width		mm/in.	1836/72.28
Height		mm/in.	1311/51.61
Wheelbase		mm/in.	2500/98.43
Track			
front at curb weight		mm/in.	1545/60.82
at total weight		mm/in.	1551/61.06
rear at curb weight		mm/in.	1514/59.60
at total weight		mm/in.	1530/60.23
Ground clearance		mm/in.	119/4.69
Overhang angle	front		22°
	rear		18° 30'

Weights

Curb weight without options			Man. trans.	Auto. trans.
	Front	kg/lb	745/1642	745/1642
	Rear	kg/lb	745/1642	785/1731
	Total	kg/lb	1490/3285	1530/3373

Curb weight with options			Man. trans.	Auto. trans.
	Front	kg/lb	765/1686	765/1686
	Rear	kg/lb	765/1686	795/1753
	Total	kg/lb	1530/3373	1560/3492

Max. axle load,	front	kg/lb	900/1984
	rear	kg/lb	1000/2200
Max. total weight		kg/lb	1870/4123
Max. roof load, including roof rack		kg/lb	35/77
Max. trailer load			
	without trailer brakes	kg/lb	750/1653 (up to grades of 16 %)
	with trailer brakes	kg/lb	1600/3527 (up to grades of 16 %)
Max. towing weight		kg/lb	3470/7650
Max. tongue weight		kg/lb	50/110

Filling Capacities

Engine oil		HD oils to API classification SD or SE, viscosity: summer SAE 30, winter SAE 20, at continuous temperatures between - 15° C and 0° C SAE 20 W 20, or SAE 10 W for continuous temperatures below - 15° C. (multi-grade oils: 15 W 50 or 20 W 50 when approved).
Engine oil change	1 tr/qt	Approx. 6.5/6.85 (level on dipstick is important)
Engine coolant	1 tr/qt	Approx. 16/17
Transmission oil		Hypoid oil SAE 90 to MIL-L 2105 B. API classifiaction GL 5.
Transmission and differential	1 tr/qt	Approx. 3.8/4
Fuel tank	1 tr/gal.	Approx. 86/22,5, of which 11 liters 2,9 gal. for reserve
Brake fluid reservoir	1 tr/qt	Approx. 0.2/0.2
Windshield washer and headlight cleaner reservoir	1 tr/qt	Approx. 8/8,5 (water)
Cleaning solution reservoir	1 tr/qt	Approx. 0.6/0.6

Performance

(with 5-speed transmission)

Top speed	km/h / mph	above 230 / 144
Acceleration 0 - 100 km/h, 0 - 62 mph	s	6.8
1000 m from standing start	s	27.0
Power to weight	kg/kW / kg/HP	8.3 / 6.0

Hill Climbing

(with 5-speed transmission)

1st gear	%	71
2nd gear	%	41
3rd gear	%	28
4th gear	%	18
5th gear	%	11

TECHNICAL DATA - 1980, 1981, 1982 Models

(Adjusting specifications and wear limits are listed in each individual repair group.)

Engine

Internal engine code		M 28/13, automatic M 28/14 from 1981: M 28/15, automatic M 28/16
No. of cylinders		8
Bore	mm/in.	95.0/3.74
Stroke	mm/in.	78.9/3.11
Displacement (actual)	cm^3/$in.^3$	4474/272.97
Displacement (rounded off)	cm^3	4420
Compression ratio		9.0 : 1
Max. engine power, DIN 70020	kW/HP	170/231
Net power, SAE J 245	kW/HP	165/220
at engine speed	rpm	5250 (5500)
Max. torque, DIN 70020	Nm/kpm	360/36.7
Net torque, SAE J 245	Nm/ft. lbs.	348/265
at engine speed	rpm	4000
Max. specific power output, DIN 70020	kW/1 / HP/1	38/52
SAE J 245	kW/1 / HP/1	37/49
Engine speed limit		without
Engine weight (dry)	kg/lb	245/540

Engine Design

Type	8 cylinder, 4 stroke, internal combustion V-engine
Crankcase	Two-piece, cast light alloy, without cylinder liners
Crankshaft	Forged steel, 5 bearings
Connecting rods	Forged sintered steel
Pistons	Cast light alloy, chrome plated or iron coated bearing surfaces

Camshaft		Cast steel, runs in camshaft housing without bearing shells
Camshaft drive		Toothed belt and tensioning roller
Cylinder head		Light alloy
Valve arrangement		1 intake, 1 exhaust, overhead, in-line
Valve timing		By overhead camshaft and hydraulic cam followers
Timing (1 mm lift, zero valve clearance)		Intake opens 12° after TDC Intake closes 48° after BDC Exhaust opens 32° before BDC Exhaust closes 6° before TDC
Valve clearance		Automatic hydraulic adjustment
Engine Cooling		Closed cooling system, mechanical fan with viscous coupling (electric fan and thermo switch for cars with air conditioner)
Engine Lubrication		Pressure lubricating system with sickle type pump
Oil filter		Full flow
Oil pressure at 5000 rpm		Approx. 5 bar at 80 to 100° C/176 to 212° F oil temperature
Oil pressure indication		Indicator lamp and pressure gauge
Oil consumption	1/1000 km qt/600 mi.	Approx. 1.5
Exhaust System		Twin pipes up to catalytic converter, then single pipe to center and final mufflers
Emission control		Oxygen sensor with 3-way catalytic converter ; from 1981 additional secondary air injection
Heating		Warm water heater with heat exchanger and blower
Fuel System		AFC (Air Flow Controlled) fuel injection
Fuel supply		Electric delivery pump

Fuel octane requirement RON/MON/CLC		91, 84, 87 leadfree

Electrical System

Battery voltage	V	12
Battery capacity	Ah	66
Battery capacity (optional)	Ah	88
Alternator output	A/W	90/1260
Ignition (breakerless)		Transistorized coil ignition
Firing order		1-3-7-2-6-5-4-8

Transmission

Front-mounted engine, rear-mounted transmission, bolted to a rigid, central tube to make up a rigid drive unit/trans-axle. Front-mounted engine, clutch, torsion drive shaft to transmission running in rigid, central tube, rear-mounted transmission and final drive unit, double constant velocity joints, rear wheels

Clutch

Double-plate, diaphragm spring, dry clutch (pull-to-release type) on engine side

Automatic transmission

Hydraulic torque converter, stall ratio **approx.** 2.0 : 1

Body Type

Coupe with integral steel body, 2 doors, rear lid and retract-able headlights. Aluminum hood, doors and bolted front fenders, (sliding roof optional)

Dimensions

Length	mm/in.	4462/175.67
Width	mm/in.	1836/72.28
Height (at DIN curb-weight)	mm/in.	1282/50.47
Wheelbase (in designed position)	mm/in.	2500/98.43
Track :		
front at curb weight	mm/in.	1549/60.98
at total weight	mm/in.	1552/61.10
rear at curb weight	mm/in.	1521/59.88
at total weight	mm/in.	1529/60.20
Ground clearance at total weight	mm/in.	120/4.72
Bed clearance at total weight	mm/in.	40/1.57
Overhang angle		
front at total weight		20°
rear at total weight		16°

Weights

Curb weight without extra equipment		
front	kg/lb	745/1643
rear	kg/lb	745/1643
total	kg/lb	1520/3351 1535/3385 automatics
Max. curb weight with extra equipment	kg/lb	1540/3395
Max. axle load		
front	kg/lb	900/1984
rear	kg/lb	1000/2200
Max. total weight	kg/lb	1870/4123
Max. roof load	kg/lb	35/77 - from 1982: 75/165 with *Porsche roof transport system

Capacities

Engine oil		Quality HD oils to API classification SE. For all year operation multigrade oils of viscosity SAE 15 W-50 or 20 W-50 (latter oil not for constant temperatures below - 15° C/+5°F). Emergency use of single grade HD oil to API classifications SE or SF and in fact SAE 30 for summer and SAE 20 for winter (only for constant temperatures below + 5° C/+ 41° F).
Engine oil volume	ltr /qt	Approx. 7.5/8.5 (level on dipstick is important)
Engine coolant	ltr /qt	Approx. 16/17
Transmission oil		Hypoid oil SAE 75 W-90 to MIL-L 2105 B, API classification GL 5
Transmission and differential	ltr /qt	Approx. 3.8/4
Fuel tank	ltr /gal.	Approx. 86/22.5 of which about 8 liters/2.1 in reserve
Brake fluid reservoir	ltr /qt	Approx. 0.2/0.2
Reservoir for windshield washer and headlight cleaner	ltr /qt	Approx. 6/6.4 (water)
Reservoir for cleaning solution	ltr /qt	Approx. 0.6/0.6

Performance

		Manuals	Automatics
Top speed	km/h / mph	230/143	225/140
Acceleration from 0 to 100 km/h (0 to 60 mph)	s	7.5	8.5
1000 m from standing start	s	28.0	29.0
1/4 mile from standing start	s	15.5	16.0
Power to weight	kg/kW / kg/HP	8.9/6.6	9.2/6.8

Hill Climbing

1st gear	%	62	39
2nd gear	%	41	21
3rd gear	%	28	11
4th gear	%	18	
5th gear	%	11	

TECHNICAL DATA – Type 928 S

(Adjusting specifications and wear limits are listed in each individual repair group).

Engine

Internal engine code		M 28/19, automatics M 28/20
No. of cylinders		8
Bore	mm/in.	97.0/3.82
Stroke	mm/in.	78.9/3.11
Displacement (actual)	$cm^3/in.^3$	4664/284.60
Displacement (rounded off)	cm^3	4608
Compression ratio		9.3 : 1
Max. engine power, DIN 70020	kW/HP	178/242
Net power, SAE J 1349	kw/HP	174/234
at engine speed	rpm	5250
Max. torque, DIN 70020	Nm/kpm	365/37,2
Net torque, SAE J 1349	Nm/ft.lbs.	357/263
at engine speed	rpm	4000
Max. specific power output,		
DIN 70020	kW/l HP/l	38/52
SAE J 1349	kw/l HP/l	37/50
Speed limit through ignition cut-off at	rpm	without
Engine weight (dry)	kg	261

Engine Design

Type	8 cylinder, 4 stroke, internal combustion V-engine
Crankcase	Two-piece, cast light alloy without cylinder liners
Crankshaft	Forged steel, 5 bearings
Connecting rods	Forged sintered steel
Pistons	Cast light alloy, chrome plated or iron coated bearing surfaces

Camshaft		Cast steel, running in camshaft housing without bearing shells
Camshaft drive		Toothed belt and tensioning roller
Cylinder head		Light alloy
Valve arrangement		1 intake, 1 exhaust, overhead, in-line
Valve timing		By overhead camshaft and hydraulic cam followers
Timing (1 mm lift, zero valve clearance)		Intake opens 11° ATDC Intake closes 46° ABDC Exhaust opens 25° BBDC Exhaust closes 2° ATDC
Valve clearance		Automatic hydr. adjustment
Engine Cooling		Closed cooling system, mechanical fan with visco coupling (also electric fan and thermo switch for cars with air conditioner)
Engine Lubrication		Pressure lubricating system with sickle type pump
Oil filter		Full flow
Oil pressure at 5000 rpm		Approx. 5 bar at 80 to 100° oil temperature
Oil pressure indication		Indicator lamp and pressure gauge
Oil consumption	l/1000 km	Approx. 1.5
Exhaust System		Double pipes up to catalytic converter, then single pipe in and out of intermediate muffler, double pipes in final muffler
Emission control		Oxygen sensor with 3-way catalytic converter and secondary air injection
Heating		Warm water heater with heat exchanger and blower
Fuel System		AFC (Air Flow Controlled) Fuel injection
Fuel supply		1 electric delivery pump

Fuel octane requirement	RON	91 leadfree

Electrics

Degree of shielding		ECE R 10 and 72/245/EC
Battery voltage	V	12
Battery capacity	Ah	88
Alternator output	A/W	90/1260
Ignition (breakerless)		Transistor coil ignition
Firing order		1 - 3 - 7 - 2 - 6 - 5 - 4 - 8

Transmission

Front-mounted engine, rear-mounted transmission, bolted to a connecting tube to make up a rigid drive unit = transaxle.
Front-mounted engine, clutch, torsional elastic drive shaft to transmission running in connecting tube, rear-mounted transmission/final drive unit, double joints, rear wheels

Clutch

Double-plate, diaphragm spring, dry clutch in pulled version and arranged on engine side

Automatic transmission

Hydraulic torque converter, moving off conversion ratio approx. 2.0 : 1

Body Type

Coupe with integral steel body, 2 doors, tailgate and retractable headlights. Aluminum hood, doors and bolted front fenders (optional with sliding roof)

Dimensions

Length	mm/in.	4462/175.67
Width	mm/in.	1836/72.28
Height (at DIN curbweight)	mm/in.	1282/50.47
Wheelbase (in designed position)	mm/in.	2500/98.43
Track width:		
front at curbweight	mm/in.	1549/60.98
at total weight	mm/in.	1552/61.10
rear at curbweight	mm/in.	1521/59.88
at total weight	mm/in.	1529/60.20
Ground clearance	mm/in.	120/4.72
Bed clearance	mm/in.	40/1.57
Overhand angle to DIN		
front		15° - 22° without front spoiler
rear		19.6^{o}

Weights

Curbweight without extra equipment		
front	kg	725
rear	kg	725
total	kg	1450
Curbweight with extra equipment up to	kg	1520, 1535 automatics
Max. axle load		
front	kg	900
rear	kg	1000
Max. total weight	kg	1870
Max. roof load	kg	75 with Porsche roof transport system
Max. trailer load		
without trailer brakes	kg	750 (for grades up to 12 %)
with trailer brakes	kg	1600 (for grades up to 12 %)
Max. towing weight	kg	3470
Max. tongue weight	kg	50

Filling Capacities

Engine oil		Quality HD multi-grade pils of API classification SE or SF. Single-grade oils may only be used when multi-grade oils are not available and operating conditions are normal.
Engine oil volume	l	Approx. 7.5 (level on dipstick is important)
Engine coolant	l	Approx. 16
Transmission oil		Hypoid oil SAE 75 W-90 to MIL-L 2105 B, API classification GL 5
Oil volume for transmission and differential	l	Approx. 3.8
Fuel tank	l	Approx. 86, of which 8 liters in reserve
Brake fluid tank	l	Approx. 0.2
Tank for windshield washer and headlight cleaner	l	Approx. 6 (water)
Tank for cleaning solution	l	Approx. 0.6

Performance

		Manual	Automatic
Top speed	km/h / mph	235/146	230/143
Acceleration from 0 to 100 km/h (0 to 60 mph)	s	6.8	7.2
1000 m from standing start	s	27.5	28.2
1/4 mile from standing start	s	15.2	15.5
Power to weight			
DIN 70020	kg/kW/kg/HP	8.5/6.3	
SAE J 1349	kg/kW/kg/HP	8.7/6.5	8.8/6.6

Hill Climbing

1st gear	%	61	52
2nd gear	%	39.5	30.5
3rd gear	%	25	14.5
4th gear	%	16	7.5
5th gear	%	9.5	

TECHNICAL DATA – TYPE 928 S – 1984/'85/'86 Models

(Adjusting specifications and wear limits are listed in each individual repair group.)

Note: USA values are in brackets.

Engine

Internal engine code		M 28/21, Automatic M 28/22 (USA, Japan, Canada M 28/19, Automatic M 28/20)
Bore	mm/in.	97.0/3.82
Stroke	mm/in.	78.9/3.11
Displacement (actual)	cm^3/$in.^3$	4664/284.60
Displacement (rounded off)	cm^3	4632
Compression ratio		10.4 : 1 (9.3 : 1)
Max. engine power 80/1269/EC	kW/HP	228/310 (178/242)
Net power, SAE J 1349	kW/HP	174/234
at engine speed	rpm	5900 (5250)
Max. torque, 80/1269/EC	Nm/kpm	400/40.7 (365/37.2)
Net torque, SAE J 1349	Nm/ft. lbs.	357/263
at engine speed	rpm	4100 (4000)
Max. specific power output		
DIN 70020	kW/l / HP/l	49/67 (38/52)
SAE J 1349	kW/l / HP/l	37/50
Speed limit by stopping fuel feed	rpm	6400 (USA, without)
Engine weight (dry)	kg	261

Engine Design

Type	8 cylinder, 4 stroke, internal combustion V-engine
Crankcase	Two-piece, light alloy, without cylinder liners
Crankshaft	Forged sintered steel, 5 bearings
Connecting rods	Forged sintered steel
Pistons	Cast light alloy, chrome plated or iron coated bearing surfaces
Cylinders	Light alloy

Camshaft		Cast steel, runs in camshaft housing without bearing shells
Camshaft drive		Toothed belt
Cylinder head		Light alloy
Valve arrangement		1 intake, 1 exhaust, overhead, in-line
Valve timing		By overhead camshafts and hydraulic cam followers
Timing (1 mm lift, zero valve clearance)		Intake opens 6° ATDC (11° ATDC) Intake closes 54° ABDC (46° ABDC) Exhaust opens 43° BBDC (25° BBDC) Exhaust closes 4° BTDC (2° ATDC)
Valve clearance		Automatic hydraulic adjustment
Engine Cooling		Closed cooling system, mechanical fan with viscous coupling (additional series connected electric fan and thermo switch for cars with air conditioner)
Engine Lubrication		Pressure lubricating system with sickle type pump
Oil filter		Full flow
Oil pressure at 5,000 rpm		Approx. 5 bar at 80 to 100 °C/176 to 212 °F oil temperature
Oil pressure indication		Indicator lamp and pressure gauge
Oil consumption	l/1000 km	Up to 1.5
Exhaust System		Twin pipes entire length; primary, center and final mufflers (twin pipes up to catalytic converter, then single pipe in and out of center muffler, twin pipes in final muffler)
Emission Control		(USA, oxygen sensor with 3-way catalytic converter and secondary air injection)
Heating		Warm water heater with heat exchanger and blower
Fuel System		LH-Jetronic (L-Jetronic)
Fuel supply		1 electric delivery pump

Fuel octane requirement	RON	98 (91 leadfree)	
Fuel consumption to DIN 70030/1		Manual	Automatic
at constant 90 km/h	l/100 km	8.7	8.6
at constant 120 km/h	l/100 km	10.2	10.5
EC city test	l/100 km	19.2	16.7

Electrical System

Interference suppression		ECE-R 10 and 72/245/EC
Battery voltage	V	12
Battery capacity	Ah	88
Alternator output	A/W	90/1260
Ignition		Electronic ignition, breakerless
Firing order		1–3–7–2–6–5–4–8

Transmission

Front-mounted engine, rear-mounted transmission, bolted to a rigid, central tube to make up a rigid drive unit/transaxle.
Front-mounted engine, clutch, torsion drive shaft to transmission running in rigid, central tube, rear-mounted transmission and final drive unit, double constant velocity joints, rear wheels

Clutch: Double-plate, diaphragm spring, dry clutch (pull-to-release type) on engine side

Automatic transmission: Hydraulic torque converter, stall ratio approx. 2.0 : 1 (2.12 : 1)

Body Type

Coupe with integral steel body, 2 doors, rear lid and retractable headlights; aluminum engine hood, doors and bolted front fenders (sliding roof optional)

Dimensions

Length	mm/in.	4447/175.08 (4462/175.67)
Width	mm/in.	1836/72.28
Height (at DIN curbweight)	mm/in.	1282/50.47
Wheelbase (in designed position)	mm/in.	2500/98.43
Track at DIN curbweight		
Front	mm/in.	1549/60.98
Rear	mm/in.	1521/59.88
Ground clearance	mm/in.	120/4.72
Bed clearance	mm/in.	40/1.57
Overhang angle to DIN		
Front		15 – 22° without front spoiler (20°)
Rear		19.6°

Weights – DIN 70020 –

Curbweight		
Front	kg	750 – 770 (760 – 780)
Rear	kg	750 – 770 (760 – 780)
Total	kg	1500 with manual transmission 1540 with automatic transmission (1520 – 1560)
Max. axle load		
Front	kg	900
Rear	kg	1100 (1000)
Max. total weight	kg	1870
Max. roof load	kg	35 75 with Porsche roof transport system
Max. trailer load		
Without brakes	kg	750
With brakes	kg	1600
Max. car/trailer weight	kg	3470
Max. drawbar load	kg	75

Capacities

Engine oil		Quality HD multigrade oils to API classification SE or SF according to plant approval list. Emergency use of single grade oils only when multigrade oils are not available and operating conditions are normal.
Engine oil volume	ltr.	Approx. 7.5 (level on dipstick is important)
Engine coolant	ltr.	Approx. 16
Transmission oil		Hypoid oil SAE 75 W-90 to MIL-L 2105 B, API classification GL 5
Transmission oil volume for manual transmission with differential	ltr.	Approx. 3.8
Fuel tank	ltr.	Approx. 86, of which approx. 8 liters in reserve
Brake fluid reservoir	ltr.	Approx. 0.2
Washing fluid reservoir for headlights and windshield	ltr.	Approx. 9 (water)
Cleaning solution reservoir	ltr.	Approx. 0.6

Performance		Manuals	Automatics
Top speed	km/h / mph	255/158 (235/146)	250/155 (230/143)
Acceleration from 0 to 100 km/h (0 to 60 mph)	sec.	6.2 (6.8)	6.7 (7.2)
1,000 mtr. from standing start	sec.	25.6 (27.5)	26.3 (28.2)
1/4 mile from standing start	sec.	(15.2)	(15.5)

Hill Climbing		Manuals	Automatics
1st gear	%	* 93 (61)	65.4 (52)
2nd gear	%	49.8 (39.5)	37.4 (30.5)
3rd gear	%	31.5 (25)	18.1 (14.5)
4th gear	%	20.7 (16)	8.9 (7.5)
5th gear	%	12.7 (9.5)	

* engine orientated

Changes (values) in the model '85/'86 year

Battery capacity	Ah	72	'86 models onward
Alternator/output	A/W	115/1610	'85 models onward
Weights - to DIN 70020 -			'85 models onward
Curb weight			
Front	kg	795	
Rear	kg	735 - 755	
Total	kg	1530 Manual transmission 1550 Automatic transmission	
Per. axle load front	kg	920	
Per. total weight	kg	1890	
Per. total weight with trailer	kg	3490	
Transmission oil capacity with differential - manual transmission	L	approx. 4.5	'86 models onward
Reservoir for windscreen and headlamp wash system	L	approx. 7.5 (water)	'86 models onward

TECHNICAL DATA - 928 S - '85/'86 models (32-valve engines)

(Adjustment specifications and wear limits are listed in the individual repair groups).

Engine

Internal engine code		Manual transmission M 28/43 Automatic transmission M 28/44 USA, Canada, Japan
Bore	mm/in.	100/3.94
Stroke	mm/in.	78.9/3.11
Displacement (actual)	cc/in.^{3}	4957/302.5
Displacement (rounded down)	cc	4898
Compression ratio		10.10 : 1
Max. power 80/1269/EC (Net power, SAE J 1349) at engine speed	kW/HP kW/HP rpm	215/292 215/288 5750
Max. torque 80/1269/EC (Net torque, SAE J 1349) at engine speed	Nm/kpm Nm/lbft rpm	410/42 410/302 2700
Max. specific power, DIN 70020 (SAE J 1349)	kW/L/HP/L kW/L/HP/L	43.4/59.0 43/58.2
Fuel cut-off to limit engine speed at	rpm	6400
Engine weight (dry)	kg	264

Changes (values) in the '85/'86 model year (32-valve engines)

Valve arrangement	2 intake, 2 exhaust, overhead V
Valve actuation	2 overhead camshafts and hydraulic bucket tappets
Camshaft drive	Toothed belt and internal chain
Timing (1 mm lift, zero play)	Intake opens 11 degrees before TDC Intake closes 50 degrees after BDC Exhaust opens 30 degrees before BDC Exhaust closes 5 degrees before TDC
Fuel octane rating	RON/MON 96/86, unleaded

PERFORMANCE

		Manual trans.	Automatic trans.
Maximum speed	km/h	250	242
	(mph)	155	150
Acceleration:			
0 - 100 km/h	s	6.3	6.8
0 - 100 mph	s	13.8	15.7
0 - 60 mph	s	6.1	6.6
Kilometer from standing start	s	25.8	26.8
1/4 mile from standing start	s	14.2	14.9

CLIMBING PERFORMANCE

		Manual trans.	Automatic trans.
1st gear	%	62.4	57.3
2nd gear	%	43.2	33.0
3rd gear	%	28.1	17.2
4th gear	%	19.2	8.9
5th gear	%	10.7	-

TECHNICAL DATA - 928 S - '86 models (32-valve engines)

(Adjustment specifications and wear limits are listed in the individual repair groups).

Engine

Internal engine code		Manual transmission M 28/45 Automatic transmission M 28/46 Australia, Germany, Austria, Switzerland
Bore	mm/in.	100/3.94
Stroke	mm/in.	78.9/3.11
Displacement (actual)	cc/in.^{3}	4957/302.5
Displacement (rounded down)	cc	4898
Compression ratio		9.3 : 1
Max. power 80/1269/EC	kW/HP	212/288
at engine speed	rpm	5750
Max. torque 80/1269/EC	Nm/kpm	400/40.8
at engine speed	rpm	2700
Max. specific power, DIN 70020	kW/L/HP/L	42.8/58.1
Fuel cut-off to limit engine speed at	rpm	6394
Engine weight (dry)	kg	264

Changes (values) in the '86 model year (32-valve engines)

Valve arrangement	2 intake, 2 exhaust, overhead V
Valve actuation	2 overhead camshafts and hydraulic bucket tappets
Camshaft drive	Toothed belt and internal chain
Timing (1 mm lift, zero play)	Intake opens 11 degrees before TDC Intake closes 50 degrees after BDC Exhaust opens 30 degrees before BDC Exhaust closes 5 degrees before TDC
Fuel octane rating	RON/MON 91/82, unleaded

PERFORMANCE

		Manual trans.	Automatic trans.
Maximum speed	km/h	252	247
	(mph)	157	154
Acceleration:			
0 - 100 km/h	s	6.2	6.7
0 - 100 mph	s	14.3	14.4
Kilometer from standing start	s	25.6	26.3

CLIMBING PERFORMANCE

		Manual trans.	Automatic trans.
1st gear	%	62.5	62.3
2nd gear	%	48.8	38.3
3rd gear	%	31.8	20.1
4th gear	%	22.2	11.9
5th gear	%	14.8	-

TECHNICAL DATA - 928 S - '87/88 models

(Adjustment specifications and wear limits are listed in the individual repair groups).

Note: USA values are stated in parentheses

Engine

Internal engine code		Manual transmission M 28/41 Automatic transmission M 28/42 Worldwide	
Bore	mm/in.	100/3.94	
Stroke	mm/in.	78.9/3.11	
Displacement (actual)	cc/in.^{3}	4957/302.5	
Displacement (rounded down)	cc	4898	
Compression ratio		10.0 : 1	
			Australia
Max. power 80/1269/EC	kW/HP	235/320	221/300
(Net power, SAE J 1349)	kW/HP	235/316	221/296
at engine speed	rpm	6000	
Max. torque 80/1269/EC	Nm/kpm	430/43.9	420/42.8
(Net torque, SAE J 1349)	Nm/lbft	430/316.9	
at engine speed	rpm	3000	
Max. specific power, DIN 70020	kW/L/HP/L	47.4/64.6	44.6/60.5
(SAE J 1349)	kW/L/HP/L	47.4/63.7	
Fuel cut-off to limit engine speed at	rpm	6600	
Engine weight (dry)	kg	264	

Changes (values) in model year '87/88

Valve arrangement		2 intake, 2 exhaust, overhead V
Valve actuation		2 overhead camshafts and hydraulic bucket tappets
Camshaft drive		Toothed belt and internal chain
Timing (1 mm lift, zero play)		Intake opens 11 degrees after TDC Intake closes 36 degrees after BDC Exhaust opens 17 degrees before BDC Exhaust closes 2 degrees before TDC
Fuel octane rating	RON/MON	95/85 unleaded Australia 91/82 unleaded
Blower drive		Double electric fans
Clutch		Single-plate dry clutch with diaphragm spring, extended, mounted on engine
DIMENSIONS		(Curb weight to DIN)
Length	mm/in.	4520/177.95 (4523/178.07)
Track:		with rims
Front	mm/in.	1551/61.06 7 J x 16
Rear	mm/in.	1546/60.9 8 J x 16
Overhang angle:		
Rear		14.1 degrees

PERFORMANCE

		Manual trans.		Automatic trans.	
			Australia		Australia
Maximum speed	km/h (mph)	270 168	265 165	265 165	260 162
Acceleration:					
0 - 100 km/h	sec	5.9	6.0	6.3	6.6
0 - 60 mph	sec	5.7	5.7	6.0	6.3
Kilometer from standing start	sec	25.4	25.4	25.9	26.2
1/4 mile from standing start	sec	14.2	14.1	14.5	14.7

WEIGHTS (to DIN 700 20)

Curb weight:		Manual trans.	Automatic trans.
Front	kg	820	820
Rear	kg/lbs	760/770	780/790
Total	kg/lbs	1580/1590	1600/1610
Total per. weight	kg/lbs	1920/1900	

CLIMBING PERFORMANCE

		Manual trans.		Automatic trans.	
			Australia		Australia
1st gear	%	63	62	63	63
2nd gear	%	54	47	47	39
3rd gear	%	34	29	25	20
4th gear	%	23	20	15	11
5th gear	%	15	12	-	-

Technical data - Type 928 GT - Model 89

(Adjustment and wear values are contained in respective repair groups)

Note: USA values are given in brackets

Drive assembly

Internal engine designation		Manual gearbox M 28.47
Bore	mm/in.	100 (3.94)
Stroke	mm/in.	78.9 (3.11)
Displacement (actual)	$cm^3/in.^3$	4957 (302.5)
Displacement (rounded down)	cm^3	4898
Compresion ratio		10.0 : 1
Max. engine power,		
80/1269/EWG	kW/HP	243 / 330
(Net Power, SAE J 1349)	kW/HP	243 (326)
at engine speed	rpm	6200
Max. torque		
80/1269/EWG	Nm/kpm	430 / 43.9
(Net Torque, SAE J 1349)	Nm/lb ft	430 (317)
at engine speed	rpm	4100
Max. specific output		
DIN 70020	kW/l/PS/l	49.0 / 66.6
(SAE J 1349)	kW/l/HP/l	49.0 (65,8)
Speed limitation by		
fuel interruption	rpm	6800
Idling speed	rpm	775 ± 25
Motor weight (dry)	kg	264

Printed in Germany – XXIV, 1989

Technical Data - Type 928 GTS - 1992 Model Year

(Adjustment values and wear limits are included in the relevant Repair Groups)

Note: U.S. values are given in brackets

Power Unit

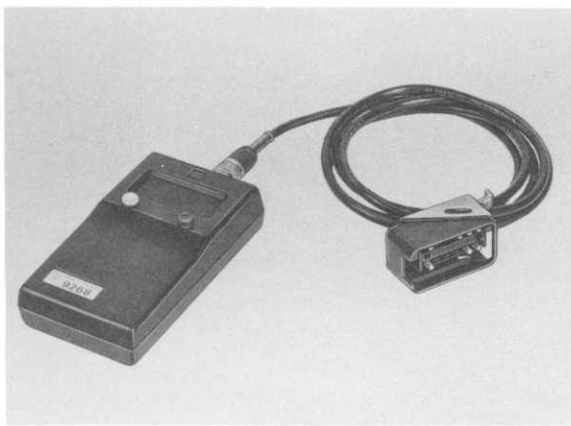
Internal engine designation		Manual transmission M 28.49 Automatic transmission M 28.50
Bore	mm (in.)	100 (3,94)
Stroke	mm (in.)	85,9 (3,38)
Displacement (actual)	c.c.(cu.in.)	5397 (329.3)
Octane requirements	RON/MON	98/88
Compression ratio		10.4 : 1
Max. engine power		
80/1269/EEC	kW/HP	257 / 350
(Net Power, SAE J 1349)	kW (HP)	257 (345)
at engine speed	rpm	5,700
Max. torque		
80/1269 EWG	Nm/kpm (ftlb)	500 / 51 (369)
(Net Torque, SAE J 1349)	Nm (ftlb)	500 (369)
at engine speed	rpm	4,250
Max. liter output		
DIN 70020	kW/l / HP/l	46,3 / 63
(SAE J 1349)	kW/l (HP/l)	46,3 (68,4)
Torque limitation via		
fuel cutoff	rpm	6,600
Idle speed	rpm	675 ± 25
Engine weight (dry)	kg	266

Printed in Germany - XXVII, 1991

LH / EZK control unit error diagnosis

LH/EZK control unit error diagnosis 928 S 4 as from Model 88.

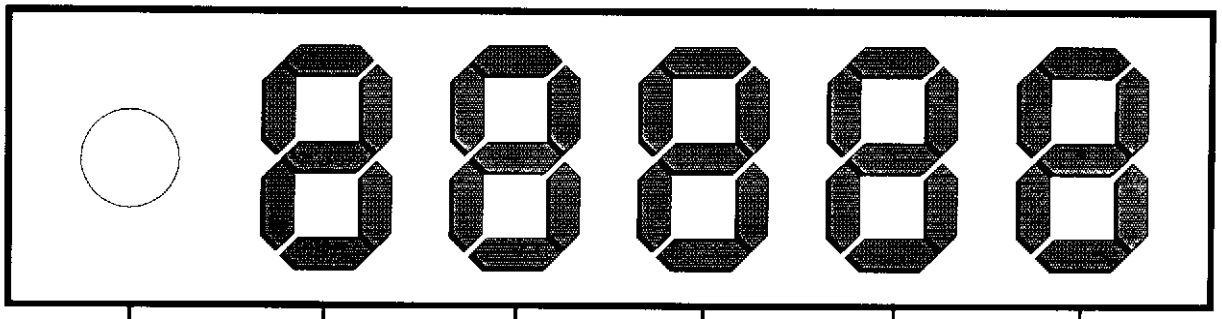
The LH/EZK control unit is capable of self-diagnosis as from model year 88. That is to say that the control unit is capable of detecting, storing and displaying system errors. An amended part number identifies the control unit capable of diagnosis. A special developed diagnostic tester (special tool No. 9268) is then used to read out the error memory and to test specific components and control signals of the fuel and ignition system.



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Important: Do not disconnect the battery or the connector of the DME control unit before diagnosis as otherwise the error memory will be erased.

Display



LED

Control unit identifikation

1 = LH / DME
2 = EZK

Diagnosis mode

1 = Continuous error
2 = Occasionally occuring error
3 = Actuator/input signal testing
4 = System adaption
5 = No error

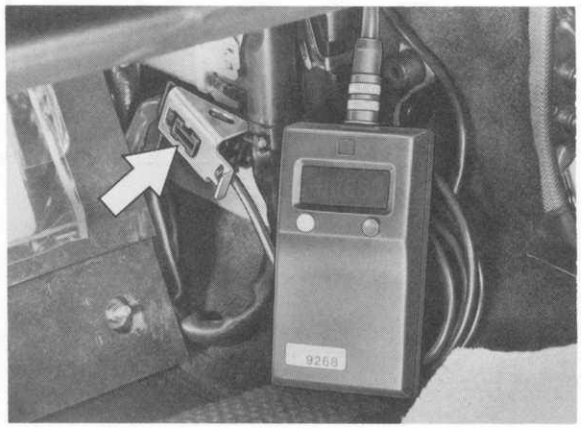
Error code test code

Function-display

○	**LED off**	Test sequence terminated /ignition off
◑	**Flashing LED**	Error code / test code
●	**LED on**	Ignition on

Connection in the 928 S 4

The diagnosis socket in the 928 S 4 is located on the retaining plate of the EZK control unit.

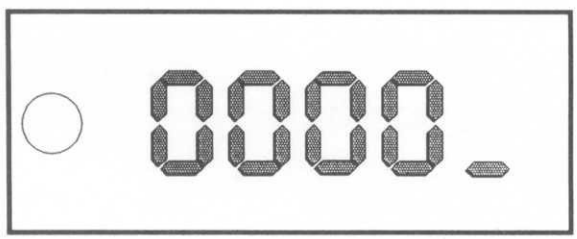


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Ignition off

After connecting the tester, the following display must appear.

Display:



If this is not the case, check the tester terminals and/or the power supply to the diagnosis socket in the car by referring to the circuit diagram.

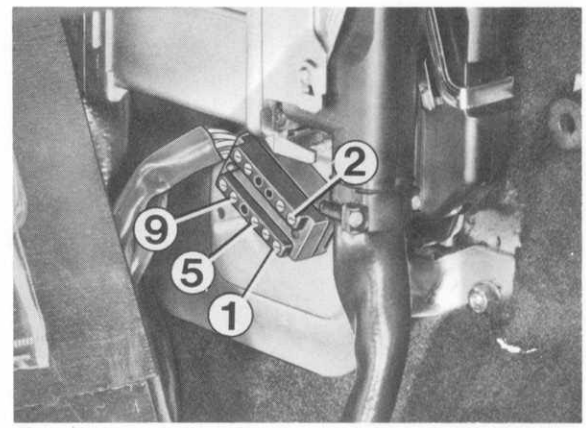
Diagnosis socket in the car

Pin 1 = Terminal 15

Pin 2 = Terminal 31

Pin 5 = Terminal 30

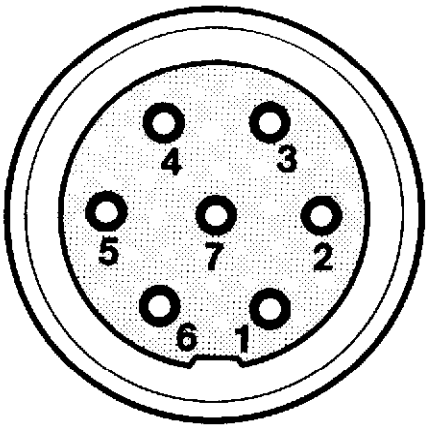
Pin 9 = Hall generator



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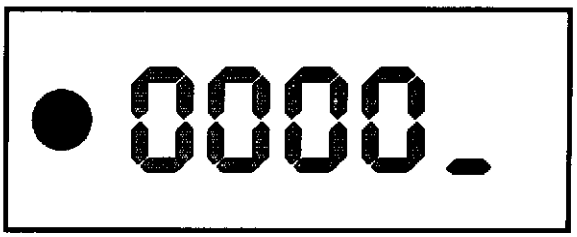
Tester cable

Diagnosis plug		Round plug
Pin 1	→	Pin 4
Pin 2	→	Pin 1
Pin 3	→	Pin 7
Pin 4	→	Pin 6
Pin 5	→	Pin 2
Pin 6		Unused
Pin 7		Unused
Pin 8		Unused
Pin 9		Unused
Pin 10		Unused
Pin 11	→	Pin 5
Pin 12	→	Pin 3



Switch on the ignition

Display:



The ignition must not be switched off during the entire error diagnosis procedure.

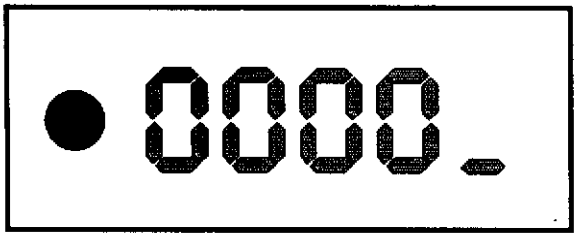
34

Starting error diagnosis

Condition:

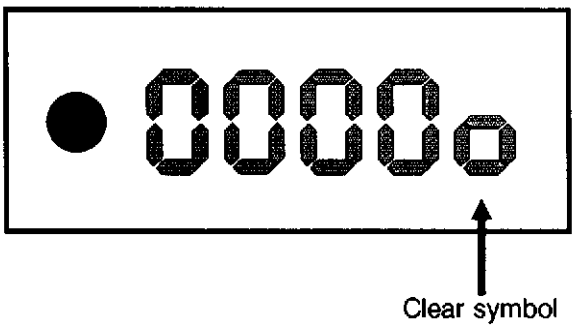
Engine off
Ignition on

Display:



Press the *green* key until the clear symbol appears on the function display.

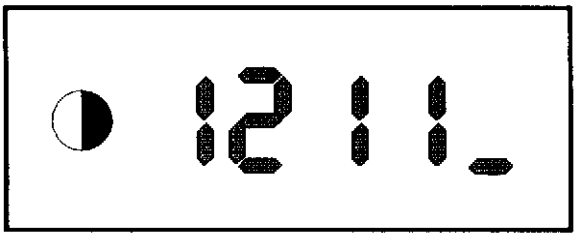
Display:



The diagnosis sequence for the LH control unit takes place first followed by that of the EZK control unit.

If an error is displayed– make a note of the error (e.g. 1211).

Display:

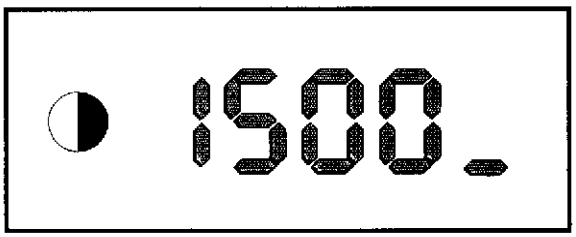


The error is displayed until the *green* key is pressed again on the tester. The next error code is then displayed, if applicable.

This must be repeated until 1000 appears on the display.

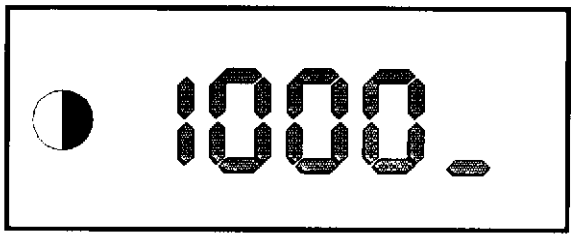
If there is no error, the following display appears.

Display:



Press the *green* key until the clear symbol appears on the function display. The following display must then appear.

Display:



This shows that diagnosis of the DME control unit has been terminated.

If one or several errors (max. 3 in the LH control unit and max. 5 in the EZK control unit) has/have been displayed, the error memory must be reset, see Chapter "Resetting the error memory".

Functional check of actuator and input signals

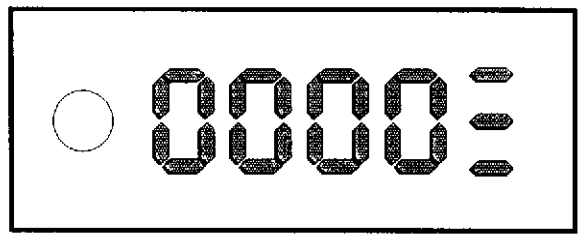
A functional check of actuator and input signals can be carried out independent of an error diagnosis. This functional check tests individual components or electrical signals with respect to their function or signal path. Functions are triggered by the diagnosis tester. During the functional check of components, these must be heard or felt to operate and it is therefore possible to determine whether they are in proper electrical working order or whether they are defective. An error display by the tester is not possible in this mode but the tester will detect faulty input signals or wiring connections.

Starting actuator and input signal functional check.

Ignition off

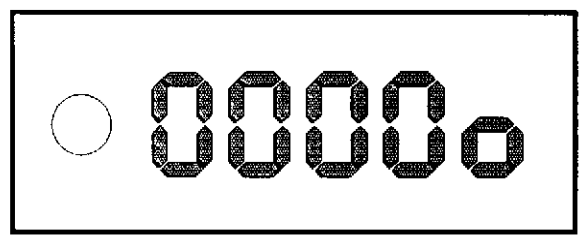
Press the *yellow* key repeatedly until the function symbol (see display) appears on the function display.

Display:



Press the *green* key until the clear symbol appears on the function display.

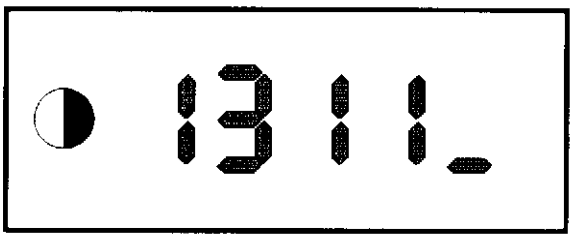
Display:



Switch on the ignition within 8 seconds.

The first testing step is activated and the injection valves are actuated.

Display:



The injection valves must all be heard or felt to operate.

Note:

There may be starting difficulties in later attempts to start the engine because a slight residual amount of fuel is injected during this testing step.

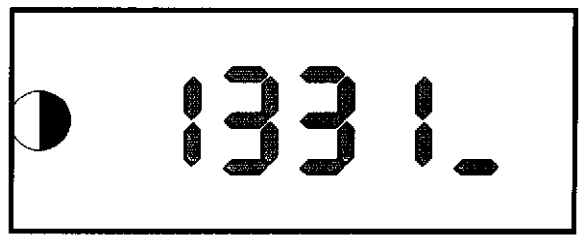
The testing steps remain in operation until the *green* key is pressed again on the tester and the clear symbol appears.

The next testing step is initiated by pressing the *green* key again.

Refer to the test code list for the sequence of testing steps.

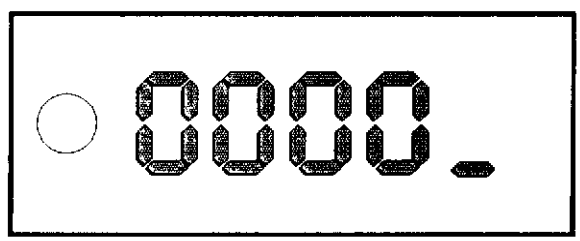
After testing step "speed signal from EZK to LH control unit", additional controls must be operated on the car to check the input signals.

Display:



Operate the starter motor for approx. 5 seconds. The LED on the tester will go out shortly afterwards and the following display will appear.

Display:



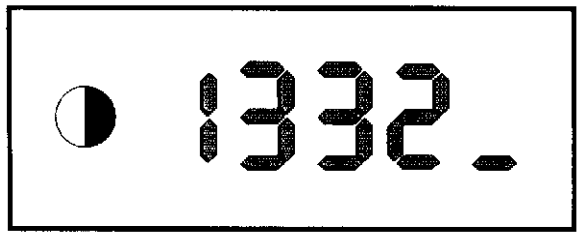
Note:

The ignition must not be switched off after the starting procedure.

If the 0000 display does not appear, there is an error (check with reference to the circuit diagram). It is possible to move on to the next testing step at any time. To do this, press the *green* key until the clear symbol appears.

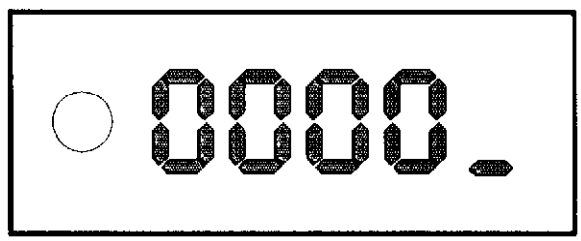
Initiate the idle contact testing step.

Display:



Press the accelerator pedal slightly. After approx. 20 mm, the LED must go out and the following display must appear.

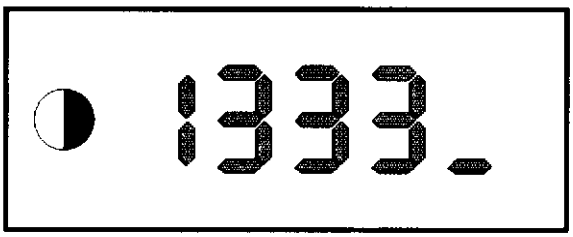
Display:



If this is not the case, there is a fault in the area of the idle contact (see idle contact trouble-shooting).

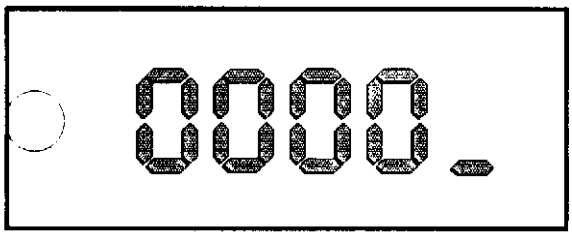
Initiate the full load contact testing step.

Display:



Press the accelerator pedal down slowly until the full load position has been reached. At the same time, the LED must go out and the following display will appear.

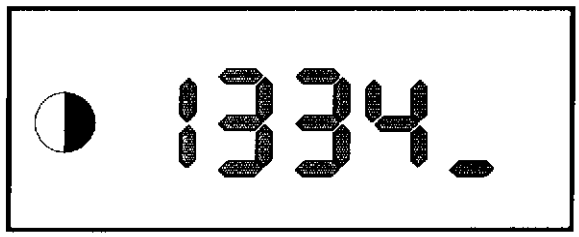
Display:



If this is not the case, there is a fault in the area of the full load contact (see full load contact trouble-shooting).

Initiate the testing step for air-conditioning control to the LH control unit (terminal 15).

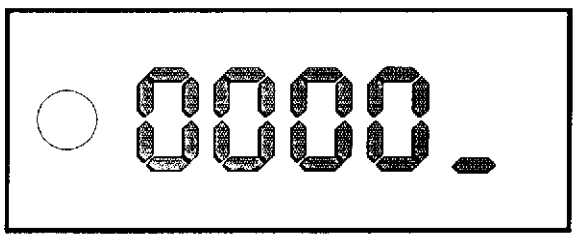
Display:



Set the air-distribution slide switch to up / down.

Switch on the air-conditioning system briefly (AC pushbutton). The LED must go out and the following display will appear.

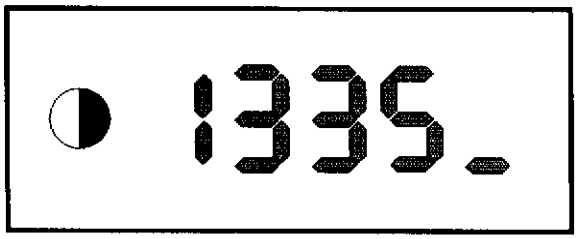
Display:



If this is not the case, there may be a fault in the area of the air- conditioning system's wiring. In the event of an error, check with reference to the circuit diagram.

Initiate the testing step for the air-conditioning control to the LH control unit (terminal 14).

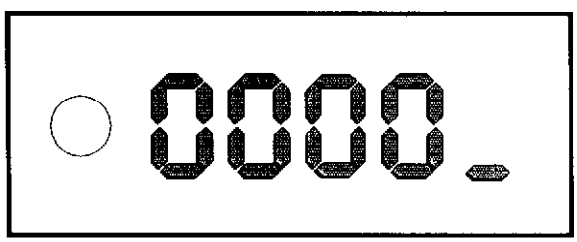
Display:



Set the air distribution slide switch to up / down.

Switch on the air-conditioning system briefly (AC pushbutton). The LED must go out and the following display will appear.

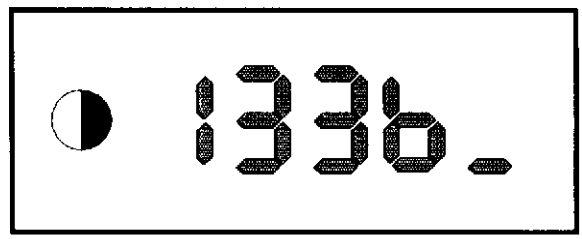
Display:



If this is not the case, there may be a fault in the wiring. In the event of an error, check with reference to the circuit diagram.

Initiate the testing step for speed reduction on automatic vehicles.

Display:



Note:

This testing step does not apply to vehicles with manual gearboxes.
Press the *green* key until the clear symbol appears.

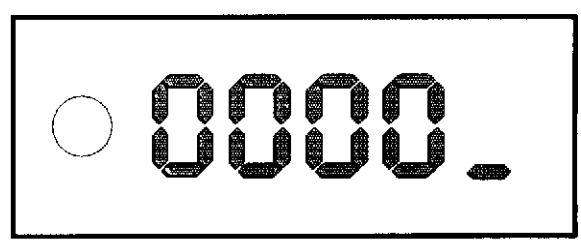
After a short period, the display 1000 will appear, i.e. output terminated.

Switch off the ignition

The functional check of actuator and input signals is thus terminated.

Move the selector lever from the P or N position to a drive position. The LED must go out and the following display will appear.

Display:



In the event of an error, check with reference to the circuit diagram.

Press the *green* key until the clear symbol appears. After a short period the display 1000 will appear, i.e. output terminated.

Switch off the ignition

The functional check of actuator and input signals is thus terminated.

Test code list

Test code	Components
1311	Injection valves
1321	Rotary idle controller
1322	Solenoid valve - tank bleeding
1323	Resonance flap
1331	Speed signal from EZK to LH -control unit
1332	Idle contact
1333	Full load contact
1334	Air-conditioning control to the LH control unit terminal 15
1335	Air-conditioning control to the LH control unit terminal 14
1336	Idle speed reduction for vehicles with automatic transmission

System adaption

System adaption can be carried out with the tester. That is to say that the electronic idle control in the LH control unit is adapted to the actual air throughput and to the current condition of the engine.

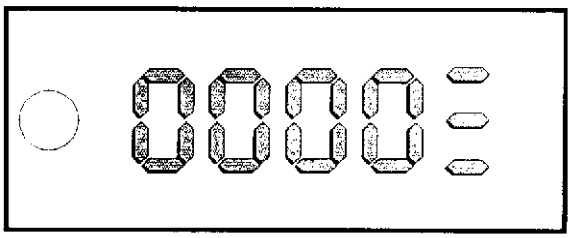
Note:

The engine must be at operating temperature for system adaption and all consumers must be switched off. The idle contact must also be functionable.

Ignition off

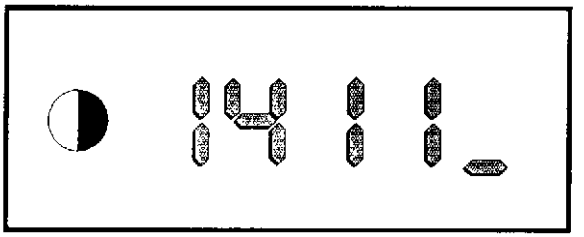
Press the *yellow* key repeatedly until the function symbol appears on the function display.

Display:



Press the *green* key until the clear symbol appears on the function display. Start the engine within 8 seconds. Allow the engine to idle until the system adaption code appears.

Display:



The engine must now idle for at least 30 seconds.

System adaption is then terminated.

Ignition off

Knock detection

An error diagnosis must be carried out before knock detection is performed to guarantee that there is no electrical fault in the area of the knock control and knock sensors.

Knock detection should only be carried out if the customer has complained of poor performance or excessive consumption, for instance.

Condition

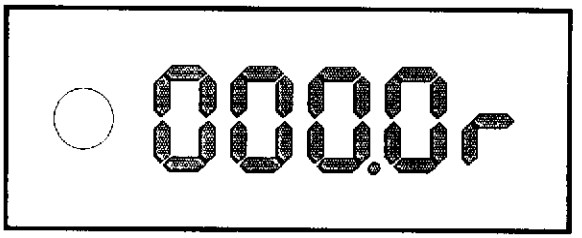
The engine must be at operating temperature during the test. The test must be carried out during a test drive or on the roller test stand.

Knock detection

Engine at operating temperature

While the engine is running, press the *yellow* and *green* keys simultaneously until the knock detection function symbol appears on the function display.

Display:



The tester is now in knock detection mode.

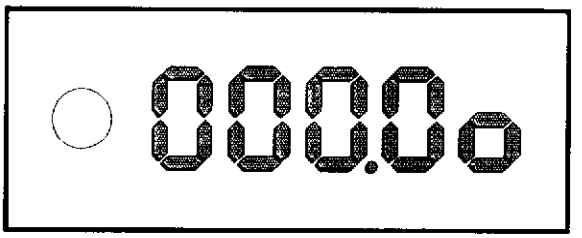
Note:

Normal driving is a prerequisite for the test drive (roller test stand).

Start the test drive (roller test stand).

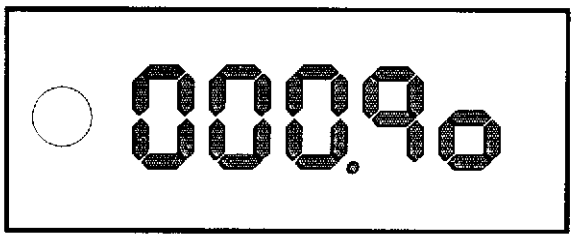
Press the *green* key until the clear symbol appears on the function display.

Display:



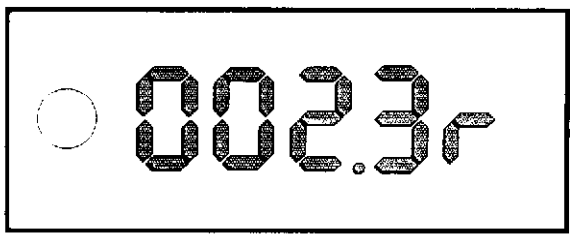
The tester is now active. If knocking occurs, this will be indicated by the tester, e.g.:

Display:



The function display will change to "r" after 10 000 ignition firings have elapsed.

Display:



Counting is now terminated.

The number of knocks is displayed in "per mil". 23 knocks have been counted in this example.

Knock detection must be carried out until the function display switches over from the clear symbol to the knock detection symbol.

This is always the case after 10 000 ignitions have taken place. All occurring knocks are added up and displayed as the end result.

To restart knock detection, press the *green* key until the clear symbol appears again.

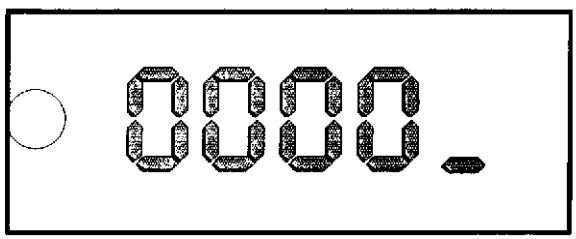
A knock display of > 5.0 (50) indicates a fault.

Possible faults:

Defective bucket tappets
Connecting rod damage
Damage to the crankshaft drive

Press the *green* and *yellow* keys simultaneously to leave knock detection mode, until the following display appears.

Display:



Trouble-shooting

LH control unit

Diagnosis using the tester can only indicate the error path but not a defective component.

Note:

The entire error memory must be read out before trouble-shooting.

Error code 1111

The supply voltage is too low
< 10 V or too high > 16 V.

Possible causes of inadequate supply voltage.

Battery exhausted

Poor contact to the grounding strap

Poor contact in the control unit

A defective regulator may be the cause of excessive supply voltage.

Error code 1112

This error code indicates a fault in the area of the idle contact.

Possible faults:

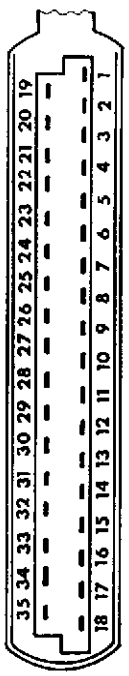
Short-circuit to ground
Switch stuck

Testing the idle contact

Ignition off

Disconnect the plugs from the EZK control unit and from the LH control unit.

Connect an ohmmeter between terminal 2 and terminal 5 on the LH control unit plug.



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Display:

Throttle valve closed: $R < 10\ \Omega$

Throttle valve open: $R = \infty\ \Omega$

Switchover must occur even if the throttle valve is only slightly open (approx. 1°).

In the event of an error, check with reference to the circuit diagram.

Error code 1113

This error code indicates a fault in the area of the full load contact.

Possible faults

Short-circuit to ground
Switch stuck

Testing the full load contact

Ignition off

Disconnect the plugs from the EZK control unit and from the LH control unit.

Connect an ohmmeter between terminal 3 and terminal 5 on the LH control unit plug.

Display:

Throttle valve closed: $R = \infty\ \Omega$

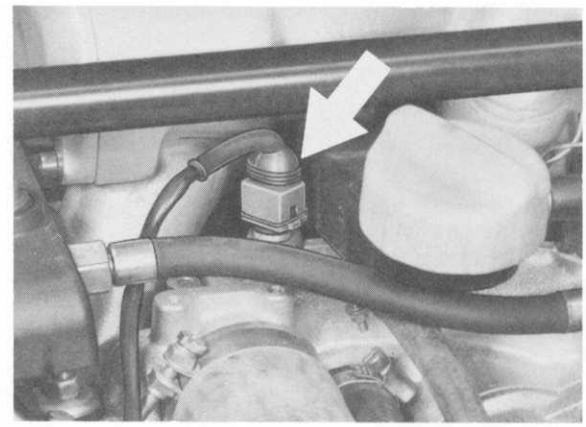
Throttle valve open: $R < 10\ \Omega$

The switching point must be just before full load.

In the event of an error, check with reference to the circuit diagram.

Error code 1114

This error code indicates a fault in the area of the engine temperature sensor.



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Possible faults

Short-circuit to ground
Short-circuit to positive
Break in the circuit
Defective engine temperature sensor

Testing the engine temperature sensor

Ignition off

Disconnect plugs from the EZK control unit and the LH control unit.

Connect an ohmmeter between terminal 13 and terminal 5 on the LH control unit plug.

Display:

32°F	=	4400 Ω - 6800 Ω
59 - 86°F	=	1400 Ω - 3600 Ω
104°F	=	1000 Ω - 1300 Ω
176°F	=	250 Ω - 290 Ω
212°F	=	100 Ω - 210 Ω

If these values are not achieved during this testing step, measurement must be carried out directly on the engine temperature sensor.

Note:

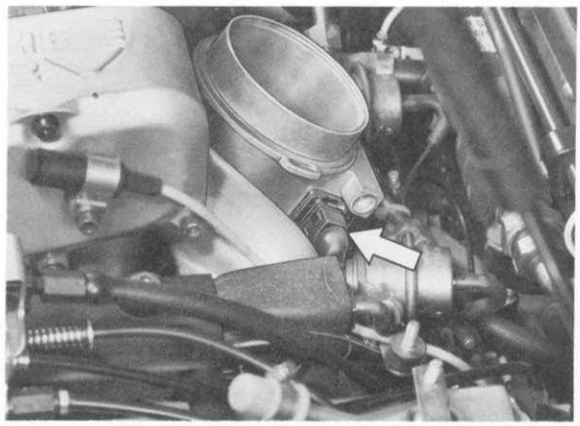
When measuring the resistance of the engine temperature sensor, always measure between the contact lug and the housing, as this contains two temperature sensors, independent of one another.

The engine temperature sensor makes the mixture richer for cold or hot start.

In the event of an error, check with reference to the circuit diagram.

Error code 1121

This error code indicates a fault in the area of the air-flow sensor.



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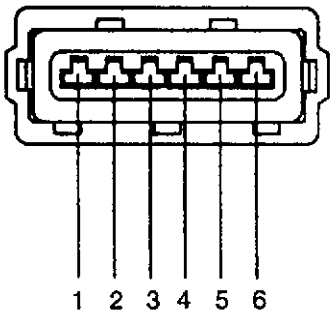
Checking the voltage supply to the air-flow sensor:

Ignition off

Disconnect the plug to the air-flow sensor.

Connect terminals 17 and 21 of the disconnected LH control unit plug.

It must be possible to measure the battery voltage between terminal 2 (positive) and terminal 4 (ground) of the disconnected air-flow sensor plug.



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If the battery voltage display does not appear, check the cable harness and plug connections with reference to the circuit diagram.

Functional check of the hot-wire signal

Plug the connector into the air-flow senor. Remove LH relay (XXV) and press terminal 30 and terminal 87 into the relay socket.

It must be possible to measure a voltage between terminals 6 and 7 on the disconnected LH control unit plug.

Display: ≈ 1.5 V - 1.8 V

Blow onto the hot-wire in the air-flow sensor and observe the voltmeter.

Display: ≈ 1.5 V - 5 V

Functional check of the hot-wire self-cleaning process

Allow the engine to run with integrated, connected air-flow sensor.

Condition:

Engine temperature > 140°F

Increase speed to above 2000 rpm.

Turn off the engine, i.e. ignition off. After approx. 4 seconds, the hot-wire must glow for approx. 1 second (self-cleaning function).

Error code 1122

This error code indicates a fault in the area of the rotary idle controller.

Note:

A functional check can be carried out using the actuator and input signal functional check.

In the event of an error, check the cable harness with reference to the circuit diagram.

Error code 1123

This error code indicates that the Lambda control has detected that the mixture is too rich.

Possible causes for too rich a mixture

System pressure too high

No partial vacuum at the pressure regulator

Injection valve does not close

Blockage in the return line to the fuel tank

Misfiring

Short-circuit to positive, Lambda probe

Error code 1124

This error code indicates that the Lambda control has detected that the mixture is too lean.

Possible causes for too lean a mixture

Short-circuit to ground, Lambda probe

Air infiltration on the intake side

Air infiltration on the exhaust side before the Lambda probe

Injection valve does not open

Fuel pressure too low

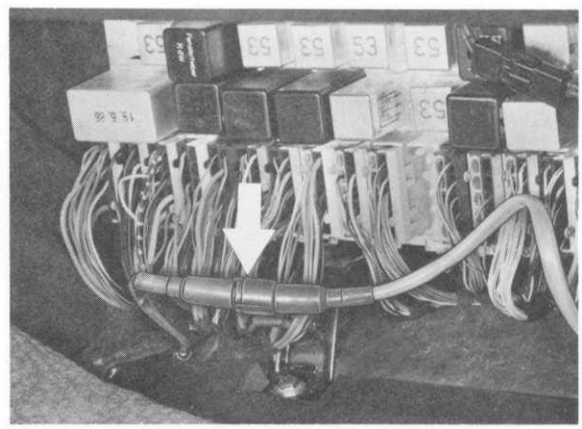
Error code 1125

This error code indicates a fault in the area of the Lambda probe.

Possible faults:

Short-circuit to ground
Short-circuit to positive
Break in the circuit

Testing the Lambda probe signal



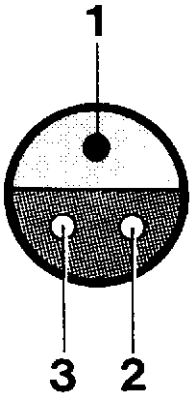
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Disconnect the Lambda probe plug

Note:

Only use a digital voltmeter to measure the voltage of the Lambda probe, or use a comparable measuring device with an internal resistance (Ri) of not less than 10 MΩ.

Measure the voltage between pin 1 and ground.



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The voltage will be in the range of approx. 150 mV - 900 mV , according to the mixture composition.

Check the cable harness to the LH control unit with reference to the circuit diagram.

Error code list for the LH control unit

Error code	Error path
1500	No fault
1000	Output terminated
1111	Supply voltage too low / high
1112	Idle contact
1113	Full load contact
1114	Engine temperature sensor
1121	Air-flow sensor
1122	Rotary idle controller
1123	Lambda control detects too rich a mixture
1124	Lambda control detects too lean a mixture
1125	Lambda probe

The digit 2 may also appear in the second error code digit position (e.g. 1211) indicating "sporadic error", i.e. an occasionally occurring fault.

This does not apply to error code 1000 and 1500.

Trouble-shooting, EZK control unit

Diagnosis using the tester can only indicate the error path, but not a defective component.

Note:

The entire error memory must be read out before trouble-shooting.

Error code 2112

This error code indicates a fault in the area of the idle contact.

Possible faults:

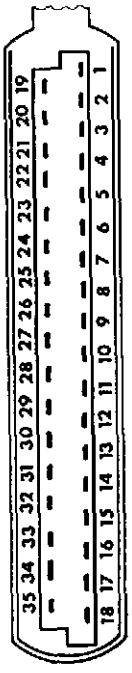
Short-circuit to ground
Switch stuck

Testing the idle contact

Ignition off

Disconnect the plugs from the EZK control unit and the LH control unit.

Connect an ohmmeter between terminal 8 and terminal 18 of the EZK control unit plug.



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Display:

Throttle valve closed: $R < 10\ \Omega$

Throttle valve open: $R = \infty\ \Omega$

Switchover must occur even if the throttle valve is only slightly open (approx. 1°).

Error code 2113

This error code indicates a fault in the area of the full load contact.

Possible faults:

Short-circuit to ground
Switch stuck

Testing the full load contact.

Ignition off

Disconnect the plugs from the EZK control unit and the LH control unit.

Connect an ohmmeter between terminal 26 and terminal 18 of the EZK control unit plug.

Display:

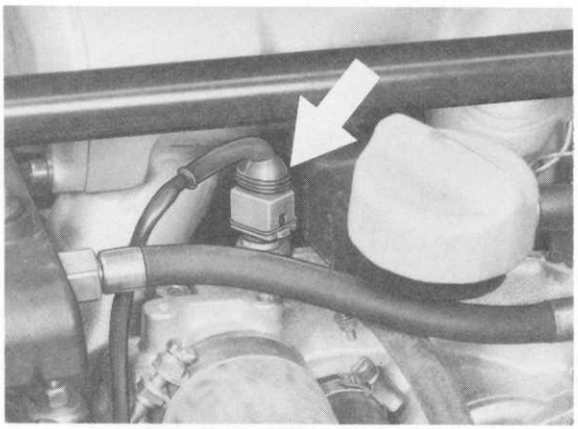
Throttle valve closed: $R = \infty\ \Omega$

Throttle valve open: $R = 10\ \Omega$

The switching point must be just before full load.

Error code 2114

This error code indicates a fault in the area of the engine temperature sensor.



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Possible faults

Short-circuit to ground
Short-circuit to positive
Break in the circuit
Defective engine temperature sensor

Testing the engine temperature sensor

Ignition off

Disconnect the plugs from the EZK control unit and the LH control unit.

Connect an ohmmeter between terminal 19 and terminal 18 of the EZK control unit.

Display:

32°F	=	4400 Ω - 6800 Ω
59 - 86°F	=	1400 Ω - 3600 Ω
104°F	=	1000 Ω - 1300 Ω
176°F	=	250 Ω - 290 Ω
212°F	=	100 Ω - 210 Ω

If these values are not achieved during this testing step, measurement must be carried out directly on the engine temperature sensor.

Note:

Always measure the resistance of the engine temperature sensor between the contact lug and the housing as this contains two temperature sensors, independent from one another.

The engine temperature sensor advances the spark angle when the engine is cold for improved running.

Error code 2115

This error code does not clearly determine whether the fault is in the area of the full load contact or in the area of the idle contact.

More detailed information is then given by error code 2112 or 2113.

Error code 2121

This error code indicates a fault in the area of the load signal (e.g. partial load) between the LH control unit and the EZK control unit.

Possible faults

Break in the circuit
Short-circuit to ground

If this load signal is not received by the EZK control unit, ignition is retarded in the partial load area and full load area.

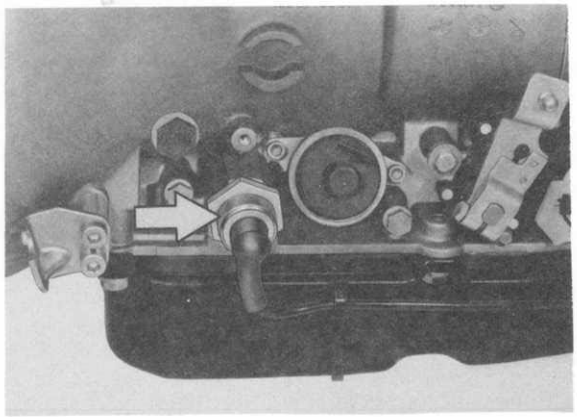
Control value for an intact load signal

3000 1/min 32° before TDC ±4°

In the event of a fault, check the cable harness with reference to the circuit diagram.

Error code 2126

This error code indicates a fault in the area of the transmission safeguard switch.



Possible faults

Switch defective
Short-circuit to ground

Trouble-shooting:

See repair manual, checking the transmission safeguard switch, Page 28 - 70.

Error code 2131 and error code 2132

These error codes indicate a fault in the area of the knock sensors.

Error code 2131	Knock sensor 1
Error code 2132	Knock sensor 2

Error testing of the knock sensors is an active error test, i.e. the error test is carried out while driving.

If there is a fault, first check the wiring for short-circuit to ground, short-circuit to positive and continuity, with reference to the circuit diagram, before replacing knock sensors.

Error code 2133

This error code indicates a fault in the control unit.

If this error code appears, replace the EZK control unit.

Error code 2134

This error code indicates a fault in the area of the Hall generator signal.

Possible faults:

Short-circuit to ground
Break in the circuit

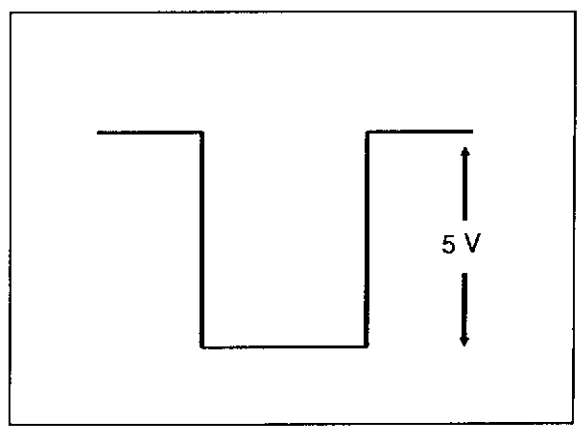
Testing the Hall generator signal

Disconnect the plug from the EZK control unit.

Connect an oscilloscope to terminal 22 and terminal 4 of the EZK plug.

Operate the starter motor

The following image must appear on the oscilloscope.



If this is not the case, carry out the test on the Hall generator directly.

If the Hall generator is defective, the control unit retards the ignition by approx. 6° for all cylinders in the upper partial load or full load areas.

Error code 2141

This error code indicates a fault in the control unit.

If this error code appears, replace the EZK control unit.

Error code list for the EZK control unit

Error code	Error path
2500	No fault
2000	Output terminated
2112	Idle contact
2113	Full load contact
2114	Engine temperature sensor
2115	Idle/full load contact
2121	Load signal from the LH control unit
2126	Transmission safeguard switch
2131	Knock sensor I
2132	Knock sensor II
2133	Knock control in the control unit
2134	Hall generator signal
2141	EZK control unit

The digit 2 may also appear in the second error code digit position (e.g. 2212), indicating "sporadic error", i.e. an occasionally occurring fault.

This does not apply to error code 1000 and 1500.

Resetting the error memory

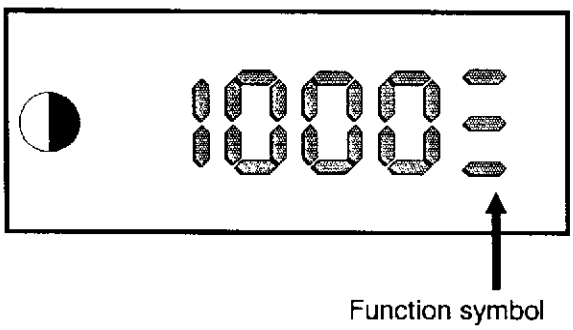
The error memories of the LH control unit and the EZK control unit must each be reset individually.

Once error diagnosis has been terminated for the LH or EZK control units, this is indicated by error code 1000 for the LH control unit or 2000 for the EZK control unit.

It is only possible to reset the error memories when this error code has appeared. Proceed as follows:

Press the *yellow* key repeatedly until the function symbol (see display) appears on the function display.

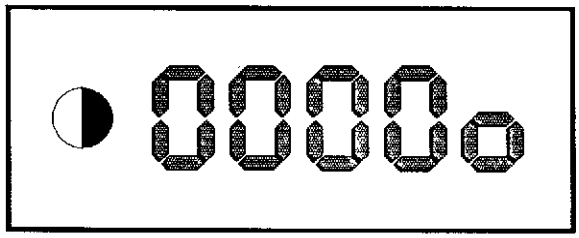
Display:



Function symbol

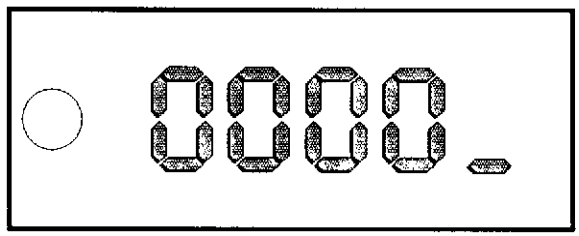
Press the *green* key until the clear signal appears on the function display.

Display:



The error memory has been reset when the LED goes out and the function display changes to 0000.

Display:



Note:

A test drive must be made after resetting the error memory

Observe the following conditions for this:

1. The engine must be at operating temperature, i.e. at least 176°F.

2. The duration of the test drive (minimum 6 minutes)

3. At the end of the test drive, run the engine for at least 60 seconds without opening the throttle valve.

   After the test drive, read out the error memory once again.

Operating conditions for start of diagnosis

Systems	Ignition on Engine standing still	Engine running
928 S4 / 928 GT 928 GTS (5,4 l)		
LH-Jetronic	yes	to n < 2500 rpm
EZK	yes	to n < 2600 rpm
ABS / lock	yes	no
Airbag	yes	yes
Alarm system	yes	yes
RDK	yes	yes

Printed in Germany - XXVII, 1991

Operating Instructions for System Tester 9288



Printed in Germany – XXII,1989

1. General information

1.1 Application

The Systemtester 9288 (BOSCH KTS 301) is a microprocessor-controlled self-diagnosis tester.

All systems which have a diagnosis interface as per ISO Standard can be tested with this tester. The following tests are possible:

- Reading out the fault memory
- Testing of the actuators
- Testing the circuit inputs
- System adaptation
- Engine-knock detection
- Sensor and status checks, tire-pressure monitoring (RDK)

The Systemtester 9288 is a high-quality piece of electronic equipment. In order to prevent damage to the equipment as a result of improper use, please read the information in the operating instructions carefully and comply with it.

In addition, the instructions (specifications) of the vehicle manufacturer are also to be observed.

If the tester should fail, check the following points before sending it in for repair:

1. Has the tester been operated incorrectly?
2. Is the battery sufficiently charged?
3. Is the adapter cable OK?
   (Please note when checking the adapter cable that a highly sensitive electronic matching circuit is installed in the vicinity of the 19-pole plug).

1.2 Construction (Fig. 1)

No.	Description	Function	Remarks
1	LCD indicator	Dot matrix 5 x 8 4 lines each with 20 characters Foreign languages possible Illumination	If the Systemtester 9288 is switched on without the program module, following the self-test the tester switches off automatically and informs the user that the program module is not fitted.
2	Keyboard	Keys 1, 2, 3 = Selection key Keys < > = Previous page/next page Key H = Help menu, e.g.: Illumination Screens stored Control-unit overview Setting up printer Switching off unit Key N = Return to the next higher program level following termination of a test sequence or, during a test sequence, return to the last display Key ⇩ = Storing indication Key ⇧ = Playing back stored reading	Switching on: = Press any key Switching off: = 180 s after last depression of a key or if no data stream flows across the serial interface. (automatic) The last field in the top right-hand corner is filled completely, this means that this is a stored figure and not an actual, real-life figure.
3	Power supply	Fitted accumulator with NiCd batteries. The Systemtester 9288 must be switched off during the initial battery charging process. Charging time > 8 hours	Discharged upon delivery. Following charge: Operating time: 4 – 8 hours without scale illumination 1 – 2 hours with scale illumination
	If the voltage is not sufficient, "Charge battery" appears on the display. If this is not done, the unit switches itself off.	Connection to vehicle battery by means of vehicle-specific adapter lead (see 1.4)	Connection through ISO-interface Charging voltage supply
		Battery charger (accessory)	For test operation and for charging the NiCd batteries.
4	Connection for input and output devices	Connection facility for Printer e.g. Epson, IBM, Hewlett Packard (HP)	The Systemtester 9288 transmits data with the following configurations: 8 data bits / 1 start bit / 1 stop bit / No parity (for printer matching)
5	Connection for vehicle specific adapter lead	Reading out the data	Input for flashing-code support
6	Plug-in programme module (see also Figure 2) ⚠ C-MOS ! Do not touch plug !	Operating system LCD drive Keyboard Interface communication Computations and data conversions	Plug in module: remove rubber protector, insert module fully.

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1.3 Battery charger run off mains voltage (Figure 3)

– Accessory –

Item 1 Charger with connecting cable, 1.5 m long

Item 2 8-pin AMP plug

1.4 Vehicle-specific adapter cable

Porsche No. 000 721 928.81

1.5 Connecting lead (Figure 4)

– Self-fabrication –

for printer, programme load station or similar unit.

For interface-trunk assignment, see manual of corresponding unit.

Printer cable for standard D 25
BOSCH No. 1 684 465 193

Printer cable for EPSON
BOSCH No. 1 684 465 194

2. Connection

The following points must be observed:

- No gear must be engaged on the vehicle (Automatic transmission in position N - P) – Danger of Accident !
- **ALL** work on the vehicle must only be carried out with the ignition switched off.

After having connected the vehicle-specific adapter cable, the instructions listed under "3" are displayed on the Systemtester 9288:

2.1 Charging with the battery charger (Fig. 3)

Connecting the Systemtester 9288 to the battery charger. (Fig. 1, pos. 5).

2.2 Diagnosis

Connecting the Systemtester 9288 to the diagnosis plug in the vehicle by means of the vehicle-specific adapter cable.

Switch on the tester and proceed according to the instructions displayed.

3. Testing

Scope of module:

Guidance through the menu, communication with the ECU, reading out the error memory and selection of the "Help" menus, actuator diagnosis, circuit inputs and system adaptation, engine-knock detection, sensor and event check for the tire-pressure monitor (RDK).

3.1 Reading-out the error memory

Connect the Systemtester 9288 (see 2.)
Switch on the Systemtester,
(possible with every key!)

Display:

```
PORSCHE
Eprom modul      eng
Mod. intro.  xx.xx.xx
```

If a specific instruction does not appear in a display, it is always possible to proceed by pressing the button >.

Due to the fact that the Systemtester 9288 can store error displays (see Chapter 3.7), the following display will appear if errors have been stored in the image memory:

```
Stored displays
erased ?
1 = yes
3 = no
```

Key 3

Display:

```
Print out
displays:          H

continue:          >
```

H = Help menu (see 3.6) or key 1

Display:

```
Vehicle types
1 = 944 S
2 = 911 Carrera 4
3 = 928 S 4
```

Selection of the vehicle type with key 1, 2 or 3.

After the vehicle type has been selected, the following instruction appears:

```
Connect adapter
cable to veh. plug.
Ignition "ON".
After completion:  >
```

The following then appears:

```
Wait for
Data

Break off test:    N
```

After a short pause, the Systemtester 9288 reports all the systems that are installed in the particular vehicle. If a system is preceded by " # ", this means that at least 1 error is stored in that particular system.

Examples:

```
Installed systems
1 = # LH
2 = # EZK
3 =   RDK
```

The particular system can be selected by means of key 1, 2 or 3.

After selection (for instance with key 1), the following display appears:

```
LH
System:  L01 LH-JET
Ser. No.: 92861812313
RB. No.:  0280002507
```


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After pressing the key > , a selection menu is displayed:

```
Menu
1 = Fault memory
2 = Drive links
3 = Input signals      >
```

```
< Menu
1 = System adaptation
```

In the example – press key 1. There then follows the display of the number of errors which are stored (if any).

```
Number of
faults

→ 2 ←
```

Proceed with key >

```
Additional info to
every display with
key 1
continue:              >
```

Proceed with key >

Error output:

```
1: Engine
temperature sensor 2
Short to ground
not present
```

If key 1 is pressed instead of the > key, the corresponding error code display appears (the last two digits of the flashing code).

```
Fault code: – 14 –
```

Proceed with key >

Further errors are displayed (if they exist):

```
2: Idle contact

Short to ground
present
```

If key 1 is pressed instead of key > the corresponding error-code display appears (the last two digits of the flashing code).

```
Fault code: – 12 –
```

After the last displayed error, the following instruction appears:

```
Repair fault accord-
ing to repair
instructions
Continue:              >
```

Proceed with key >

```
Fault repaired ?
1 = yes
3 = no
```

Return to display "No. of errors" with key 3.

Proceed with key 1:

```
Fault memory
1 = Erase
3 = Do not erase
```

If key 3 is pressed:
= Return to menu "error memory".

The error memory is not erased!

Proceed with key 1:

```
Fault memory
has been cleared

Return:                N
```

The test scope "Read-out error memory" is terminated at this point.

3.2 Actuator diagnosis

If an actuator is selected, this is triggered by the ECU so that it can be checked for correct functioning.

The various actuators components are gone through one after the other and are selected with the > key.

Operate the Systemtester 9288 as described under 3.1 until the following menu display appears:

```
Menu
1 = Fault memory
2 = Drive links
3 = Input signals      >
```

After pressing key 2, the display for the first actuator appears:

```
Injector
to activate
1 = Start
Continue:              >
```

If key > is pressed, the next actuator is selected.

Pressing key 1 results in the following instruction:

```
Can injectors be
heard / felt ?
1 = yes
3 = no
```


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Key 1 selects the next actuator (e.g. idle actuator). Following instruction:

```
Repair fault accord-
ing to repair
instructions
Continue:          >
```

After pressing key >, the following display appears:

```
Injector
to activate
1 = Start
Continue:          >
```

Proceed with key 1

```
Can injectors be
heard / felt ?
1 = yes
3 = no
```

Proceed with key 1 to the next actuator.

```
Idle stabilizer
to activate
1 = Start
Continue:          >
```

Proceed with key 1

```
Can idle stabilizer
be heard / felt ?
1 = yes
3 = no
```

By pressing key 1, the next actuator is selected. After pressing key 3, the next instruction appears:

```
Repair fault accord-
ing to repair
instructions
Continue:          >
```

Proceed with key >

```
Idle stabilizer
to activate
1 = Start
Continue:          >
```

After pressing key 1, the following display appears:

```
Can idle stabilizer
be heard / felt ?
1 = yes
3 = no
```

By pressing key 1, the next actuator is selected. The actuators are selected one after the other and triggered until the following display appears:

```
Drive link test
completed

Return:            N
```

By pressing the key N, the operator is returned to the menu.

3.3 Circuit inputs

In addition to the actuators, the Systemtester 9288 can also check circuit inputs. To this end, operate the Systemtester 9288 in accordance with 3.1 until this menu display appears:

```
Menu
1 = Fault memory
2 = Drive links
3 = Input signals   >
```

Press key 3

```
Idle contact
1 = Start

Continue:          >
```

By pressing key > the next circuit input is selected.

The next display appears when key 1 is pressed.

```
Activate accl. pedal
Idle contact
– closed –
Continue:          >
```

Operate the accelerator pedal, the following display appears:

```
Activate accl. pedal
Idle contact
– open –
Continue:          >
```

The next circuit input is selected by pressing key >. Repeat until this display appears:

```
Input signals
testing completed

Return:            N
```

Press key N for return to menu

3.4 System adaptation

When the function "System adaptation" is triggered, the ECU registers the basic air requirement of the engine.

To this end, operate the Systemtester 9288 as per 3.1 until the following menu display appears:

```
Menu
1 = Fault memory
2 = Drive links
3 = Input signals   >
```

Proceed with key >

```
< Menu
1 = System adaptation
```

Proceed with key 1

```
Prerequisite:
Eng. at oper. temp.
with all consumers
and ignition off.
```

Proceed with key >

```
System adaptation
1 = Start

Return:          N
```

If key N is pressed
= return to menu.

If key 1 is pressed:

```
Start engine !
```

Following engine start there appears:

```
System is being
adapted

Please wait !
```

After approx. 30 secs there appears:

```
System adaptation
completed

Return:          N
```

If it is impossible to carry out system adaptation (idle contact not closed, or defective), the following display appears:

```
No system adaptation
possible
Idle contact ?
Return:          N
```

After completion of the system adaptation, return to the menu with key N.

3.5 Engine-knock registration

The engine-knock registration function can only be triggered through the EZK or DME control unit.

To this end, operate the Systemtester 9288 as described in 3.1 until the following display appears:

```
Installed systems
1 = # LH
2 = # EZK
3 =   RDK
```

The particular system can be selected by means of key 1, 2 or 3. For instance with key 2 the following display appears:

```
   EZK
System: E01EZK
Ser. No.: 92861812415
RB. No.: 0227400154
```

Proceed with key >
The following menu display appears:

```
< Menu
1 = Fault memory
2 = Knock registration
```

Proceed with key 2

```
Condition:
Engine at operating
temperature
                  >
```

Proceed with key >

```
< Start knock
registration before
test drive
                  >
```

Proceed with key >

```
< A normal test
drive is a pre-
requisite
                  >
```

Proceed with key >

```
< Stop the test
drive only if the
display with the no.
of knocks comes on.
```

Proceed with key >

```
Knock registration
1 = Start

Return:          N
```

Pressing key 1 activates the engine-knock counter:

```
Knock registration
in progress

Please wait!
```


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The knock counter registers 10,000 ignitions before the display with the actual number of combustion "knocks" appears.

```
Number
Knocks:          xxx
Combustion:      xxxxx
Continue:          >
```

Proceed with key >

```
Knock registration
completed

Return:            N
```

If knock registration is impossible (due to lack of engine-speed signal), the following display appears:

```
No knock regist-
ration possible.
RPM signal ?
Return:            N
```

Following completion of the knock registration test, return to the menu with key N.

3.6 Help menu

The "Help" menu can be selected from every display by pressing key H. Return to the initial display with key N.

```
   Help menu
1 = Illumination
2 = Display stored
3 = Ctrl. unit chart   >
```

Proceed, for instance with key 1:

Key 1:

The scale illumination is switched on and the tester returns to the previous display.

Or with key 2:

```
Data display stored
  1 = Print
  2 = Clear
```

Proceed with key 1
Stored displays are printed out (If printer connected).

Proceed with key 2
Stored displays are erased.

With the "Help" menu, for instance

```
   Help menu
1 = Illumination
2 = Display stored
3 = Ctrl. unit chart   >
```

if the key > is pressed, a further section of the "Help" menu is displayed:

```
<  Help menu
1 = Printer setting
2 = Switch off equip.
3 = Baud Rate
```

Proceed for instance with key 1

```
Printer setting
1 = IBM
2 = HP Quiet Jet
3 = EPSON
```

The selection of the printer results in the tester being set up for the printer type in question.

3.7 Store measurement displays (Key ⇩)

Using key ⇩, all displays can be stored manually.

The following displays are stored automatically:

- ECU-Identity
- Installed systems
- All existing errors

When the memory limit is reached, the following instruction is displayed:

```
Data display mem.
full !

Return:            N
```

3.8 Show stored measurement displays (Key ⇦)

Using the keys < or >, the stored displays for the selected system can be shown.

The stored displays can be called up by means of the ⇦ key.

The system selection (LH - EZK - RDK) takes place with the keys 1, 2 or 3.

4. Service and wear parts (BOSCH)

Fig.	BOSCH Part No.	Designation	Comment
1/3	1 687 335 002	NC-battery	
4/1	1 684 483 152	Plug	
4/2	1 684 485 170	Socket	9pole
4/3	1 680 552 005	Screwed cap	
	1 684 465 193	Printer cable (Standard D 25)	
	1 684 465 194	Printer cable (EPSON)	

4.1 Service parts (Porsche)

Designation	Porsche Part No.	Special tool No.
Systemtester 9288	000.721.928.80	9288
Adapter cable	000.721.928.81	9288/1
Battery charger	000.721.928.82	9288/2
Module (D)	000.721.928.84	9288/4
Module (GB/USA)	000.721.928.85	9288/5
Module (F)	000.721.928.86	9288/6
Module (I)	000.721.928.87	9288/7
Module (E)	000.721.928.88	9288/8

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TOLERANCES AND WEAR LIMITS

		When Installed (new)	Wear Limit
Cooling System			
Coolant thermostat	Opening temperature	81 - 85° C	
Radiator Cap			
High pressure valve	Opening pressure	0.9 - 1.15 bar	
Low pressure valve	Opening pressure	0.07 - 0.12 bar	
Oil Circuit			
Oil consumption	ltr/1000 km		ca. 1.5
Oil pressure at 80° C oil temperature and at 5000 rpm	Pressure	5 bar	
Oil dipstick			
Upper mark	Oil volume	7.5 ltr	
Lower mark	Oil volume	6.0 ltr	
Oil pump			
Clearance	Axial play	0.080 - 0.120	
	Radial play	0.060 - 0.088	
Valve Timing			
Camshaft bore	Inside dia.	$60.5^{+0.03}_{-0}$	
Camshaft	Diameter	$60.5^{-0.03}_{-0.045}$	
Camshaft	Axial play	0.10 - 0.18	
Bucket tappet bore	Inside dia.	$38^{+0.010}_{+0.038}$	
Bucket tappet	Diameter	$38^{-0.018}_{-0.034}$	
Camshaft	Runout	0.02	
Cylinder Head and Valves			
Bearing surface	Distortion		max. 0.08
Valve seat:			
Intake	Width	1.7	
Exhaust	Width	2.0	
Intake	Seat angle	45°	
Exhaust	Seat angle	45°	
Outer correction angle		30°	
Inner correction angle		60°	
Valve guides:			
Intake and exhaust	Inside dia.	9 + 0.015	
Valve stem:			
Intake	Diameter	8.97 - 0.012	
Exhaust	Diameter	8.95 - 0.012	

			When Installed (new)	Wear Limit
Valve guide/valve stem	Clearance			0.80
Intake				0.80
Exhaust				
Compression			8 bar and more	6.5 bar

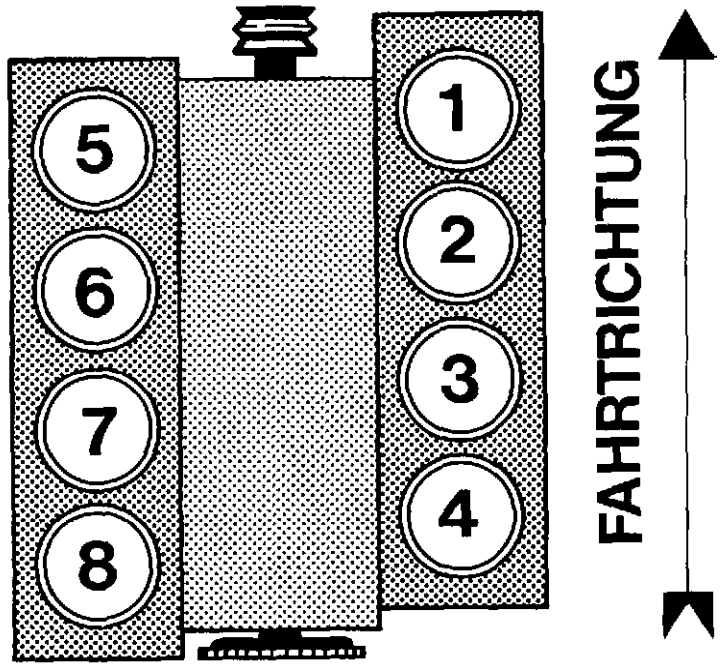
Pistons and Connecting Rods

Cylinder/piston	Clearance		0.024 - 0.048	ca. 0.080
			Mahle | KS	
Piston rings	Side clearance	Groove 1	0.06 - 0.102 | 0.05 - 0.082	
		Groove 2	0.04 - 0.072 | 0.05 - 0.082	
		Groove 3	0.013 - 0.127 | 0.023 - 0.137	
Piston rings	End clearance		Groove 1 = 0.20 to 0.40 Groove 2 = 0.20 to 0.40 Groove 3 = 0.40 to 1.40	
Conrod bushing	Diameter		$24^{+0.018}_{+0.028}$	
Piston pin	Diameter		24 - 0.004	
Conrod bushing/piston pin	Radial play		0.018 - 0.032	

Crankshaft and Engine Block

Crankshaft (measured on 2nd, 3rd or 4th bearings, 1st and 5th bearings running in vees)	Runout	0,04 - 0,06	max. 0,08
Conrod bearing journal	Diameter	51.971 - 51.990	
Conrod bearing/crankshaft	Radial play	0.034 - 0.092	
	Axial play	0.100 - 0.400	
Crankshaft bearing journal	Diameter	69.971 - 69.990	
Crankshaft bearing/crankshaft	Radial play	0.020 - 0.098	
Crankshaft bearing/crankshaft	Axial play	0.110 - 0.312	
Cylinder bore	Out-of-true	0.010	0.020

DESIGNATION OF CYLINDERS



ENGINE TORQUE SPECIFICATIONS

Location	Tightening Specifications	Torque Nm (ftlb)	Threads
Main bearing	3 steps: 1st step	20 (14)	M 12 x 1.5
	2nd step	40 (29)	
	3rd step	60 + 5 (43 + 3.6)	
Crankcase with "X" next to case number and all crankcases with closed main bearing bushing, bearing 1		75 + 5 (54 + 3.6)	
Main bearing	2 steps: 1st step	20 (14)	M 10
	2nd step	40 + 5 (29 + 3.6)	
Crankcase with "X" next to case number and all crankcases with closed main bearing bushing, bearing 1		50 + 5 (36 + 3.6)	
Oil pump	2 steps: 1st step	15 (11)	M 8
	2nd step	20 (14)	
Conrod nut with smooth bearing surface		58 + 5 (42 + 3.6)	M 10 x 1.25
Conrod nut with ribbed bearing surface		75 (54)	M 10 x 1.25
Cylinder head	A) Pre-loading cylinder head gasket		M 12 x 1.5
	1st step	20 (14)	
	2nd step	50 (36)	
	3rd step	85 (61)	
	B) Gasket left in preloaded condition 30 minutes		
	C) Final tightening: Nuts unscrewed one after the other by 1/4 turn and then tightened. See note on page 15 - 7	85 (61)	
	New tightening instructions for changed cylinder head gasket: Part No. 928.104.361.02 Cyl. 1 – 4 Part No. 928.104.362.02 Cyl. 5 – 8 Part No. 928.104.371.09 Cyl. 1 – 4		

Location	Tightening Procedures	Torque Nm (ftlb)	Thread
Cylinder head studs	New tightening procedure for cylinder head gasket: ET-No. 928.104.372.09 Cyl. 5 - 8 from following engine numbers onward: 80 C 0260 M 28/09 80 C 5269 M 28/10 82 C 0713 M 28/11 82 C 5782 M 28/12 81 C 1037 M 28/15 81 C 6398 M 28/16 80 C 8051 M 28/17 80 C 9155 M 28/18 1st step 2nd step 3rd step torquing by angle of rotation: 1st step 2nd step 3rd step 4th Step Only in conjunction with new stud bolt Recognizable by: Color: ochre (galvanized, yellow passivated) Thread: longer and with cylinder head gasket 928.104.361.02/362.02 928.104.371.09/372.09	 20 (14.6) 50 (36.5) 90 (65.7) 20 90°of rotation 90°of rotation 90°of rotation	

Location	Tightening Specifications	Torque Nm (kpm)	Threads
Camshaft housing to cylinder head		20 (2.0)	M 8
Plug on camshaft housing		40 (4.0)	M 18 x 1.5
Camshaft		45 (4.5) 65 (6.5)	M 10 (8.8) M 10 (10.9)
Spark plugs		25 to 30 (2.5 to 3.0)	
Flywheel		90 (9.0)	M 10 x 1.25
Pulley		295 (29.5)	M 18 x 1.5
Oil drain plug		60 (6.0) 50 (5.0)	M 22 x 1.5 M 20 x 1.5
Thermostat housing plug		80 (8.0)	M 48 x 1.5
Oil pressure sensor		35 (3.5)	M 18 x 1.5
Pressure relief valve plug		40 (4.0)	M 18 x 1.5
Bypass valve adapter		70 (7.0)	M 24 x 1.5
Water drain plug in engine block		35 (3.5)	M 12 x 1.5
Radiator water drain plug		1,5(0,2)	M 10
Adapter to radiator to engine		70 (7.0) 70 (7.0)	
Oil hose to adapter on crankcase upper section		70 (7.0)	M 26 x 1.5
Oil hose to adapter on radiator		70 (7.0)	M 26 x 1.5
Temperature switch on radiator		40 (4.0)	

Location	Tightening Specifications	Torque Nm (kpm)	Threads
Coolant thermostat housing to engine	Two steps: 1st step 2nd step	10 (1.0) 20 + 2 (2.0 + 0.2)	M 8
Coolant temperature transmitter		25 – 30 (2.5 – 3.0)	
Air Injection:			
Adapter on cylinder head		40 (4.0)	
Check valve		55 (5.5)	
Oxygen sensor air line		30 (3.0) 55 (5.5)	 M 18 x 1.5
Exhaust gas test nut on catalytic converter		30 (3.0)	M 14 x 1.5
Exhaust gas test plug on catalytic converter		15 (1.5)	M 8 x 1
Temperature sensor II to thermostat housing		12 (1.2)	
Temperature valve to connector		max. 15 (1.5)	M 10 x 1
CO test line to exhaust manifold		25 (2.5)	
All other bolts and nuts:			
M 6		6 + 2 (0.6 + 0.2)	
M 8		20 + 2 (2.0 + 0.2)	
M 10		40 + 5 (4.0 + 0.5)	

Engine tightening torques (32-valve engine)

Location	Thread	Tightening torque Nm (ftlb)	
Main bearing bolts	M 12 x 1.5	1st stage	30 (22)
		2nd stage	55 (41)
		3rd stage	75 +5 (55 +4)
Main bearing bolts	M 10	1st stage	20 (15)
		2nd stage	50 + 5 (37 + 4)
Oil pump bolts	M 8	1st stage	15 (11)
		2nd stage	20 (15)
Connecting rod bolts Verbusrip nut	M 10 x 1.25	75 (55)	
928 GTS (5.4 l) Engine Type M 28.49/50 Connecting rod bolts (forged con-rods) Verbusrip nut	M 10 x 1.25	25 + 90° tightening angle	
Cylinder head **studs**		1st stage	20 (15)
		2nd stage	90° torque angle
		3rd stage	90° torque angle
		4th stage	90° torque angle
Cylinder head **hexagon head bolts**		1st stage	20 (15)
		2nd stage	90° torque angle
		3rd stage	90° torque angle
Camshaft bearing saddles to cylinder head	M 6	10 (7)	
	M 8	20 (15)	
Hex socket head bolts for chain tensioner	M 6	10 (7)	
Banjo bolt / chain tensioner	M 8 x 1	10 (7)	
Check valve / chain tensioner	M 10 x 1	15 (11)	
Camshaft bolt union	M 10 x 1.5	65 (48)	
Cylinder head cover	M 6	10 (7)	
Spark plugs	M 14 x 1.25	25 to 30 (18 to 22)	
Flywheel bolts	M 10 x 1.25	1st stage	40 (30)
		2nd stage	90 (66)

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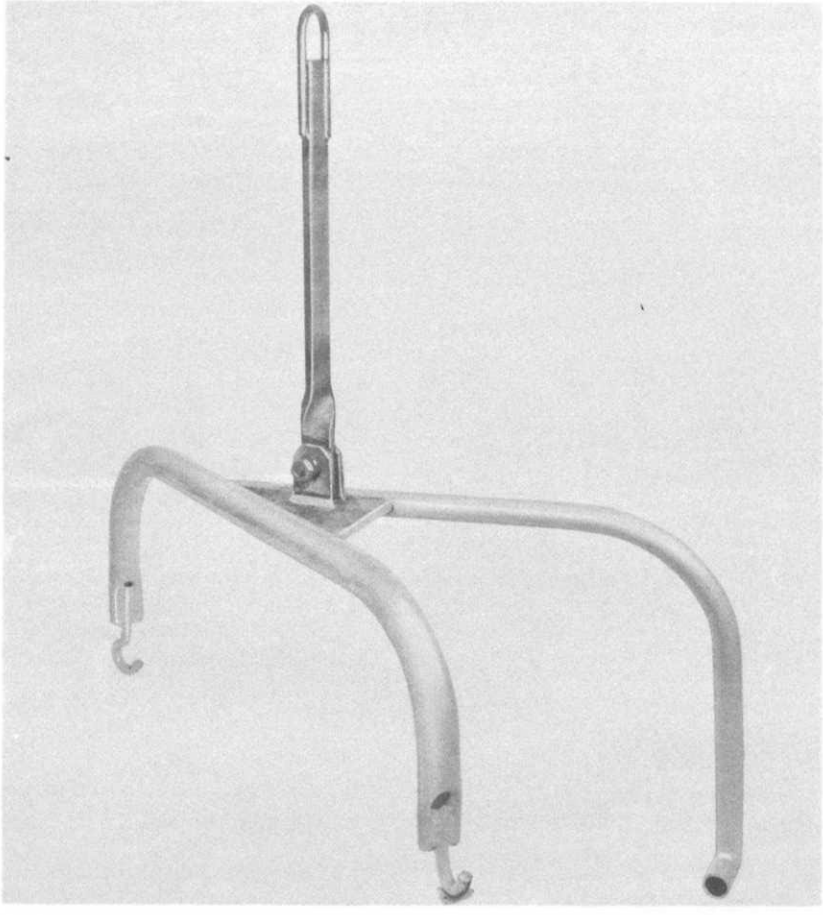
Location	Thread	Tightening torque Nm (ftlb)
Pulley bolts	M 18 x 1.5	295 (218)
Oil drain plug	M 20 x 1.5	50 (37)
Thermostat housing plug	M 48 x 1.5	80 (59)
Oil pressure sender	M 18 x 1.5	35 (26)
Pressure release valve plug	M 18 x 1.5	40 (30)
Short-circuit valve screw-in flange	M 24 x 1.5	70 (52)
Cylinder block drain plug	M 12 x 1.5	35 (26)
Radiator drain plug	M 10	1.5 (1)
Screw-in flange to radiator to engine		70 (52) 70 (52)
Oil hose to screw-in flange at upper crankcase section	M 26 x 1.5	70 (52)
at coolant radiator	M 26 x 1.5	70 (52)
Temperature switch to coolant radiator		40 (30)
Regulator housing for coolant circuit to engine	M 8	1st stage 10 (7) 2nd stage 20 + 2 (15 + 1)
Temp. sender unit - coolant temperature		25 - 30 (18 - 22)
Check valve		55 (41)
Air line		30 (22)
Oxygen sensor	M 18 x 1.5	55 (41)
Exhaust gas takeoff plug to catalytic converter	M 8 x 1	15 (11)
Temp. sensor NTC II to regulator housing		12 (9)

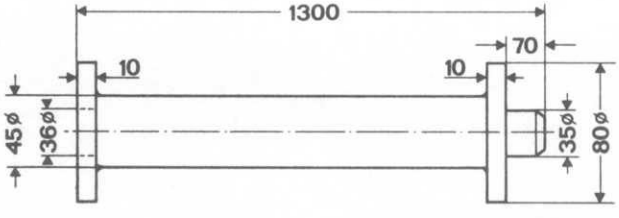
Printed in Germany – XXVII, 1991

Location	Thread	Tightening torque Nm (ftlb)
Knock sensor bolt union	M 8	20 (15), without washer
Knock sensor bolt union as of Engine No. M 28.42 81 M 51771 M 28.47 85 M 01112 928 GTS (5.4 l) engine type M 28.49/50	M 8	20 (15), original screw (micro-seal type) without washer
Intake rail mounting	M 8	15 (11)
Hall sender mounting	M 6	8 (6)
CO branch line mounting to exhaust manifold		25 (18)
All other nuts and bolts		
M 6 M 8 M 10		8 + 2 (6 +1) 20 + 2 (15 +1) 40 – 5 (30 +4)

Printed in Germany – XXVII, 1991

TOOLS





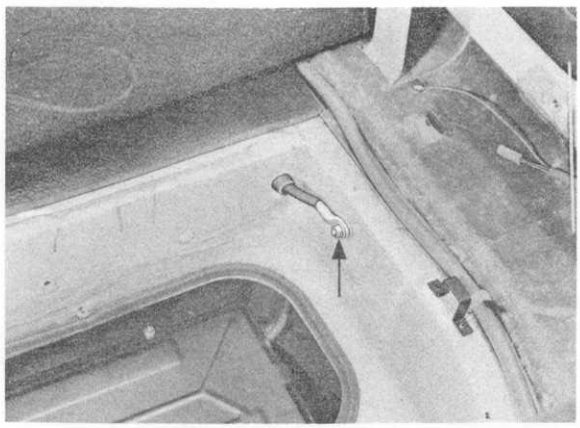
No.	Description	Special Tool	Remarks
1	Adapter for removal and installation of engine	9137	Used in conjunction with shop hoist

REMOVING AND INSTALLING ENGINE

Removing

1. Use fender and bumper protective covers.

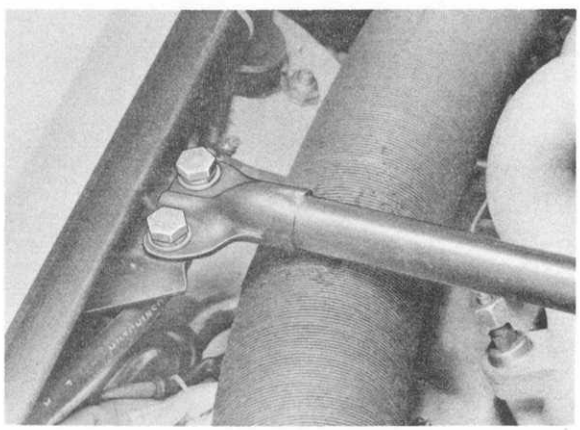
2. Disconnect battery ground cable at spare wheel well.



3. Loosen and remove engine compartment cross brace.

Note

Car must stand on its wheels when cross brace is removed or installed.



4. Set up hoist and align with specified pick-up points on car, but do not raise car.

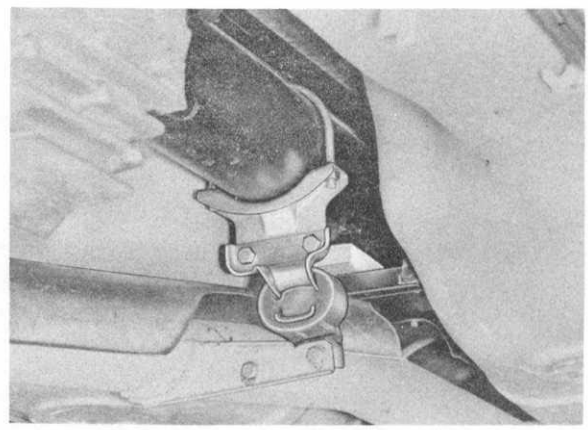
5. Detach windshield washer hoses and engine compartment light wires.

6. Disconnect engine hood supports at top, loosen engine hood bolts and remove engine hood.

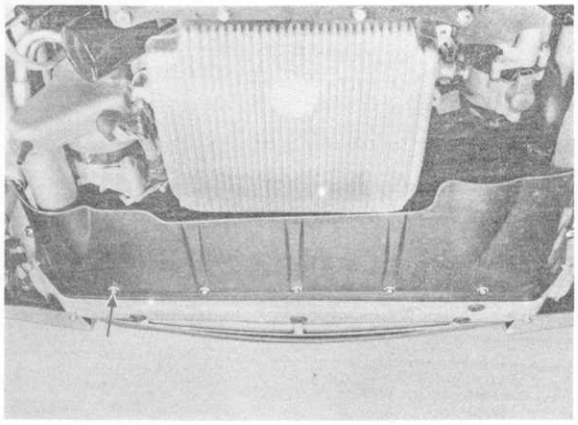
7. Remove cap from coolant expansion tank.

8. Remove air intake hoses and entire air cleaner assembly.

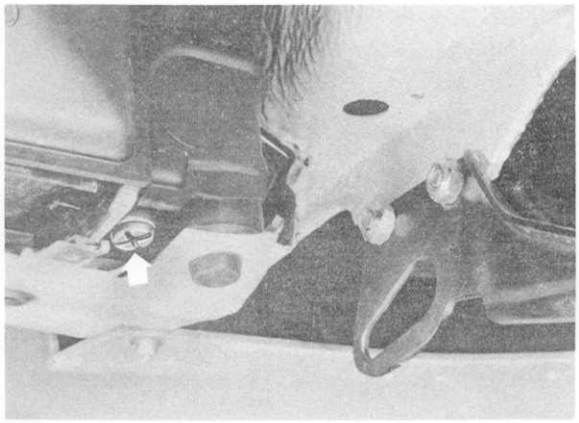
9. Raise car. Place piece of wood (locally manufactured) on central tube and rear tunnel brace.



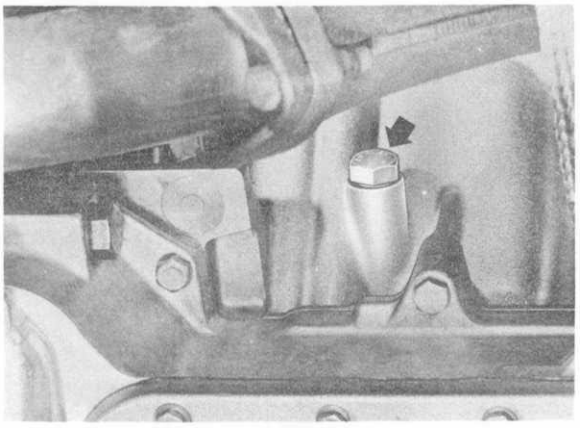
10. Detach splash shield at bottom.



11. Drain coolant from radiator.

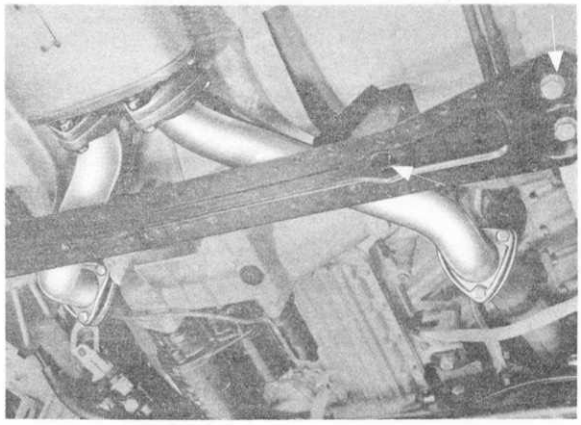


Remove water drain plugs on left and right side of crankcase.

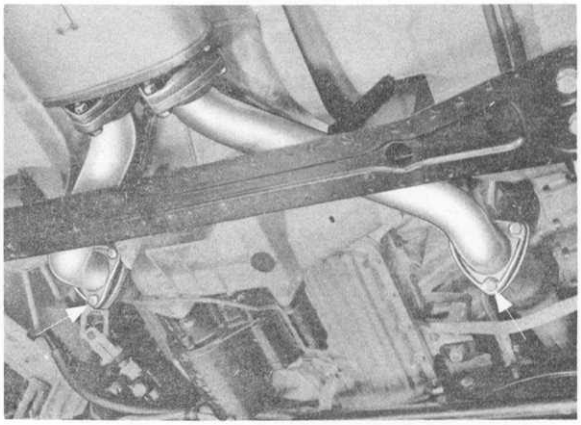


12. Drain engine oil.

13. Remove lower body brace.



14. Detach exhaust pipes at exhaust manifolds and heat shields on left and right sides.



15. Detach ground cable at body.

16. Install and tighten oil drain plug to specified torque.

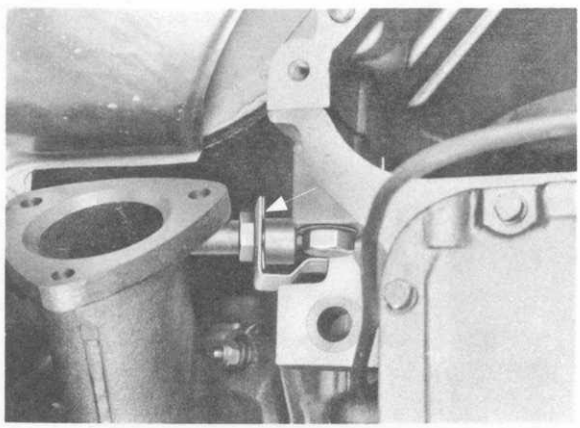
17. Install and tighten coolant drain plugs to specified torque.

18. Unscrew clutch slave cylinder at clutch housing and remove with line connected.

Note

Do not operate clutch pedal.

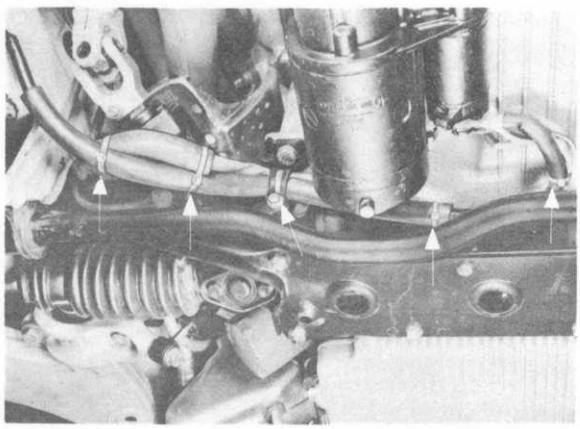
19. Remove mounting strap for pressure line to slave cylinder.



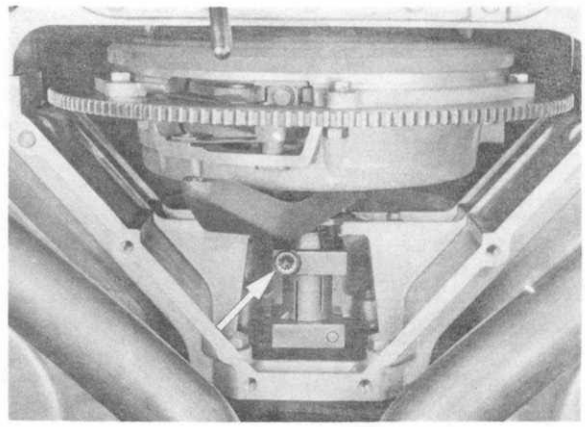
20. Disconnect wires on starter.

21. Remove clutch housing cover with starter. Disconnect release lever at ball pin by pressing release lever down in direction of clutch.

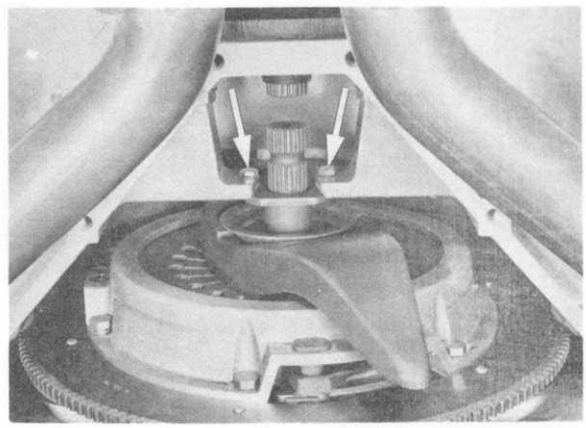
22. Open clamps for starter wires on steering cross member.



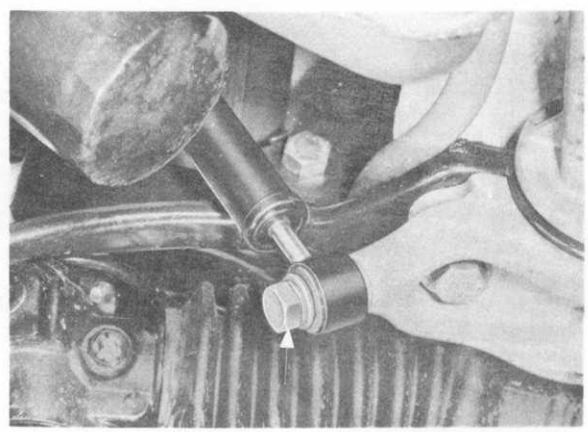
23. Remove socket head bolts and slide back clamping sleeve on drive shaft.



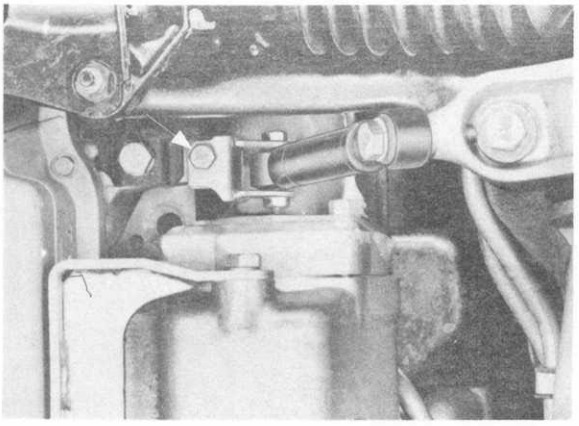
24. Unscrew throwout bearing sleeve mounting bolts and push sleeve in direction of clutch.



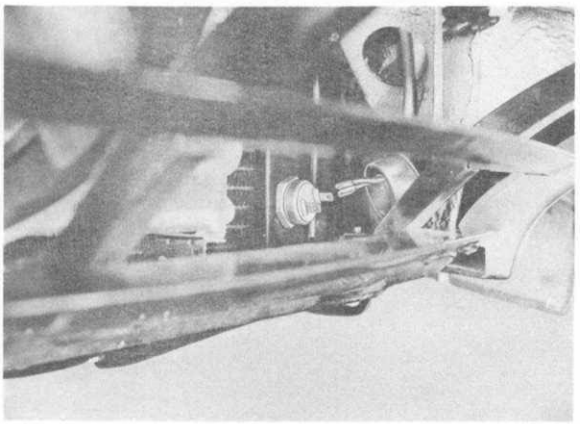
25. Disconnect left and right engine shock absorbers at control arms.



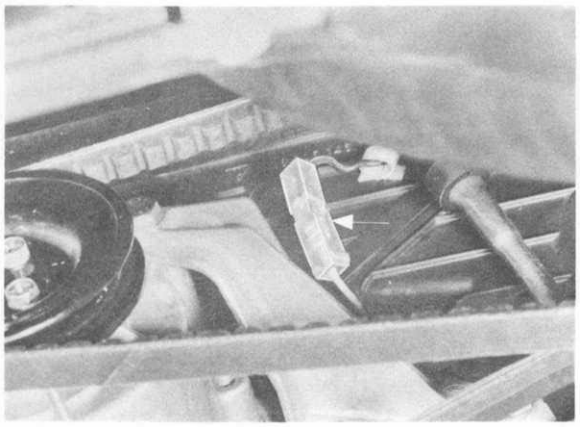
26. Detach engine shock absorbers with left and right mounts.



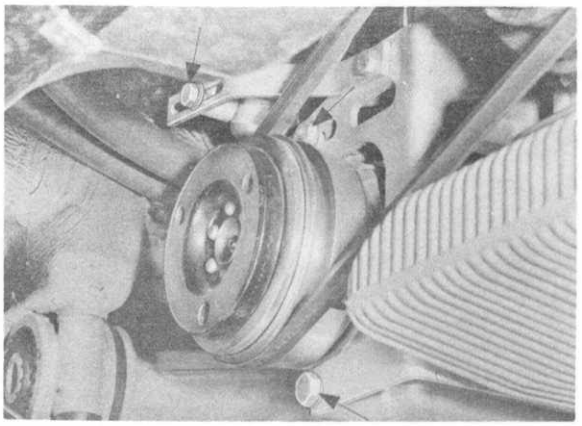
27. Cars with air conditioning: Detach temperature switch wires on radiator.

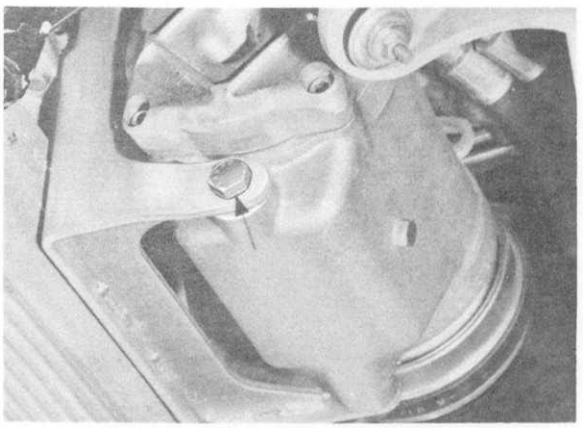


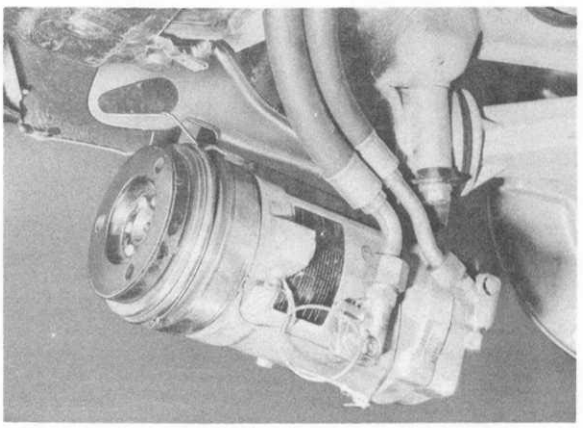
Disconnect plug leading to compressor (on right drive belt cover).



28. Loosen compressor, remove from console and suspend it with the hoses connected.



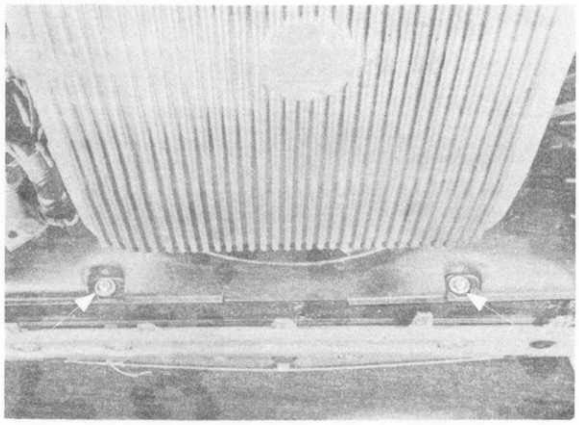




29. Loosen and remove air pump filter housing.

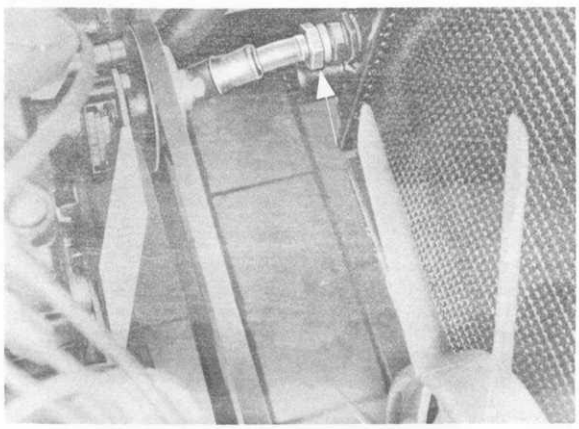
30. Detach alternator cooling hose.

31. Loosen lower fan shroud at radiator and remove.



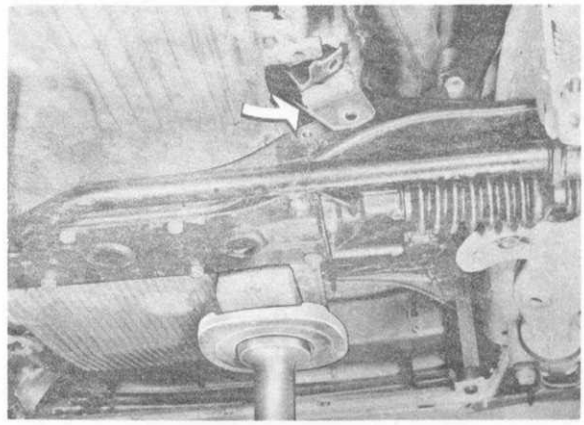
32. Detach all coolant hoses at radiator.

33. Detach bottom oil hose at radiator.



34. Remove engine mounts separately by applying a lifting force from one side to engine with a hydraulic jack, locally manufactured pad and an appropriate piece of wood on the oil pan, loosening the bolts, lifting the engine and removing the engine mounts.

    Place engine on front cross member carefully. Remove second mount accordingly.



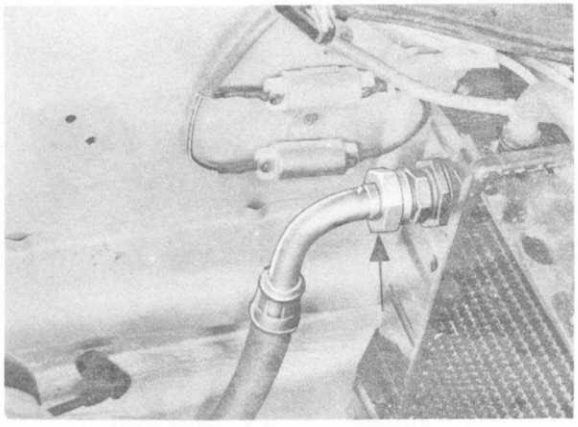
35. Remove clutch/engine mounting bolts.

36. Lower car.

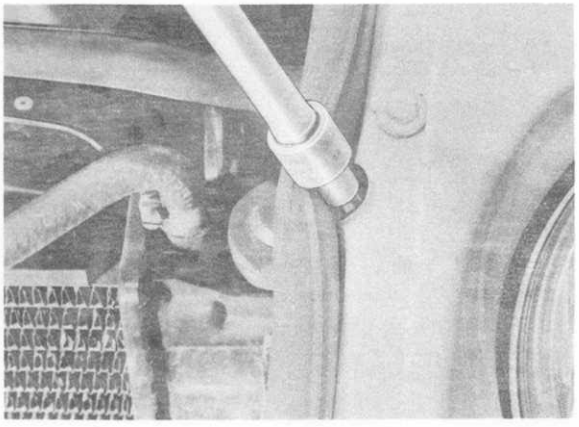
37. Loosen and detach vent hose at T-adaptor for radiator and thermostat housing.

38. Loosen and detach coolant hoses at thermostat housing.

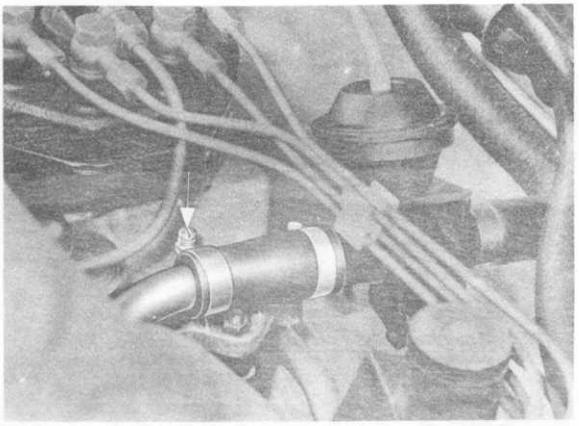
39. Detach upper oil hose at radiator while counterholding.



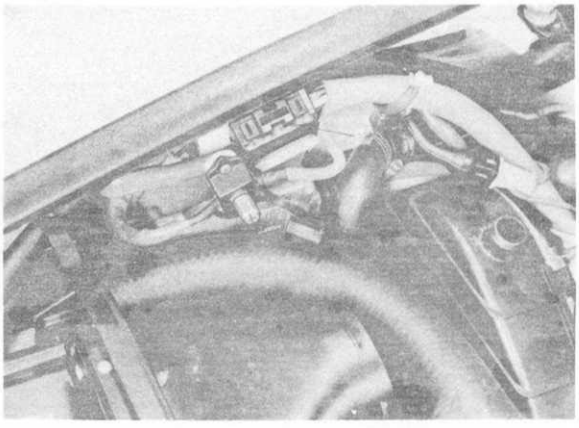
40. Loosen top radiator mountings and lift out radiator carefully.



41. Open hose clamp and remove hose between heater valve and neck.



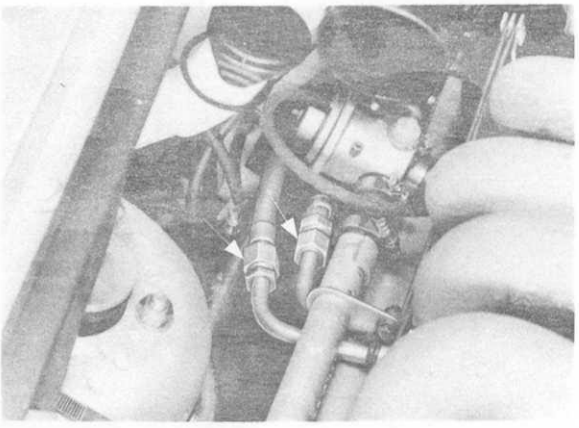
42. Disconnect B + wire, plug of transmitter wire to distributor and plug for engine wire harness.



43. Remove control unit.

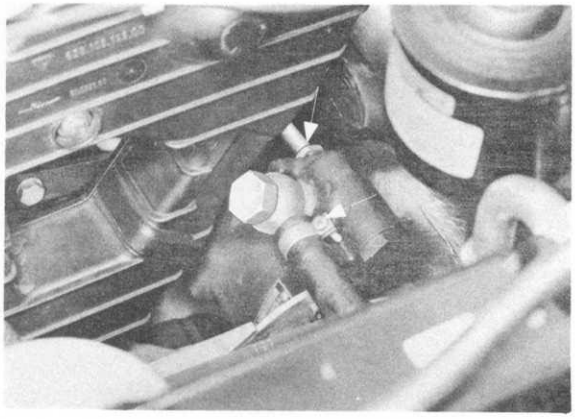
44. Detach ignition coil and place aside.

45. Detach fuel feed and return lines while counterholding.



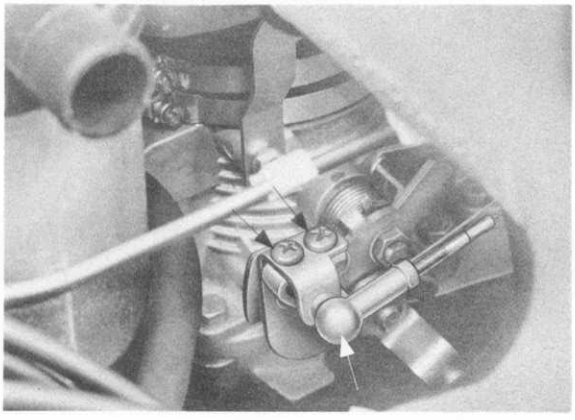
46. Detach hydraulic line at power steering pump.

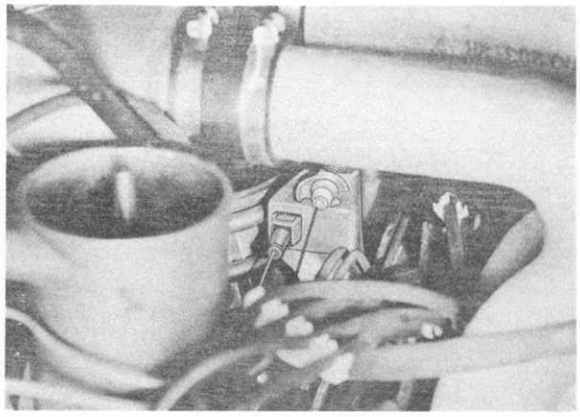
47. Detach oil hoses at supply tank of power steering pump, drain oil and remove tank.



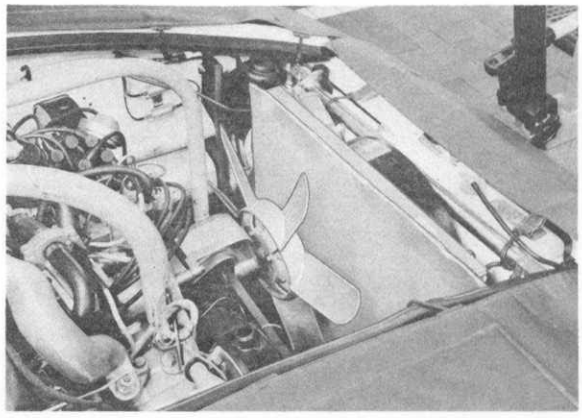
48. Detach brake booster vacuum hose at manifold.

49. Disconnect operating cable for accelerator pedal and cruise control, remove holder and clamp, and place cables outside.





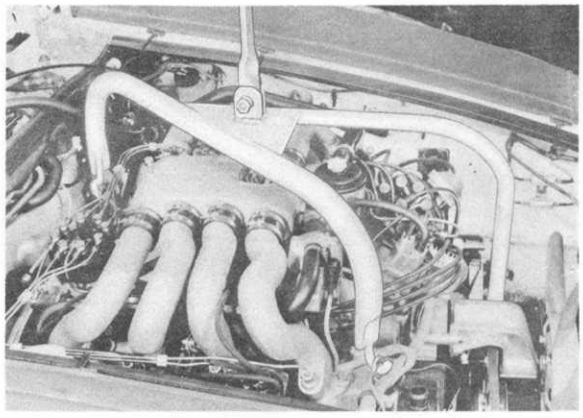
50. Be sure to cover condenser on cars with air conditioning to prevent damage when removing and installing (e.g. with a wood board).



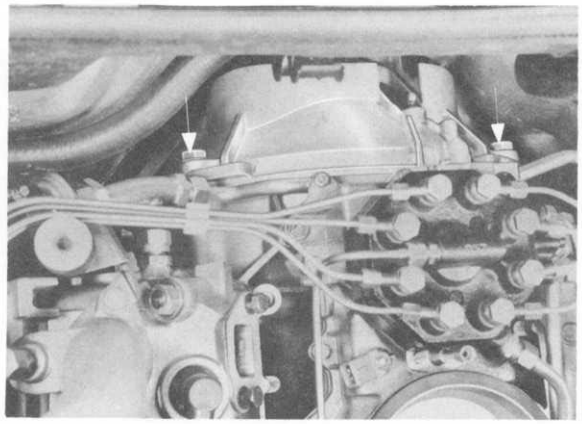
51. Engage adapter 9137 (in conjunction with floor hoist) in the eyelets provided for this purpose. Raise adapter until tight on engine.

Note

This requires that car stands on its wheels.

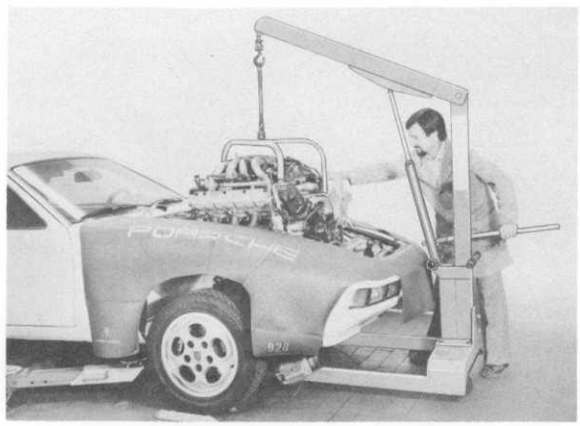


52. Unscrew top engine block/clutch housing mounting bolts.



53. Pull engine forward carefully and remove central shaft I with guide tube.

54. Lift out engine.



Installing

Note the following for installation.

1. Tighten nuts and bolts to specified torques.

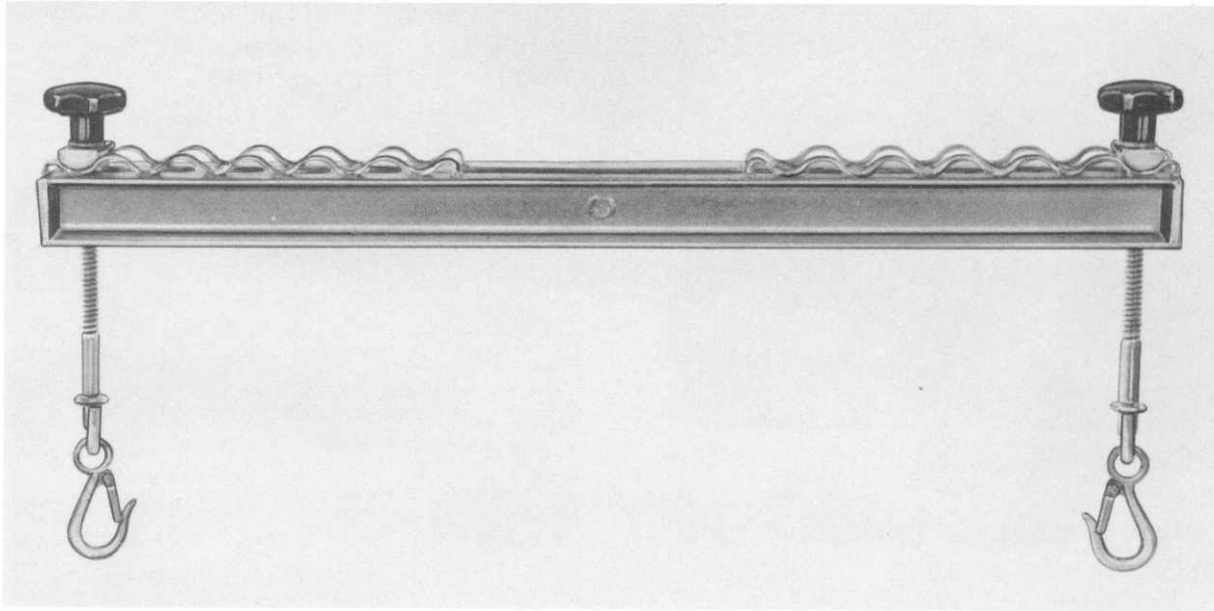
2. Add coolant until level is at edge of filler opening (position heater lever at "warm").

3. Run engine to operating temperature and check coolant level, adding more coolant if necessary.

   Coolant level must reach center of expansion tank.

ENGINE; REMOVING AND INSTALLING

(32-VALVE ENGINES) TOOLS



No.	Designation	Special Tool	Remarks
	Engine lifting tackle	3033	VW Special tool

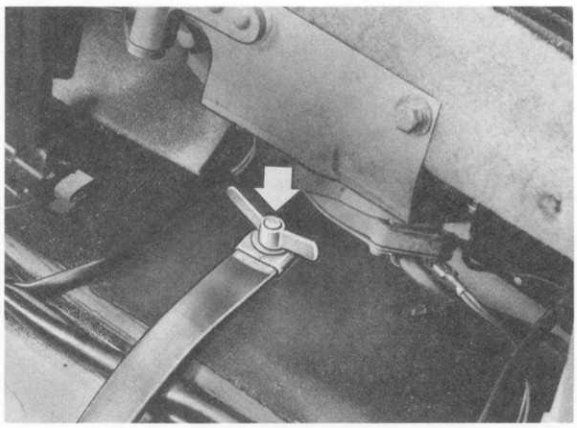
Please note:

If necessary, use a commercially available carabiner (650 kg load-bearing capacity) to attach engine lifting tackle to workshop hoist.

ENGINE, REMOVING AND INSTALLING
(32-VALVE ENGINES)

R e m o v a l

1. Disconnect ground lead to battery behind tool plate.



2. Place cover over fender and bumper.

3. Unbolt and remove cross member.

N o t e

Vehicle must be standing on its wheels. Cross member is tensioned.

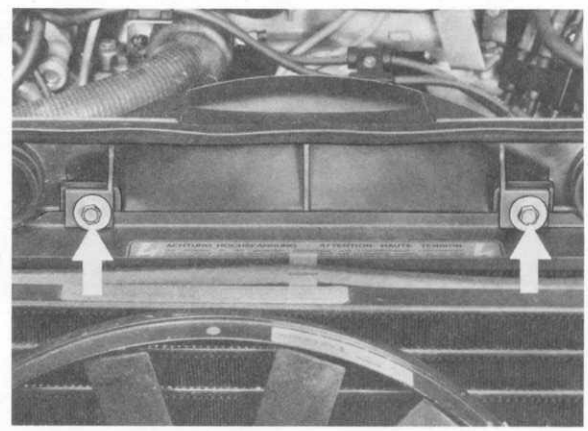
4. Position lifting platform and engage vehicle jacking points.

5. Disconnect hoses for windscreen washer, heated spray nozzles and cable for engine compartment light.

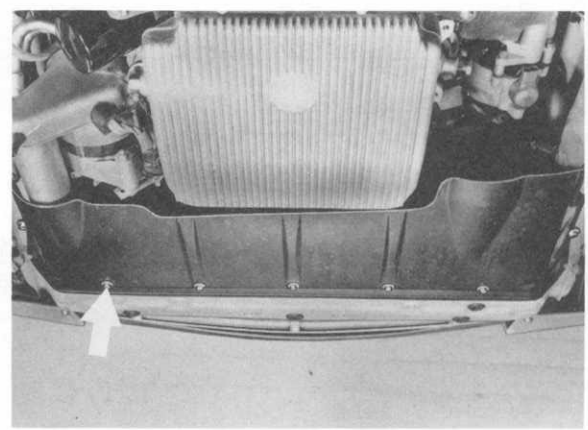
6. Unhook accelerator spring retaining clamp at bottom, unscrew hood mounts and lift off hood.

7. Remove air intake hoses and air filter housing as a unit.

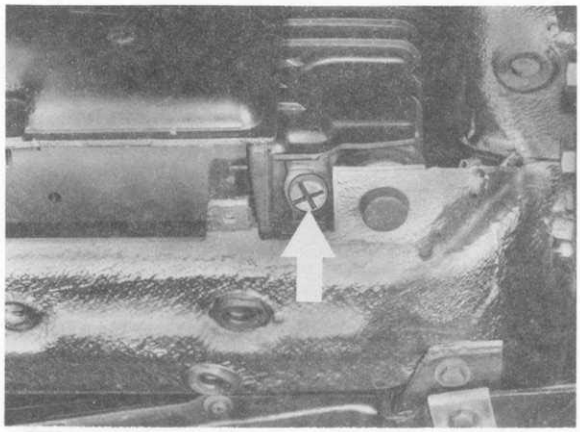
8. Open cap of cooling water expansion tank and remove top of air deflector from cooler.



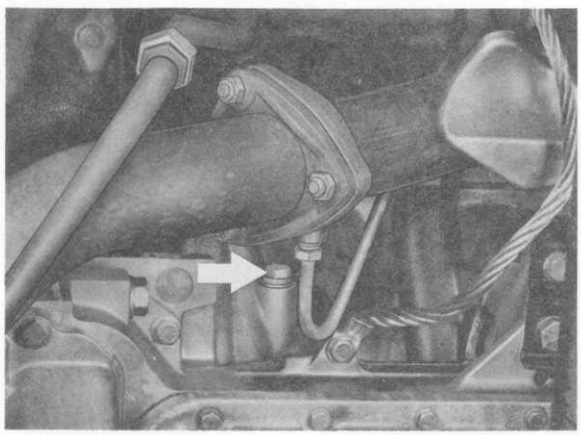
9. Raise vehicle and remove oil pan guard.



10.Drain cooler. (Catch coolant in suitable container).



11.Unscrew water drain plugs on left and right of crankcase upper half.

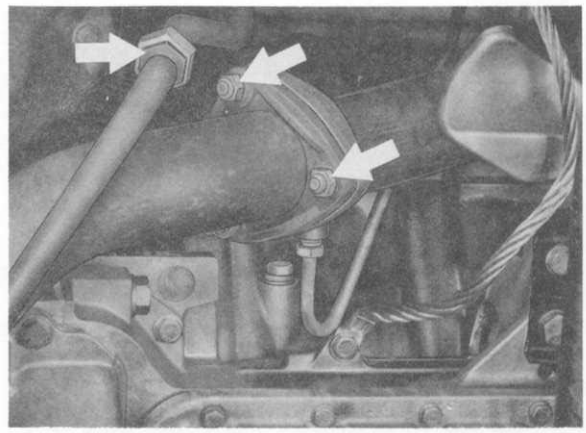


12.Drain engine oil. (Only if engine is to be overhauled.)

13.Disconnect exhaust flanges on left and right of exhaust manifold and unscrew air injector.

N o t e

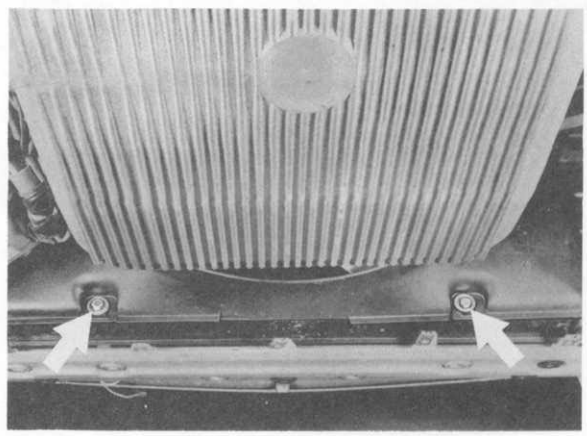
Wrap a piece of wire around exhaust system behind junction and attach to cross member.



14.Disconnect body-engine ground connection at engine.

15.Replace cooler drain plug and tighten to specified torque, 1.5 Nm (0.2 kpm).

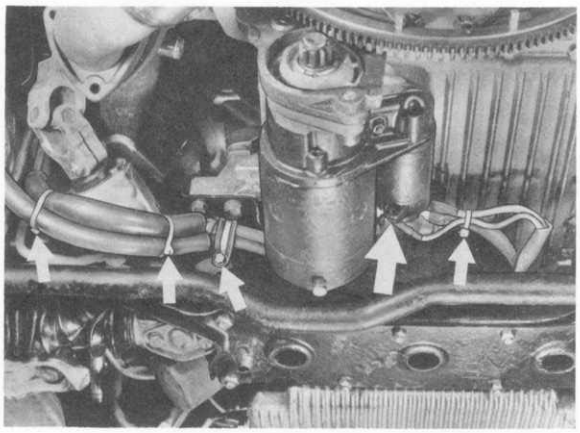
16.Remove bottom section of air deflector from cooler.



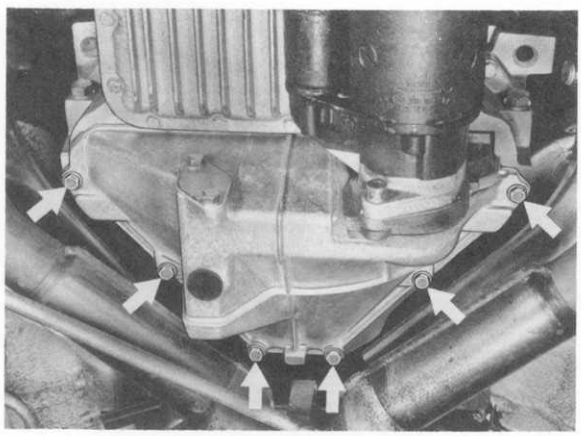
17.Pull air hose off alternator.

18.Disconnect cable from starter.

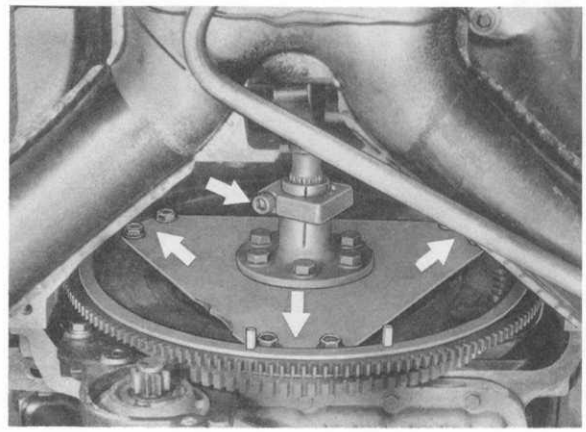
19.Detach clamps for starter cable from steering transverse and pull alternator cable thru toward front of vehicle.



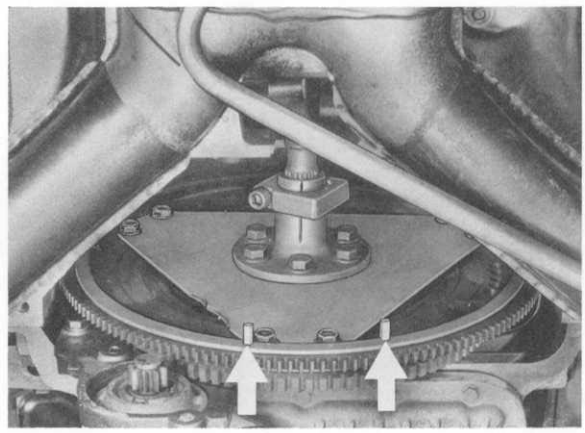
20.Remove cover from clutch housing.



21.Unscrew bolts holding driving plate, unscrew pan head screw of bearing sleeve, push driven plate back along central shaft.



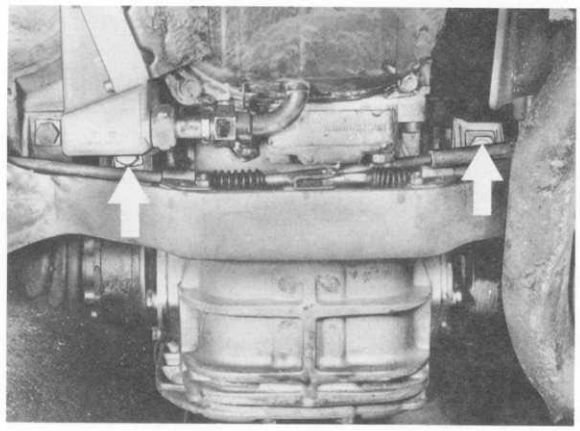
22.The pins for the oil temperature sensor must point downward before engine can be removed.



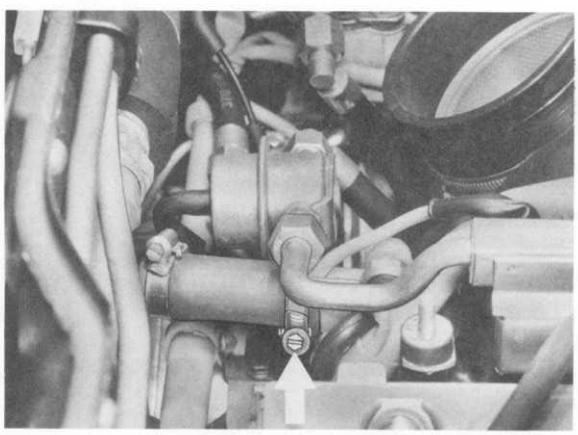
Note:

The clutch must be removed completely for vehicles from Model 87, engine type M 28.41 onwards. Refer to the Workshop Manual, Page 30 - 6b.

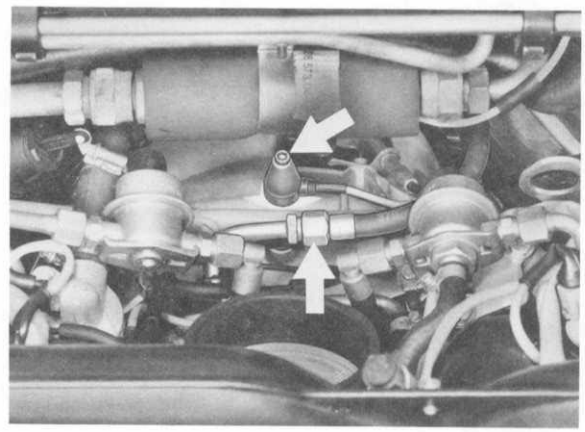
23. Remove both transmission mount bolts.



24. Disconnect hose from heating regulator and pipe stub on engine and remove. Pull underpressure line for automatic transmission from underpressure distributor.

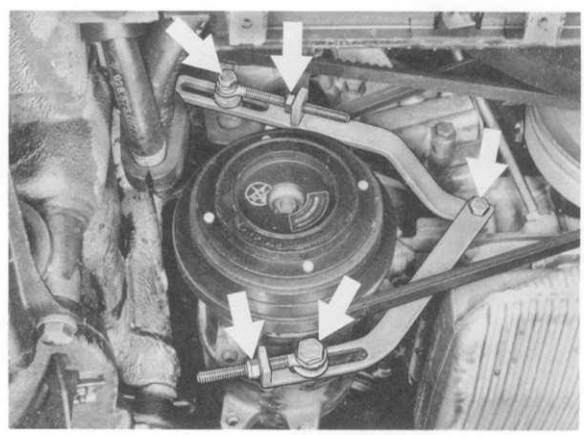


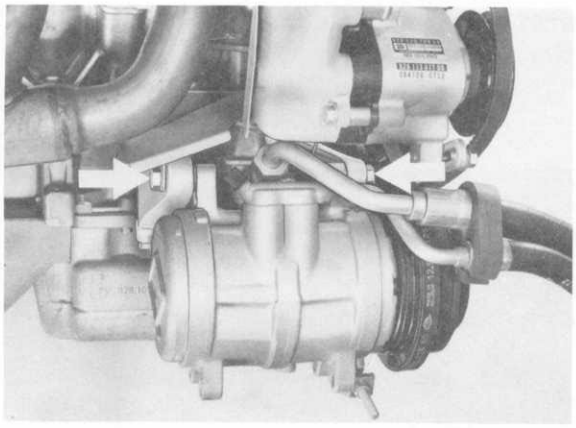
25. Disconnect and remove oil temperature sensor. Disconnect fuel return line while countering nut with second open-ended wrench.



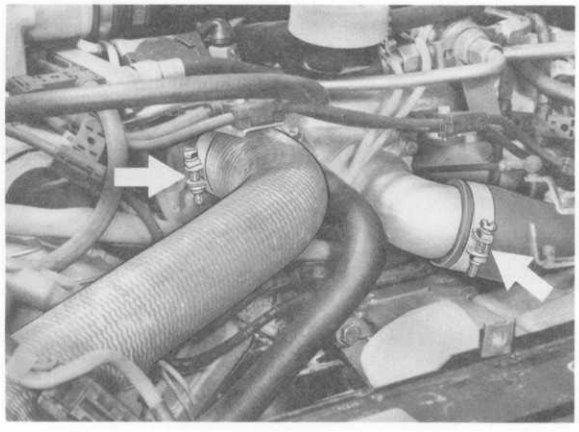
26. Unscrew bolts for clutch housing-engine housing top and bottom (e.g. jointed socket wrench) and push transmission toward rear (approx. 5 - 6 mm).

27. Disconnect air conditioner compressor plug connector, remove compressor from bracket and hang on one side with hoses in place.

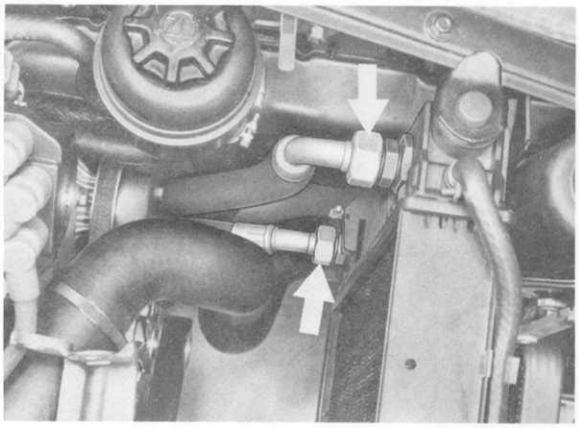




28. Detach both coolant hoses from cooler at regulator housing and remove.

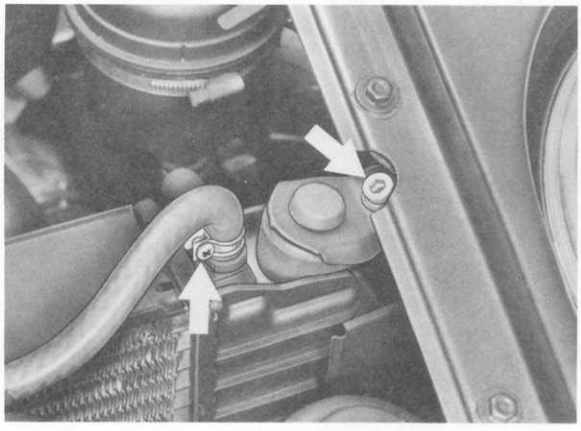


29. Detach oil hoses for engine cooling and ATF cooling from top and bottom of cooler, countering with second open-ended wrench.

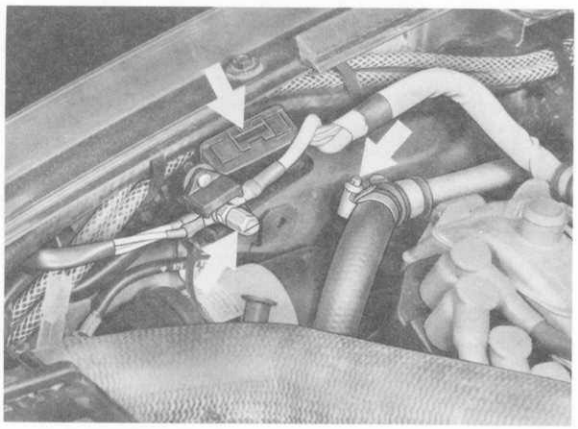


30. Disconnect cable from temperature switch at bottom left of cooler.

31. Disconnect bleed hose from top left of cooler, unscrew cooler attachment and lift cooler carefully up out of engine compartment.

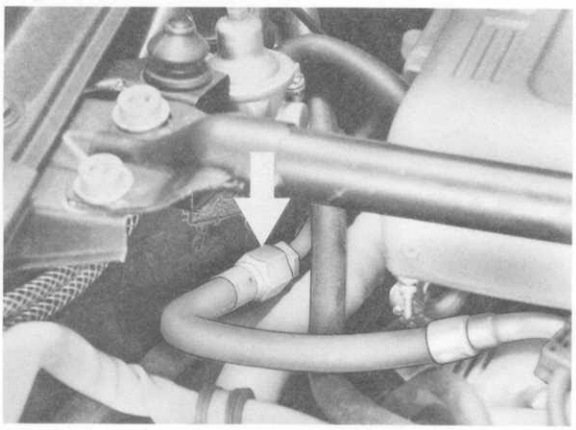


32. Disconnect coolant filler hose from cooler tube at front right, and remove. Disconnect multi-plug and B+ terminal.



33. Disconnect bleed hose from cooling water expansion tank at engine and remove.

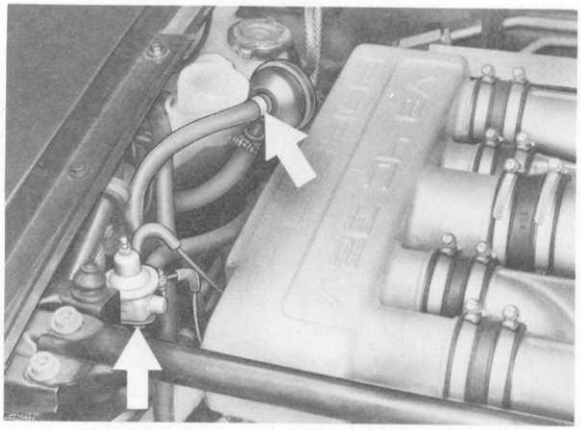
34. Disconnect fuel supply line, countering with second open-ended wrench.



35. Disconnect ignition leads on both sides from distributor cover, remove both ignition coils from bracket and lay to one side.

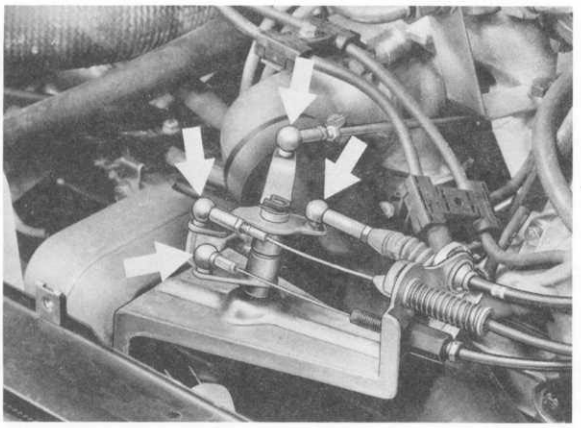
36. Detach filter housing from air pump.

37. Remove scavenging valve from holder. Disconnect hose from air-bleed valve and remove. Disconnect underpressure hose from EZF control unit.



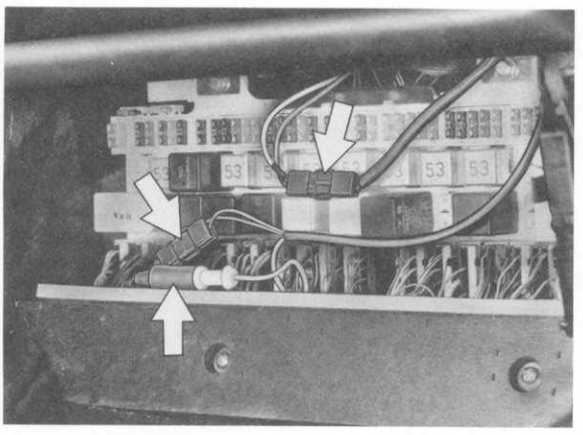
38. Disconnect underpressure hose from brake servo unit and remove.

39. Disengage actuating cables for throttle, cruise control and control cable for automatic transmission. Remove safety devices and clamp from bracket and lay cables over fender.

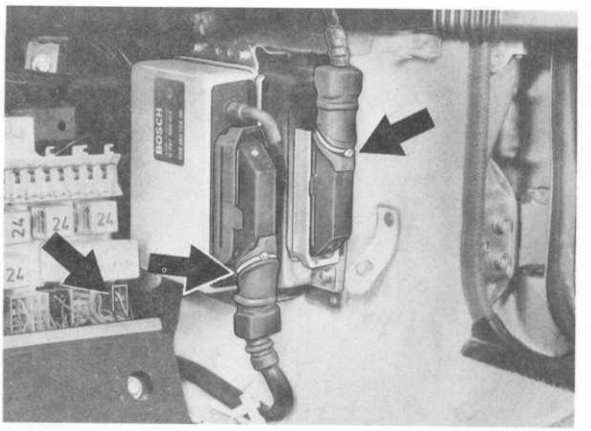


40. Disconnect oil hoses from servo pump reservoir, drain oil and catch in suitable container. Disconnect hose clamp from reservoir and remove reservoir.

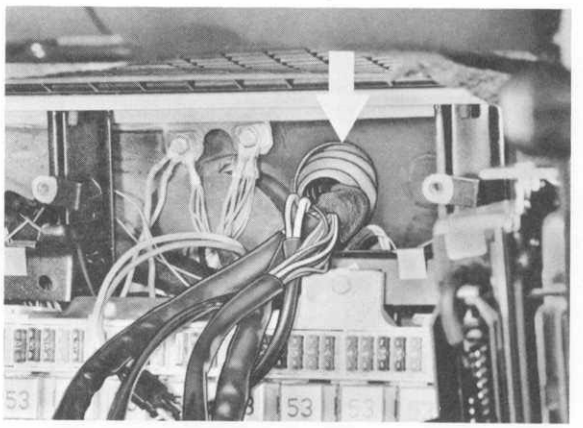
41. Remove cover of central electrics unit. Disconnect plug-type connectors for Lambda probe, probe heating and electronic ignition.



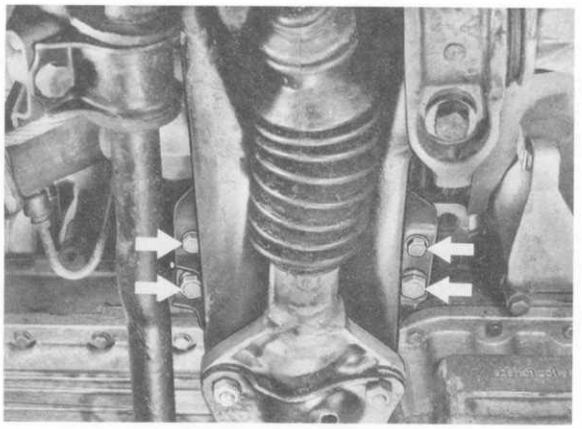
42. Disconnect multiplugs from EZF and LH control units, together with multiplug at right of central electrics unit.



43. Push rubber sleeve out of holder into engine compartment.



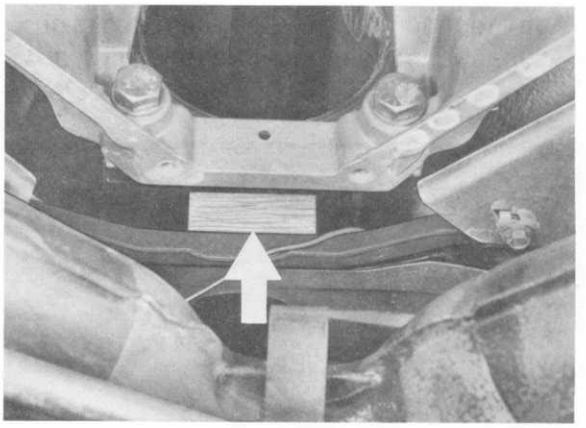
44.Unscrew left-hand and right-hand mount bolts in underside of engine brace.



45.Attach VW 3033 lifting tackle mounted on workshop hoist (e.g. Bilstein K 750 H) to eyes and slightly tension lifting tackle.



46.Place wooden block (improvised) between central pipe and cross member.



47.Tilt engine carefully toward front, lifting slightly. Once engine housing and clutch housing separate, engine can be hoisted out of vehicle.

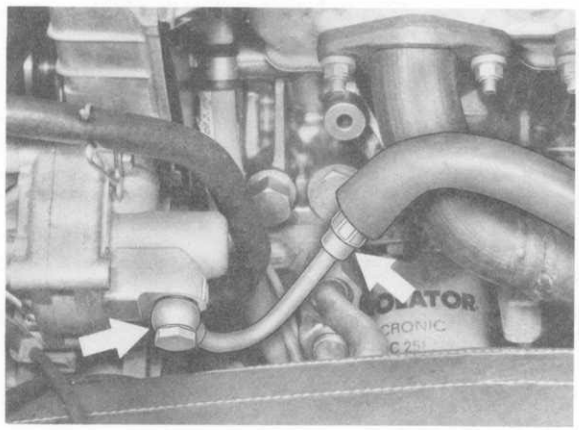
N o t e

Care must be taken to ensure that the cable bundle from the central electrics unit is paid out as the engine is lifted clear of the vehicle.

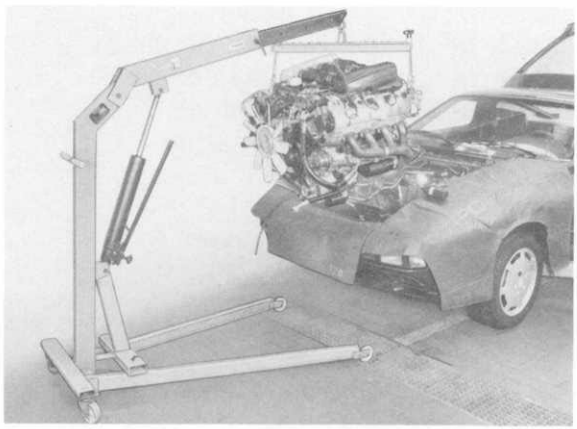
48.Disconnect delivery hose from servo pump and remove.

N o t e

Mark position of delivery hose before disconnecting.



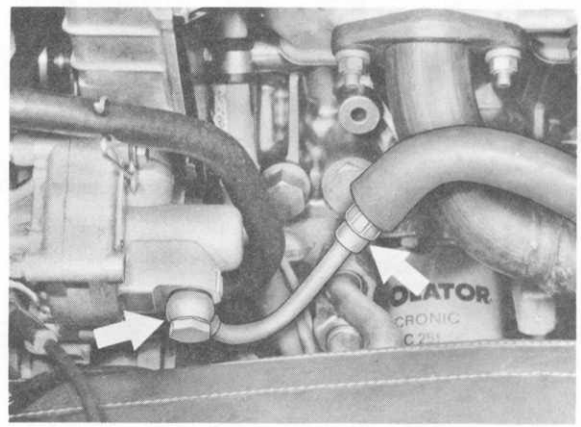
49.Lift engine clear of vehicle.



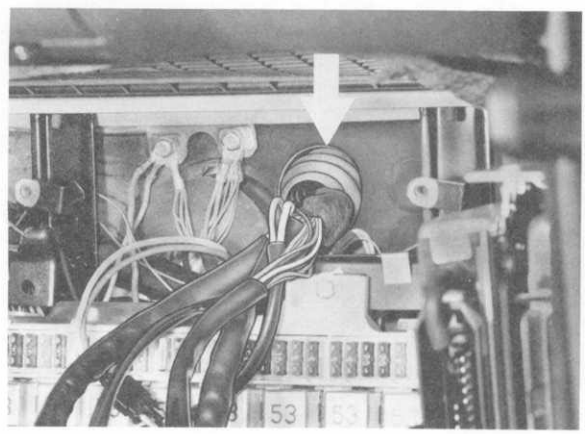
I n s t a l l a t i o n

Note the following:

1.Push transmission to rear. Place wooden block (improvised, 25 mm thick) between drive shaft casing and cross member. Connect the servo pump delivery line before installing the engine. (Note mounting position).



2.Insert cable bundle of central electrics.



3. Lower the engine onto the hydraulic mounts. Detach lifting bar and workshop hoist.

4. Use a car jack to raise the clutch housing and transaxle and bring the engine to its installation position.

Note

To avoid placing the driver plate of the flywheel under strain, start by fitting the driver plate to the flywheel using the six bolts and only tighten the pan-head screw of the clamping sleeve afterwards.
Tightening torque: 80 Nm

5. Top up coolant level to lip. Set heater lever to "warm".

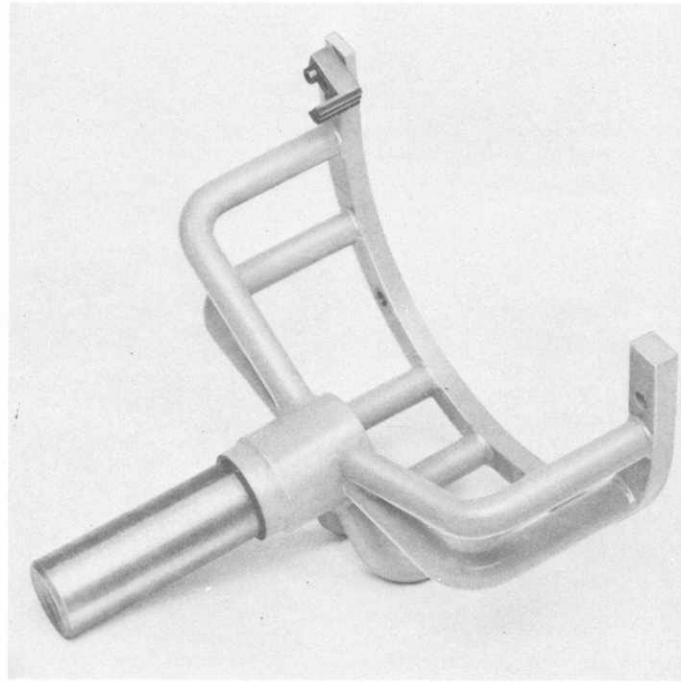
6. Run the engine until it reaches its operating temperature, check engine oil and coolant levels, top up if necessary. The coolant level should lie near the middle of the expansion tank.

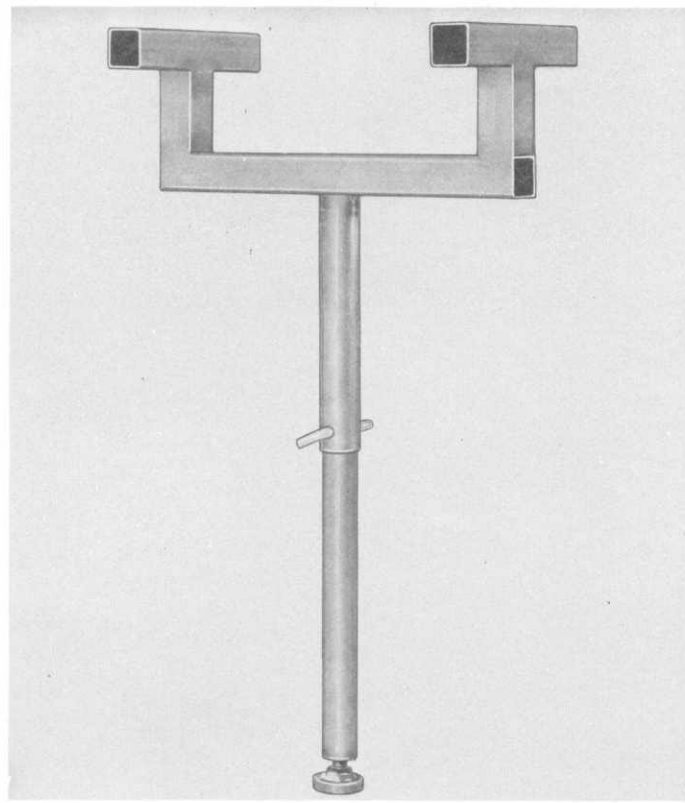
7. Fill hydraulic steering fluid reservoir and bleed the steering system.

8. Top up the ATF in the transmission.

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TOOLS

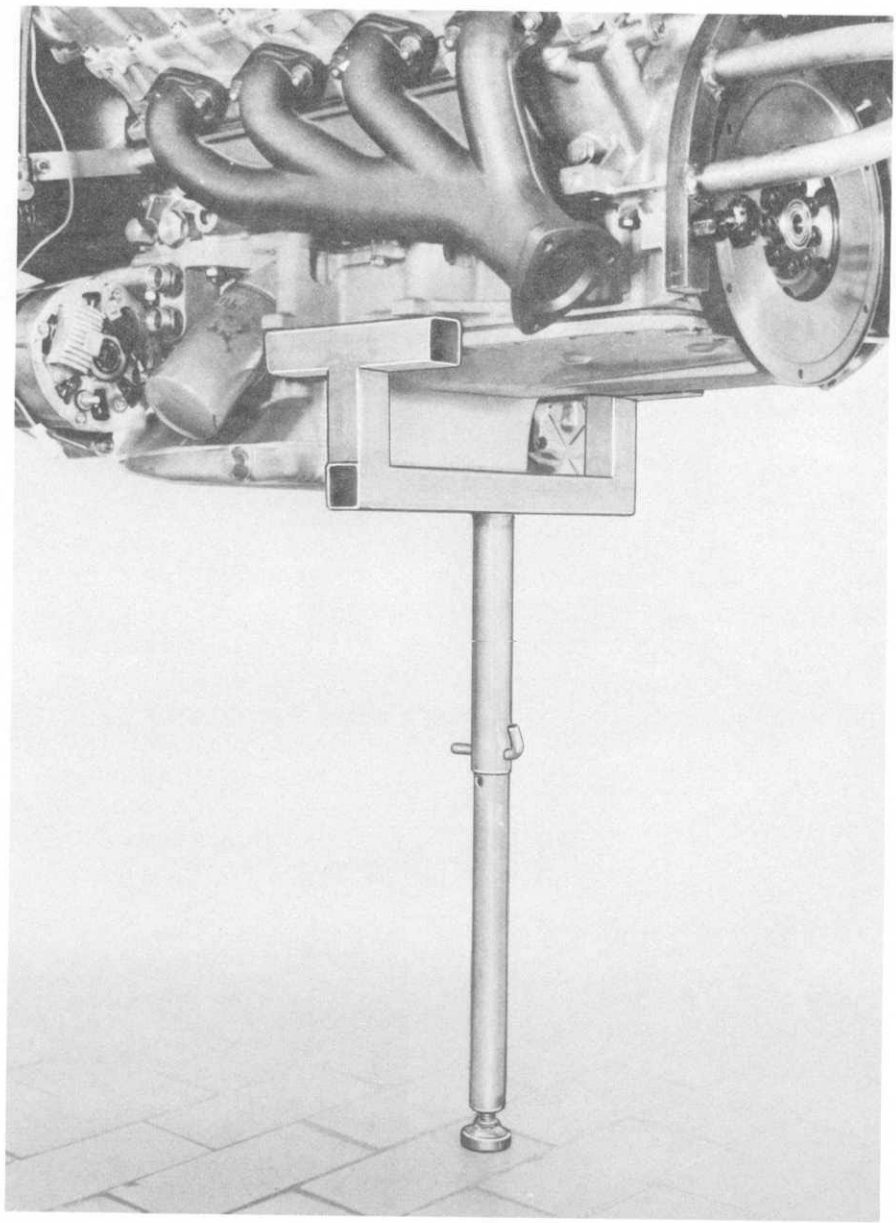




No.	Description	Special Tool	Remarks
1	Engine holder	9127	
2	Engine support	9128	

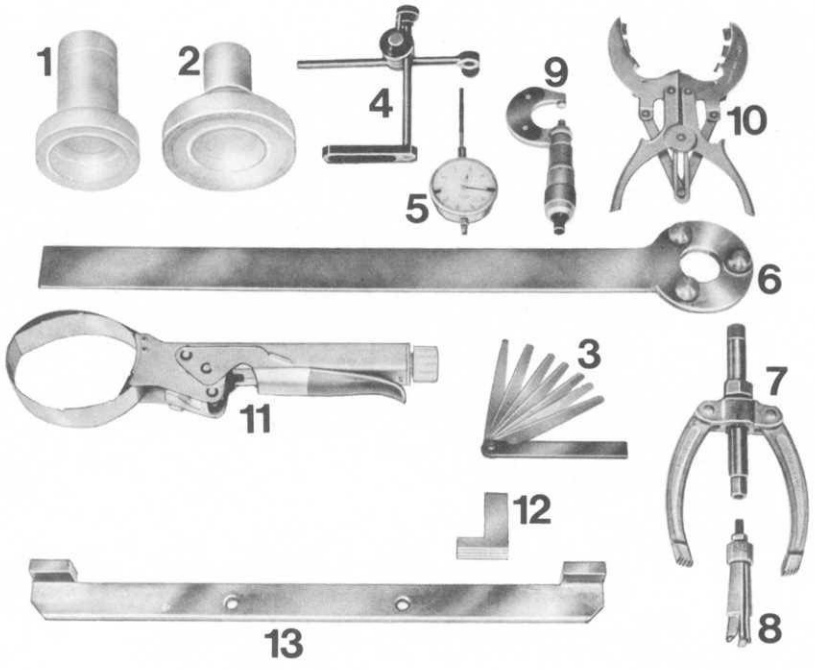
USING ENGINE SUPPORT (SPECIAL TOOL 9128)

We recommend using the engine support as from the state "cylinder heads installed" when assembling the engine.



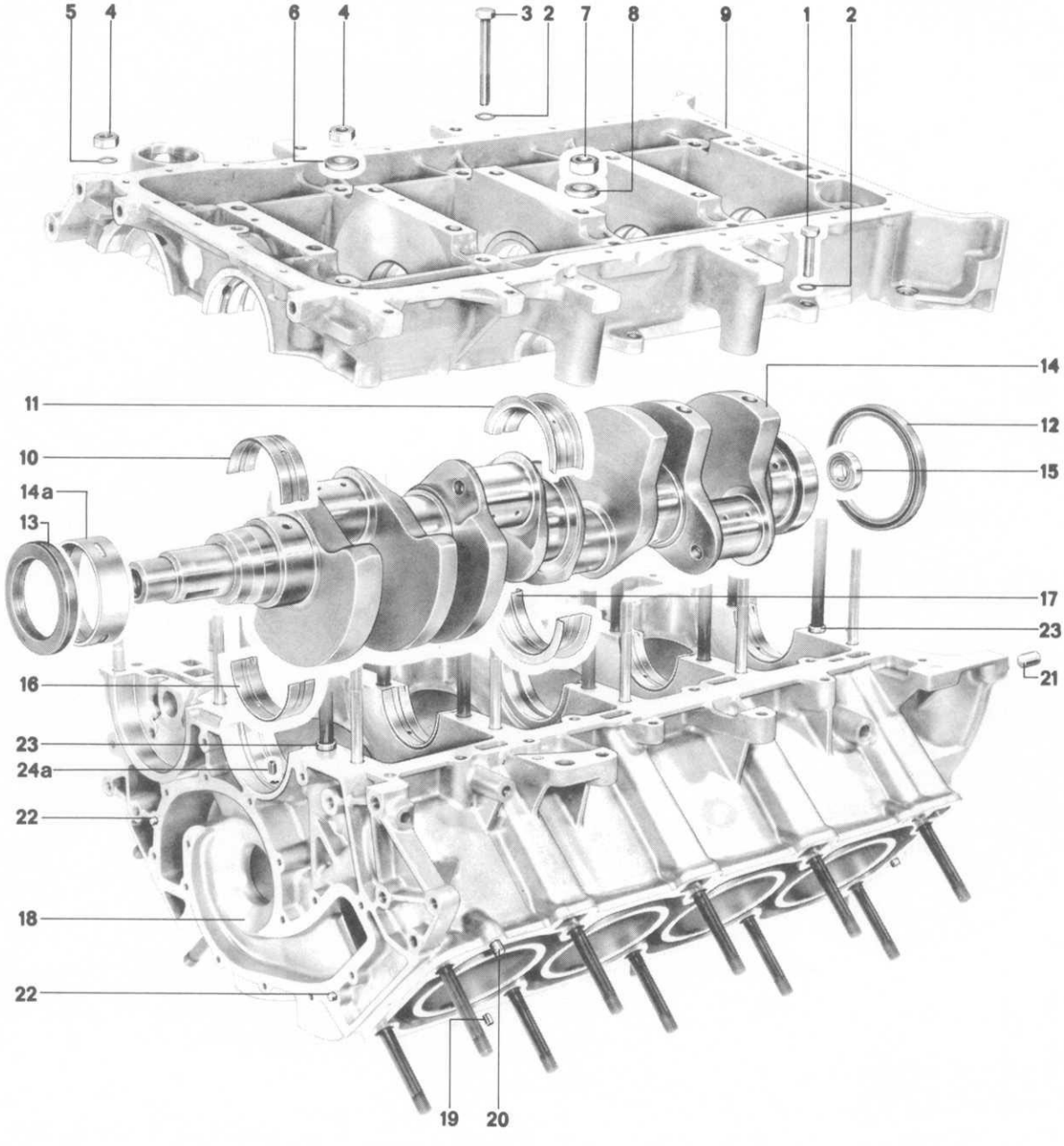
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TOOLS



No.	Description	Special Tool	Remarks
1	Crankshaft oil seal extractor (pully end)	9125	
2	Crankshaft oil seal extractor (flywheel end)	9126	
3	Feeler gage		Standard
4	Dial gage holder	VW 387	
5	Dial gage		Standard
6	Holder (for loosening oil pump drive gear)	9157	
7	Puller spindle	US 1039	
8	Internal extractor		Standard, e. g. Kukko No. 21/2 (14.5 to 18.5 mm)
9	Micrometer		Standard
10	Piston ring pliers		Standard
11	Piston ring compressor	US 1008 A	
12	Toothed segment	Part of 9127	
13	Flywheel holder	9130	

DISASSEMBLING AND ASSEMBLING CRANKCASE AND CRANKSHAFT



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bolt M 8 x 30	6			
2	Washer B 8	16			
3	Bolt M 8 x 65	10			
4	Nut M 10 (plastic coated threads)	10		Always replace	
5	Washer	2			
6	Washer	10			
7	Nut M 12 x 1.5 (plastic coated threads)	10		Always replace	
8	Washer	10			
9	Crankcase lower section	1		Clean sealing surface to remove grease	
10	Main bearing shell half	4		Lubricate	
11	Thrust bearing half (bearing 3)	1		Lubricate	
12	Shaft seal (flywheel end)	1		Replace	
13	Shaft seal (pulley end)	1		Replace	
14	Crankshaft	1		Check end and radial play	
14a	Closed main bearing shell, bearing 1	1		Lubricate, make sure bearing engages in pin	
15	Grooved ball bearing	1	Pull out with Kukko	Check, replacing if necessary	
16	Main bearing shell half	4		Lubricate	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
17	Thrust bearing shell half (bearing 3)	1		Lubricate	
18	Crankcase upper section	1		Clean sealing surface to remove grease	
19	Key	2		Install facing forward	
20	Dowel pin	4			
21	Dowel pin	2			
22	Dowel pin	2			
23	Dowel sleeve	2			
24	Key since 1982 models	1		Position correctly	

SEALING UPPER AND LOWER CRANKCASE SECTIONS

Note

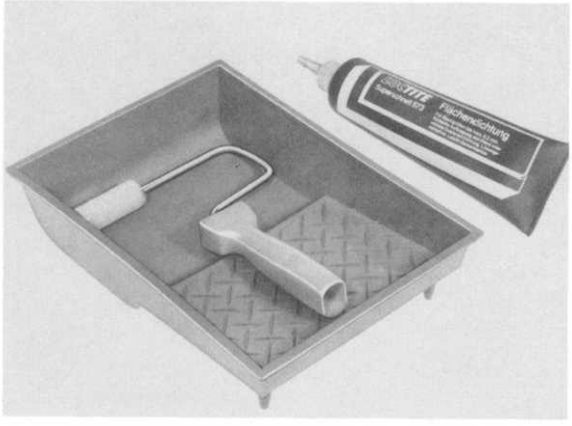
Only Loctite 574 (orange) should be used as a sealant. Loctite 574 will dry only in conjunction with metal and exclusion of air. After applying a coat of sealant the bolts should be installed and tightened no later than 10 minutes, since the sealant on the metal will start to dry.

Removing Old Sealant

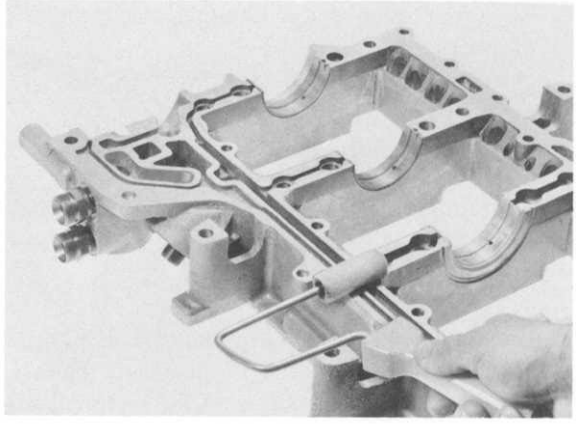
The old sealant does not have to be removed for repairs. It is only necessary to remove grease from the surface, so that after the cleaning solution has dried the new coat of sealant can be applied. The new Loctite will dissolve the old sealant in the surface finish and dry again after assembling.
We recommend a fine steel brush or Loctite remover 80646 for removing old sealant, if this is ever necessary.

Applying Sealant

1. We recommend a short-pile velour roller for application by hand. A tray will also be required for the sealant and should have a rough edge to scrape excess sealant from the roller.



2. Roll on a very thin coat of sealant with a velour roller.

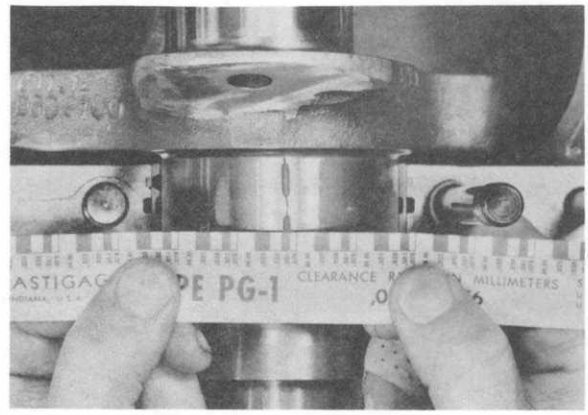


CHECKING CRANKSHAFT BEARING CLEARANCE

The "Plastigage" method is a simple way of checking bearing clearance.

Plastigage is available in three different sizes for measuring ranges from 0.025 to 0.23 mm.

Type	Color	Measuring Range
PG-1	green	0.025 to 0.075 mm
PR-1	red	0.05 to 0.15 mm
PB-1	blue	0.10 to 0.23 mm



Checking Radial Clearance

1. Remove crankcase lower section.

2. Remove oil from bearing shell and bearing journal.

3. Place Plastigage having width of bearing on crankshaft journal in axial direction. Install crankcase lower section carefully and tighten to specified torque.

Note

Do not turn crankshaft while measuring.

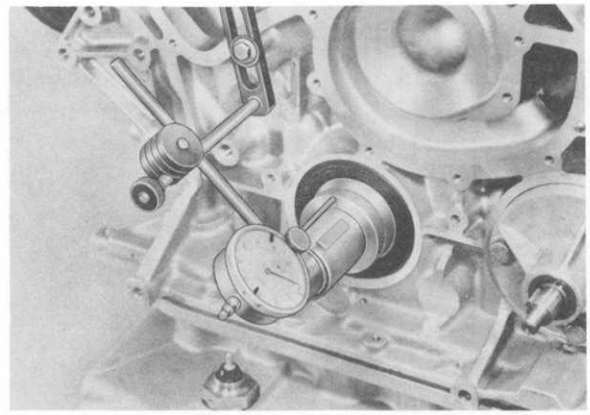
4. Remove crankcase lower section. Read wiuth of flattened Plastigage from measuring scale. Corresponding value on measuring scale equals the bearing clearance.

Play of new bearings: 0.020 to 0.098 mm
Wear limit: 0.16 mm

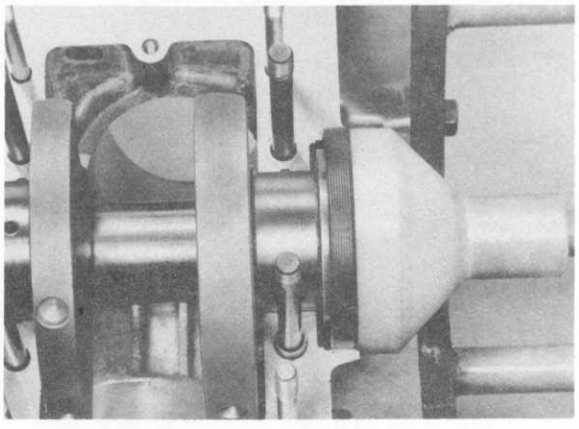
Checking End Play

Use Special Tool VW 387 to check end play.

Play of new bearings: 0.110 to 0.312 mm
Wear limit: 0.40 mm

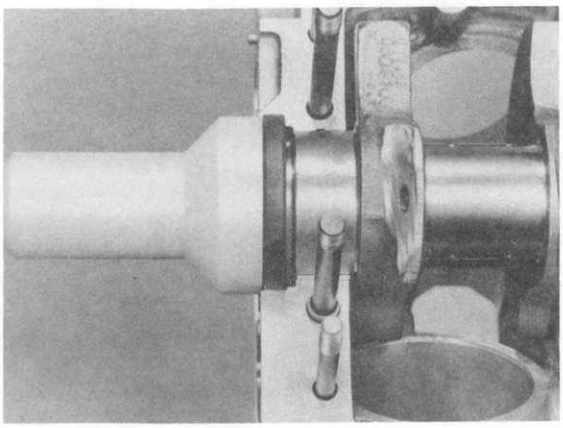


INSTALLING CRANKSHAFT SEAL (FLYWHEEL END)



Align seal with Special Tool 9126.

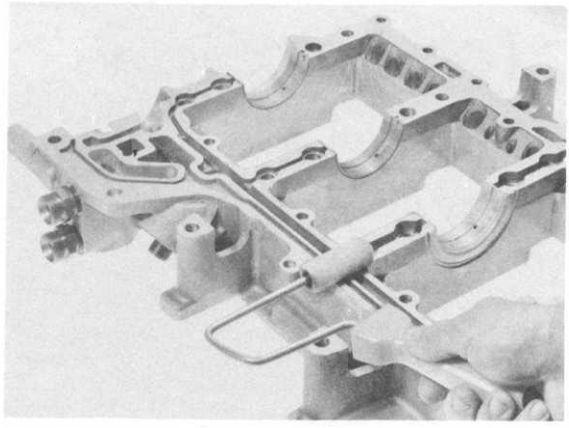
INSTALLING CRANKSHAFT SEAL (PULLEY END)



Align seal with Special Tool 9125.

INSTALLING UPPER AND LOWER CRANKCASE SECTIONS

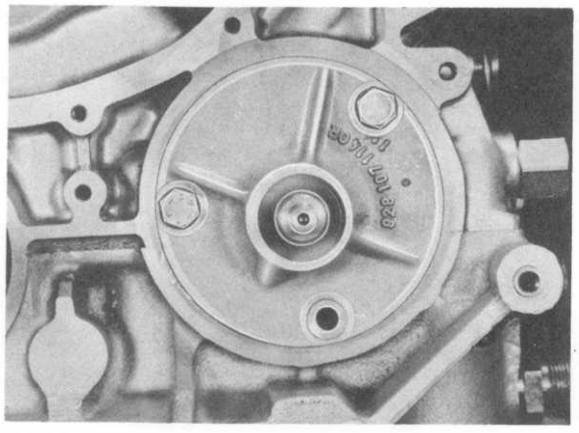
1. Apply a thin coat of Loctite 573 on crankcase lower section.



2. Install crankcase lower section.

3. Install mounting nuts by hand.

4. Install oil pump body, tightening first both upper bolts to specified torque.

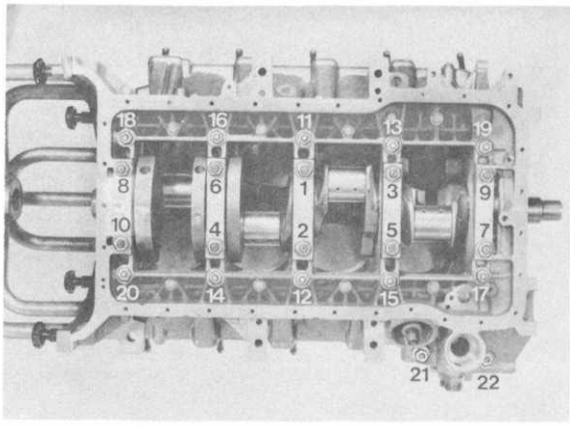


Note

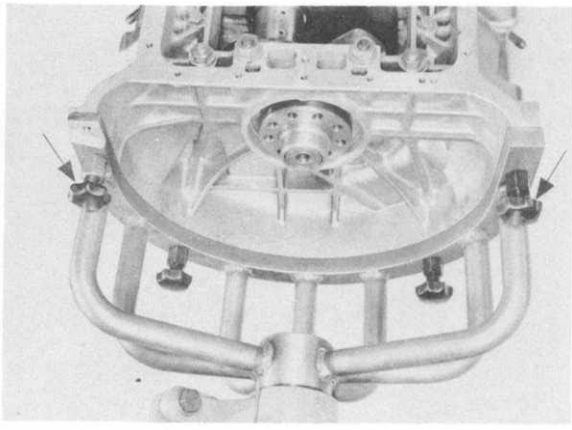
This is how crankcase upper and lower sections are located in longitudinal direction.

5. Tighten mounting nuts to final torque. See page 10 - 03 for specified torques and instructions.

Tighten to sequence.



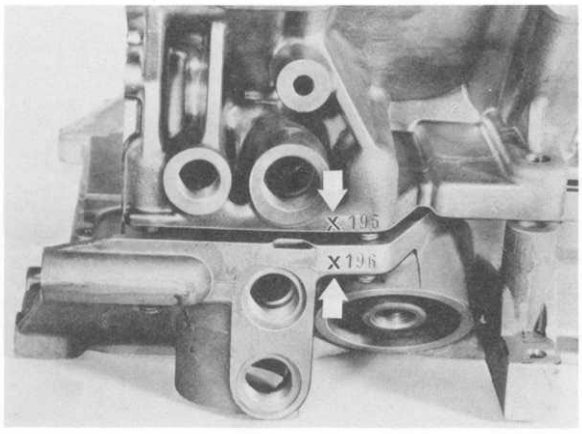
6. Mount upper section on engine holder after tightening nuts.



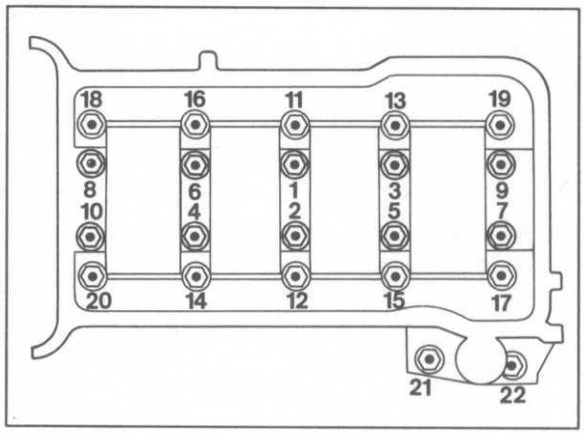
7. Remove oil pump body.

Assembly note

On crankcases that have an "X" embossed next to the housing number and on crankcases with a closed main-bearing bushing (bearing 1), the specified tightening torque of the studs has been modified.
As of Model Year '85, the matching number was extended to four digits, and the "X" embossed ahead of the number was therefore deleted.



Tightening sequence - tightening torque



1325-13

Tightening sequence:

Number 1...10 in 3 steps:
M 12 x 1.5 thread

1st step 30 Nm (22 ftlb.)
2nd step 55 Nm (41 ftlb.)
3rd step 75 + 5 Nm (55 + 4 ftlb.)

Number 11...22 in 2 steps:
M 10 thread

1st step 20 Nm (15 ftlb.)
2nd step 50 + 5 Nm (37 + 4 ftlb.)

Note

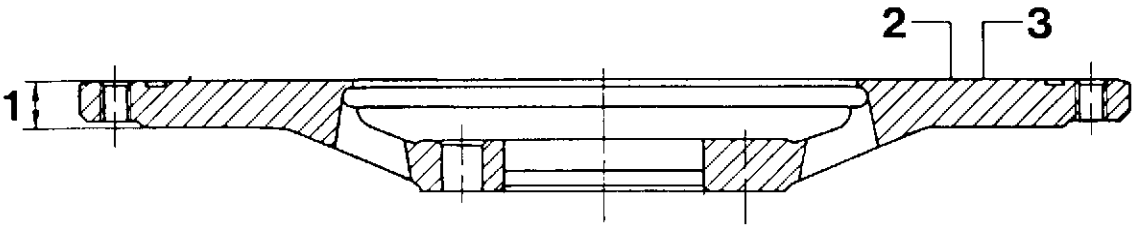
As of Model Year '92, hexagon head bolts are used to assemble the two crankcase sections.

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MACHINING FLYWHEEL

The bearing surface for the drive plate on the flywheel can be machined in a lathe when seriously scored or burnt.

The metal removal should be kept as small as possible.
Wear limit for flywheel thickness: 11.8 mm.



1 = Wear limit 11.8 mm

2 = Smallest possible metal removal

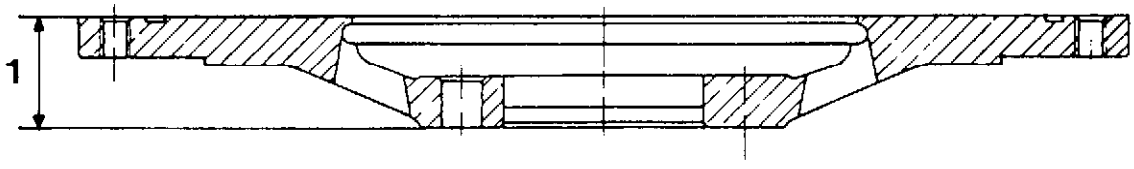
3 = Max. runout 0.05 mm

Bearing surface machining specifications:

Surface finish + waviness = 0.008 mm.

MACHINING FLYWHEEL – Beginning with 1984 Models

Engine Type M 28.21

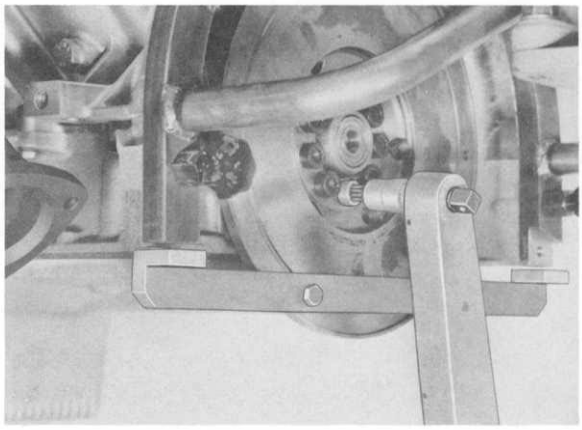


1 = Wear limit 27.5 mm

Removing and installing flywheel

Removing

Mount Special Toll 9130 on flywheel with two hex. head bolts and loosen Phillips screws.



Installing

Align marks on flywheel (cast boss) and crankshaft (punch mark).

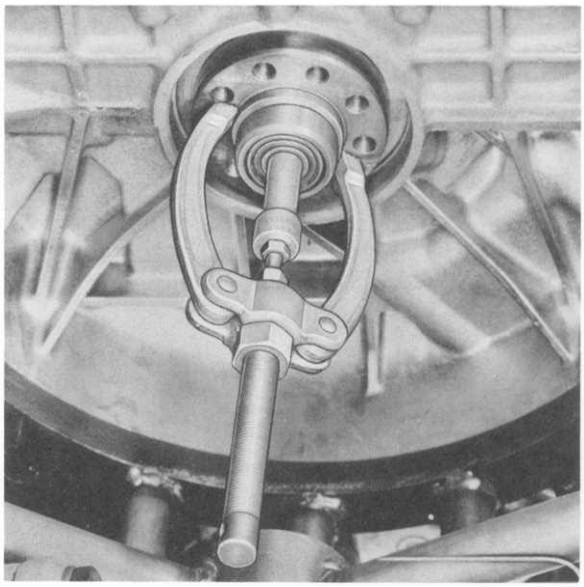
Tighten multi-tooth bolts in two stages.

1st stage	40 Nm (30 ftlb)
2nd stage	90 Nm (66 ftlb)

Removing and installing grooved ball bearing

Removing

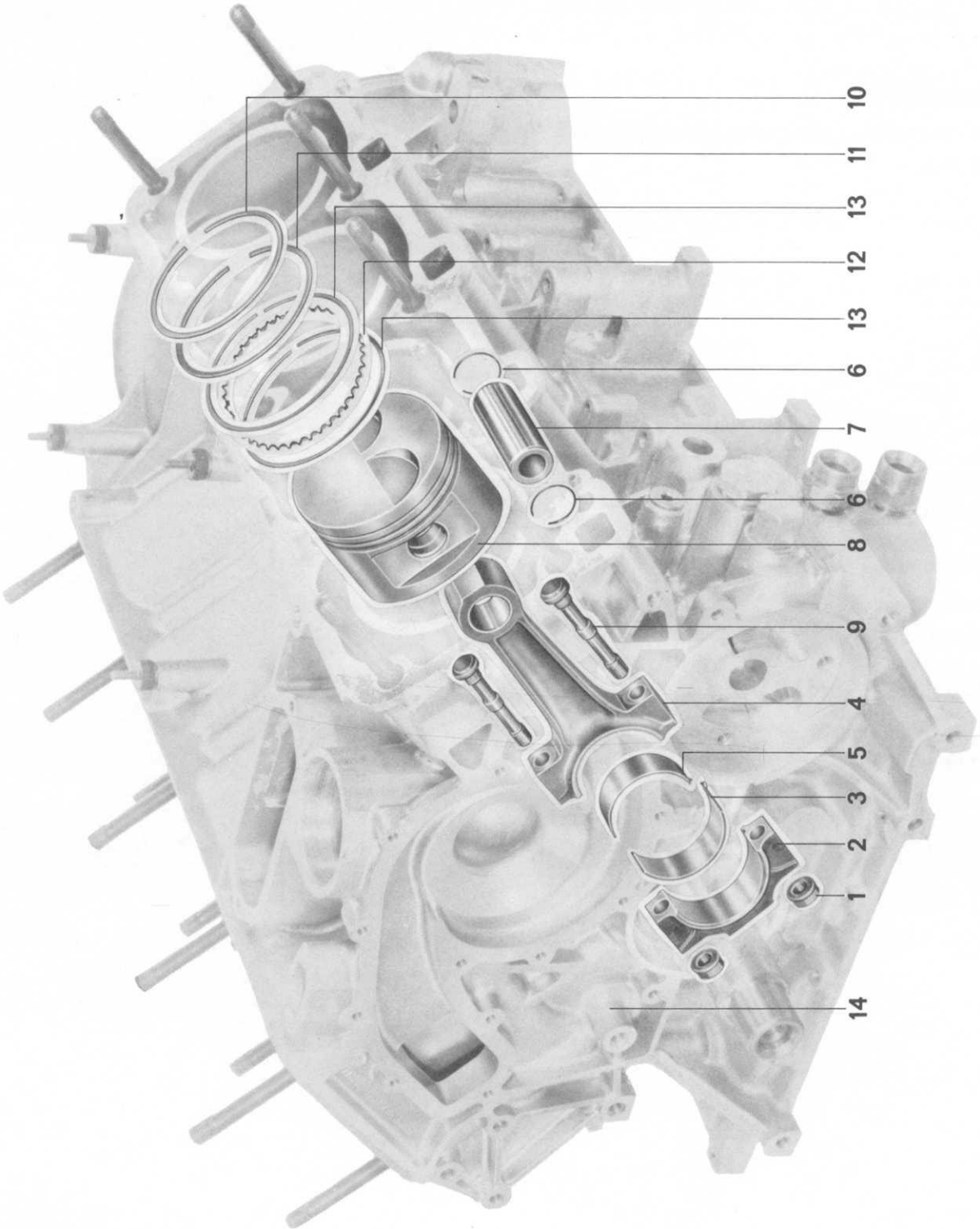
Pull out grooved ball bearing with an internal extractor, e.g. Kukko 21/2 (14.5 to 18.5 mm).



Installing

Drive bearing in to stop with a suitable mandrel.

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10
11
13
12
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6
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5
3
2
1
14

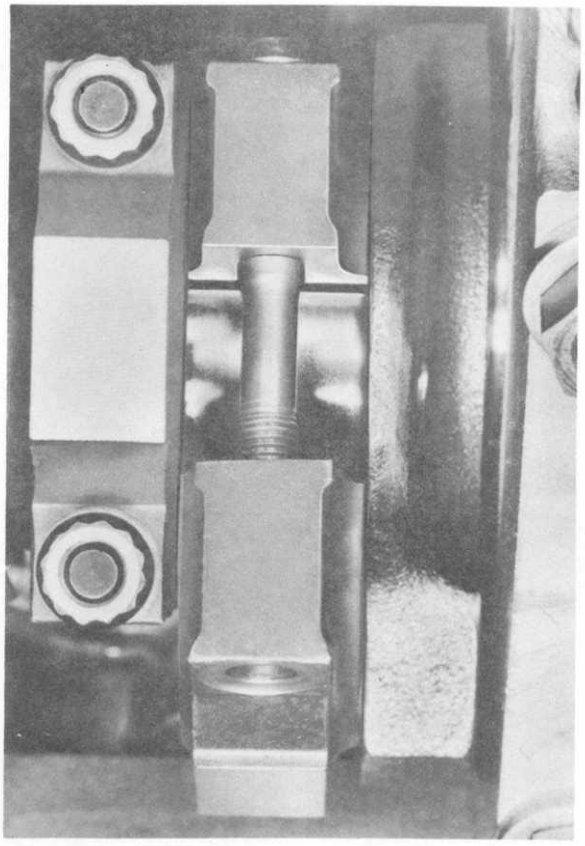
No.	Description	Qty.	Note When: Removing	Installing
1	Connecting rod nut	16		Replace, tighten to specified torque. Lubricate threads and bearing surface
2	Connecting rod cap	8		Note pairing code
3	Bearing shell	8		Always replace worn bearing shells
4	Connecting rod	8		Check for distortion and parallel deviation. Make sure that narrow side with small chamfer faces neighboring connecting rod. Wide side with large chamfer faces crankshaft cheek
5	Bearing shell	8		Always replace worn bearing shells
6	Circlip	16	Pry out	Position correctly
7	Piston pin	8		Heat piston to approx. 60° C/140° F if hard to install, lubricate slightly
8	Piston	8		Lubricate slightly. Position correctly. Note tolerance group
9	Connecting rod bolt	16		
10	Piston ring Groove 1 Tapered face	8		
11	Piston ring Groove 2 Tapered face scraper ring	8		

No.	Description	Qty.	Note When: Removing	Installing
12	Oil ring spring Groove 3	8		Install oil ring springs first, then oil rings. Check to ensure that ends of springs butt against each other.
13	Oil ring Groove 3	16		
14	Crankcase upper section	1		Check cylinder bores

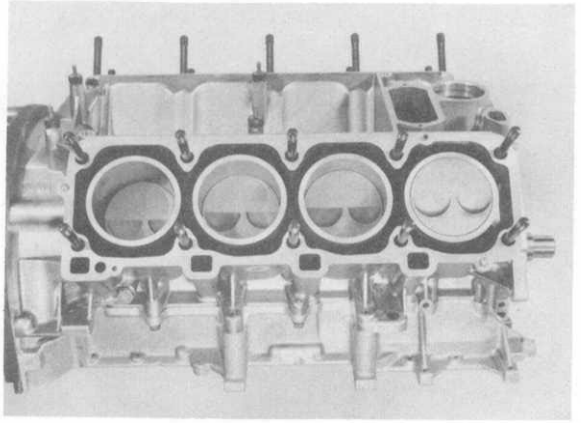
INSTALLING PISTON AND CONNECTING ROD

Installed Position of Connecting Rods

The narrow side with a small chamfer must face neighboring connecting rod; wide side with large chamfer is aligned with crank.



Make sure that piston is positioned correctly when pre-assembling the connecting rod and piston. Piston must be installed that rounded surfaces of valve pockets face down.



Installing Piston with Connecting Rod

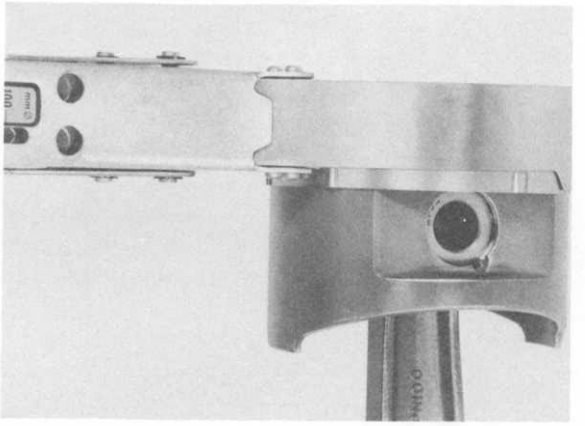
1. Install both upper piston rings that their gaps are offset by 120°.

2. Install three-piece oil scraper ring as follows.

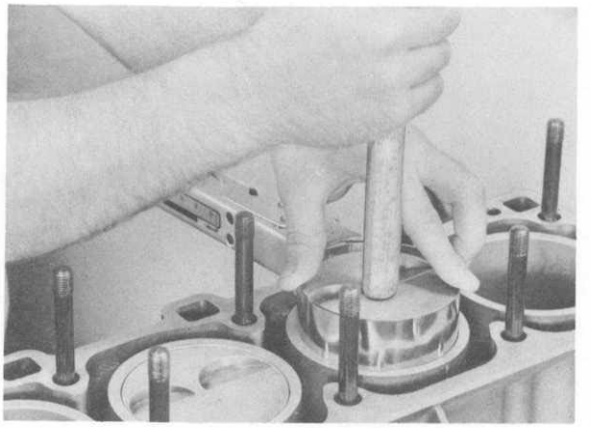
   Spring offset to steel band by approx. 45° and steel band offset to steel band by at least 90°.

3. Lubricate piston and cylinder bore slightly.

4. Apply piston ring compressor.



5. Install piston with connecting rod in cylinder bore and knock into cylinder by applying light knocks from hammer's handle and applying firm pressure to edge of compressor.



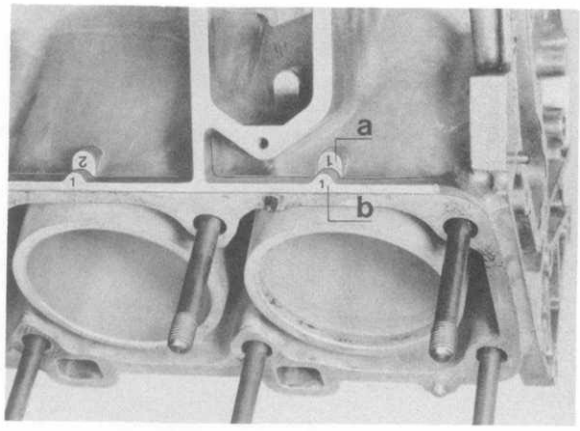
Note

Installation must be performed carefully and with feeling. If too much resistance is encountered, interrupt installing procedures, check rings and start again.

Tolerance Group of Pistons and Cylinders

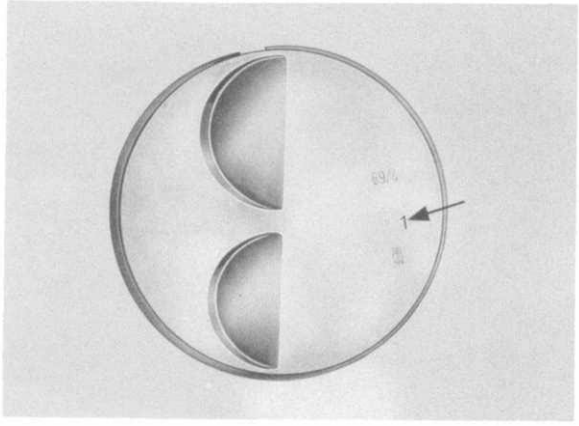
1. Only match pistons and cylinders having the same tolerance group.

2. Note cylinder marks on engine block.



a = Cylinder mark (arrangement)
b = Tolerance group

3. Note piston marks on piston skirt.



Note

Different tolerance groups could be used in one engine.

Checking Connecting Rod Radial Play

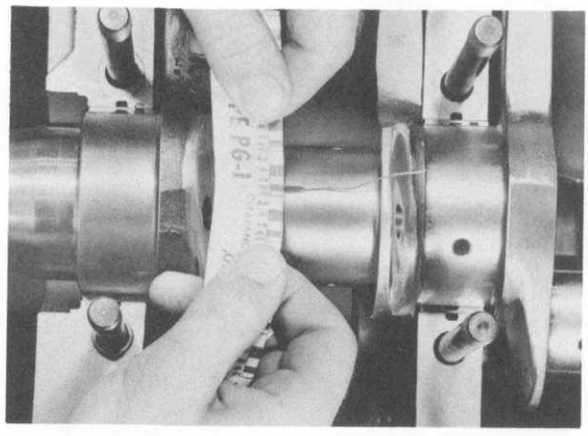
1. Remove connecting rod cap, clean bearing shell and connecting rod bearing journal to remove oil. Place Plastigage having width of bearing on crankshaft journal in axial direction. Install bearing cap carefully and tighten to specified torque.

Note

Do not turn crankshaft while measuring.

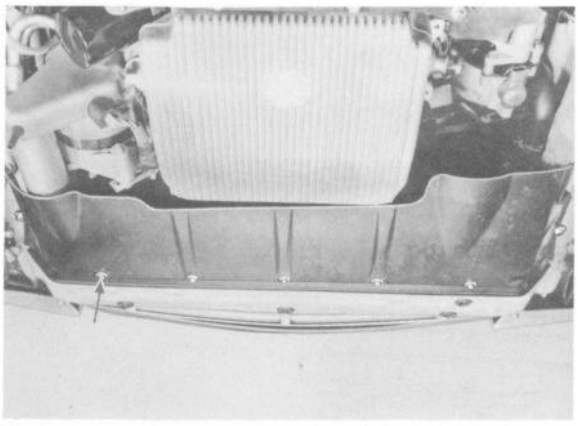
2. Remove connecting rod cap. Width of flattened Plastigage is read off of measuring scale which corresponds with bearing play.

New bearing play: 0.02 - 0.07 mm
Wear limit: 0.10 mm

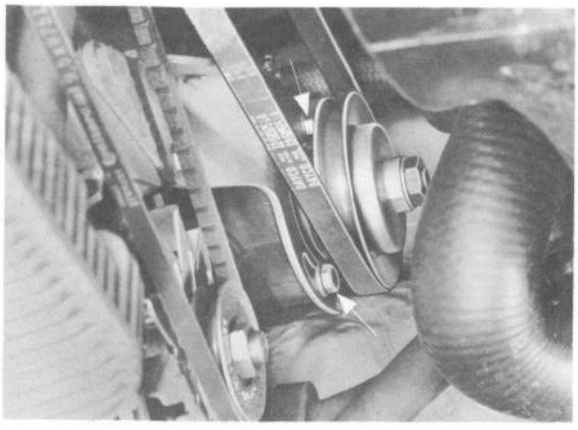


REPLACING BELTS FOR ALTERNATOR AND POWER STEERING PUMP

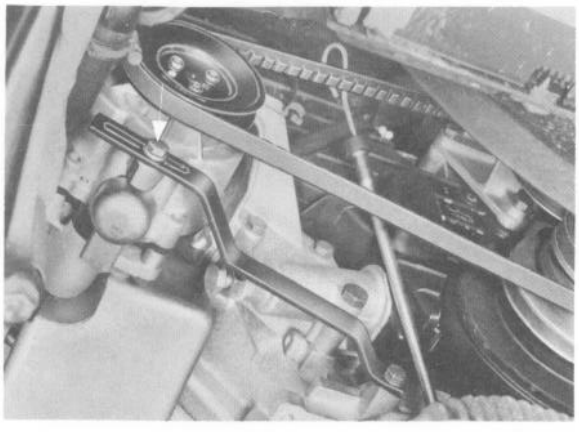
1. Remove engine guard.



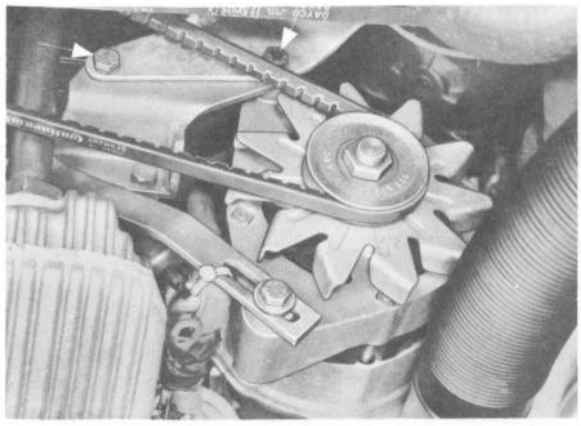
2. Loosen power steering pump bolts, swing pump in and remove belt.



3. Loosen auxiliary air pump bolt, swing pump in and remove belt.



4. Loosen alternator bolt, swing alternator in (if necessary, detach alternator vent cover) and remove belt.



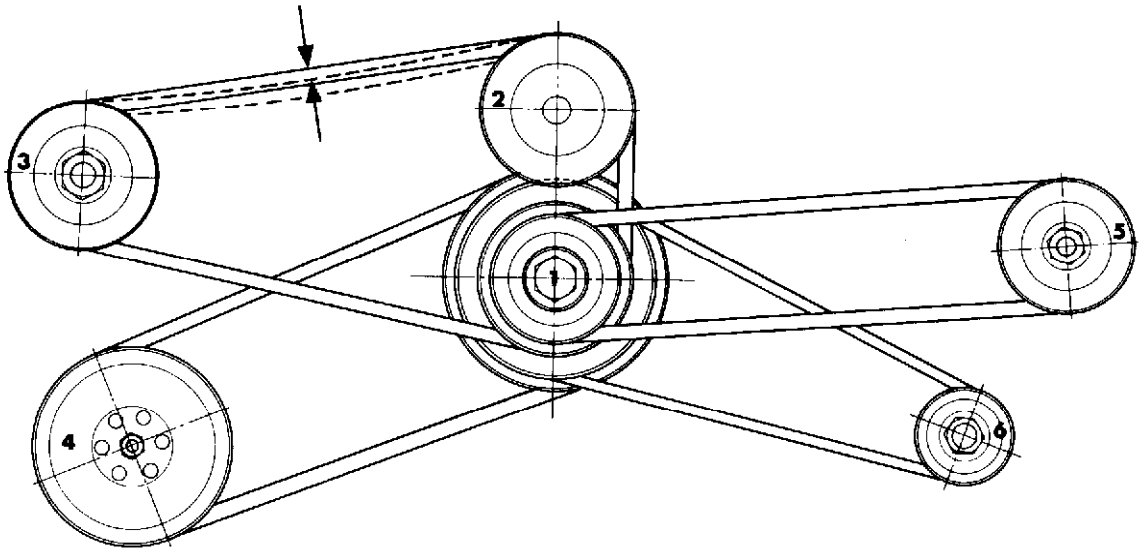
5. Tighten belts.

CHECKING AND CORRECTING BELT TIGHTNESS

Note

The tightness of all belts is checked by applying thumb pressure to belt at point midway between two pulleys.

Belts must give by approx. 10 mm.



1 - Crankshaft

2 - Fan

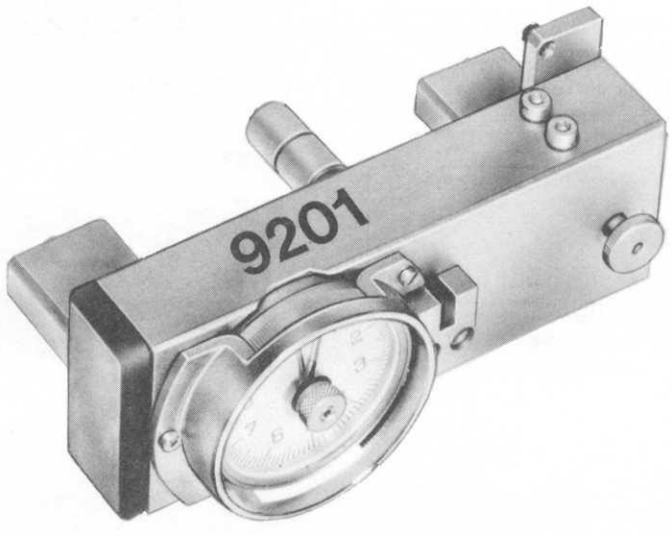
3 - Auxiliary air pump

4 - Air conditioner compressor

5 - Power steering pump

6 - Alternator

TOOLS



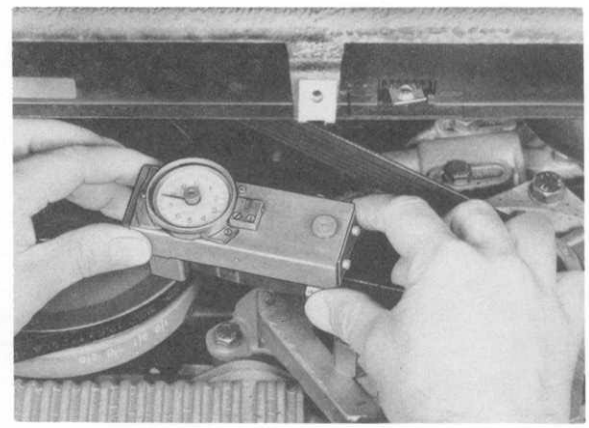
No.	Designation	Special Tool	Remarks
	Tester for belt tension	9201	

CHECKING AND ADJUSTING TENSION OF ALTERNATOR POLY-RIB BELT

'82 MODELS ONWARD

Checking

1. Prepare Special Tool 9201 for the check. Remove locking pin from Special Tool and push measuring pin opposite locking pin out as far as it will go. Align drag needle with measuring needle.



2. Push Special Tool on to belt (sliding shoe on smooth surface). Slowly press measuring button (arrowed) in until locking pin is felt to engage and read value from dial.

Settings:

New belt:	9.2
Used belt:	8.4 + 0.8

If necessary, adjust belt tension.

Remark:

The new Poly-rib belts in used '85 models onward (32-valve engines) have 6 ribs (previously 5).

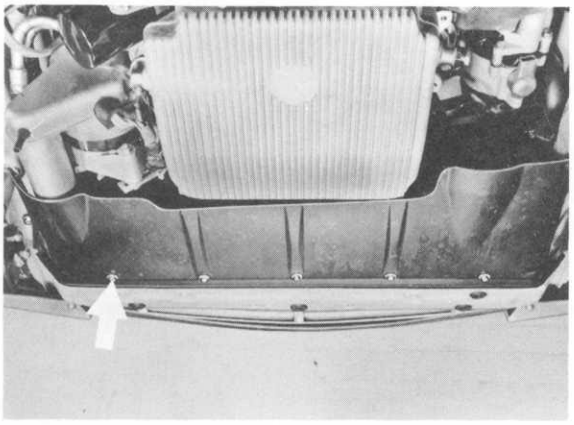
Note:

1. Contact must be established between the entire surface of the sliding shoe and the belt. While the measurement is being taken, do not allow the Special Tool to turn or its position on the belt to change.

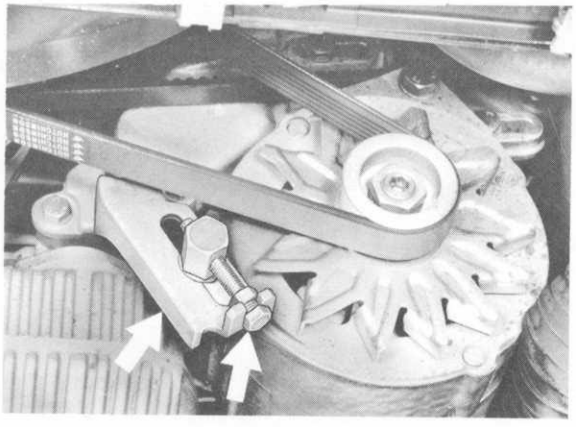
2. The lower tolerance limit of a used belt should be set with the belt cold (room temperature approx. 20°C) and the upper tolerance limit with the belt warm.

REPLACING DRIVE BELTS FOR ALTERNATOR, POWER PUMP, AIR PUMP AND AIR CONDITIONER COMPRESSOR (32 VALVE ENGINE)

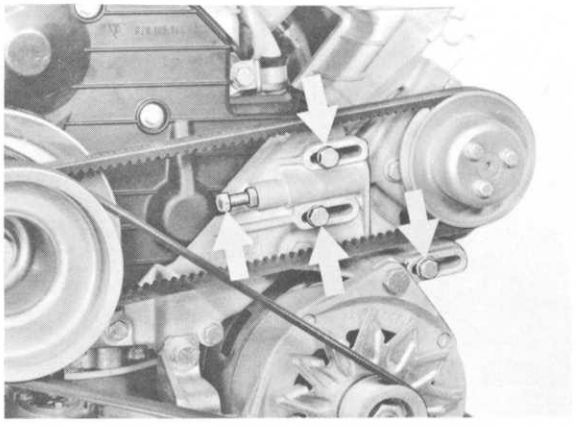
1. Remove engine splash guard.



2. Unscrew both nuts and adjusting bolt for alternator. Swing in alternator, if necessary unscrew cowl, and take off polyrib drive belt.



3. Unscrew lock nut and bolts on power pump, push in pump and take off drive belt.

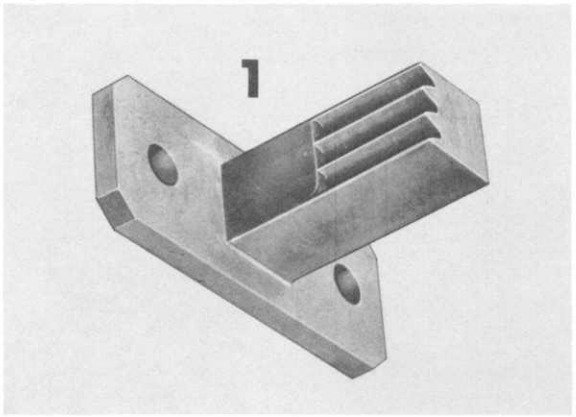


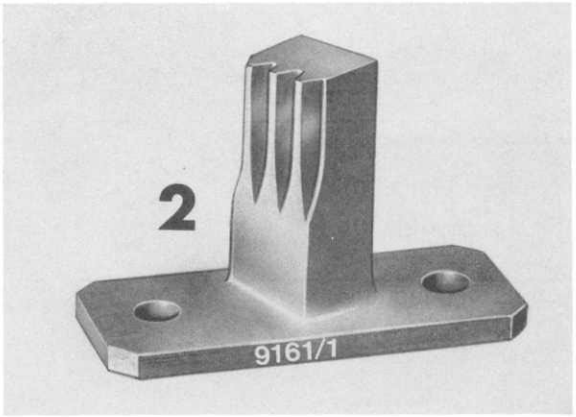
4. Unscrew adjusting nut and bolt on air pump, swing in pump and take off drive belt. Same procedures are necessary for the a/c compressor.



5. Install and adjust new drive belts.

TOOLS

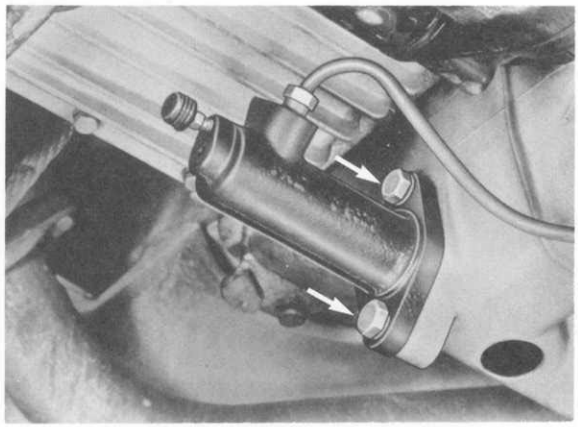




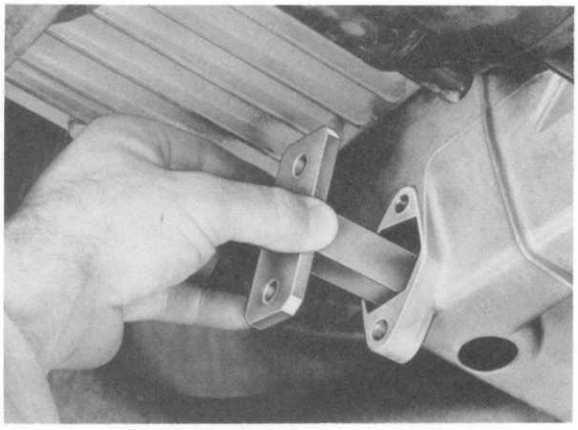
No.	Description	Special Tool	Remarks
1	Flywheel stop	9161	
2	Flywheel stop beginning with 1983 models	9161/1	In conjunction with new cover on clutch housing, starter mounted on clutch housing

STOPPING FLYWHEEL FOR ASSEMBLY JOBS

1. Unscrew clutch slave cylinder and remove with line connected.



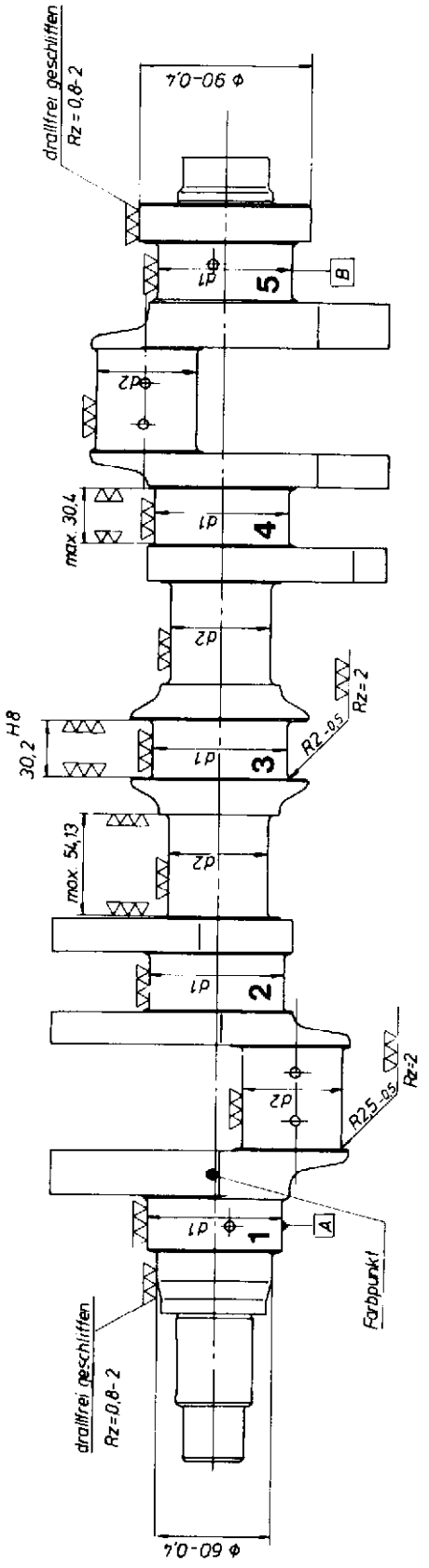
2. Guide in special tool and mount with standard bolts.



CRANKSHAFT (Standard and Machined Sizes)

Size	Crankcase Bore Dia.	Crankshaft Bearing Journal Dia. d 1	Crankshaft Connecting rod Journal Dia. d 2	Thrust Bearing Width
Standard	Standard 75.000...75.019 Oversize 75.250...75.269	69.971...69.990	51.971...51.990	max. 30.08 *
- 0.25		69.721...69.740	51.721...41.740	
- 0.50		69.471...69.490	51.471...51.490	
- 0.75		69.221...69.240	51.221...51.240	

* Thrust bearing 3
Machined size: 30.200 . . . 30.239



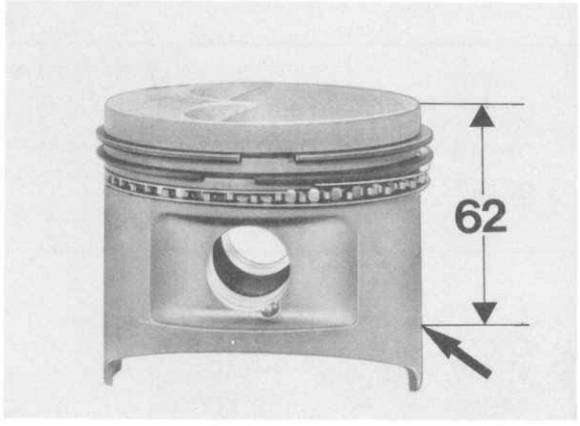
Color Codes for Machined Sizes

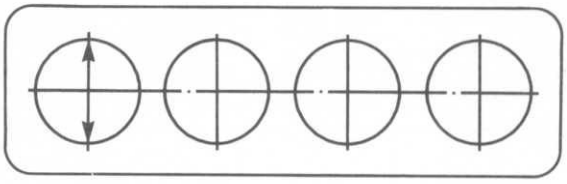
1st undersize	blue paint dot
2nd undersize	green paint dot

Only grind crankshaft oil seal surfaces as much as necessary. Otherwise, if necessary, polish to 0.8 . . . 2 microns.

After grinding, chamfer oil bores to a radius of 0.5 mm. Break sharp edges to a radius of 0.2 to 0.5 mm.

Checking pistons and cylinder bores





Repair size	Piston dia. (mm) Mahle	Piston dia. (mm) Kolbenschmidt	Cylinder bore (mm)	Tolerance group identification
Standard	94.960	94.964	95.000	0
	94.970	94.974 ± 0.007	95.010 ± 0.005	1
	94.980	94.984	95.020	2
1st oversize	95.460	95.464	95.500	0 KD 1
	95.470	95.474 ±0.007	95.510 ±0.005	1 KD 1
	95.480	95.484	95.520	2 KD 1

Checking the pistons

Measure approx. 62 mm from piston crown, 90 deg. offset to piston pin axis.

Checking the cylinder bores

Measure approx. 62 mm from upper edge of cylinder bore in transverse direction of cylinder block.
Prior to measuring, fit crankcase bottom section and tighten to specified torque.

Note

It is recommended that the stocks of the relevant piston tolerance group are checked before machining the cylinders. If necessary, hone to the piston size available.
In some cases, certain tolerance groups may be in short supply.

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Engine Type M 28.11/12 (928 S)

Repair size	Piston dia. (mm) Mahle		Cylinder bore (mm)		Tolerance group identification
		as of 4.82			
Standard	96,960	96,965	97,000		0
	96,970	96,975 ± 0,005	97,010	± 0,005	1
	96,980	96,985	97,020		2
1st oversize	97,460	97,465	97,500		0 KD 1
	97,470	97,475 ± 0,005	97,510	± 0,005	1 KD 1
	97,480	97,485	97,520		2 KD 1

Engine Type M 28.19/20 (USA)

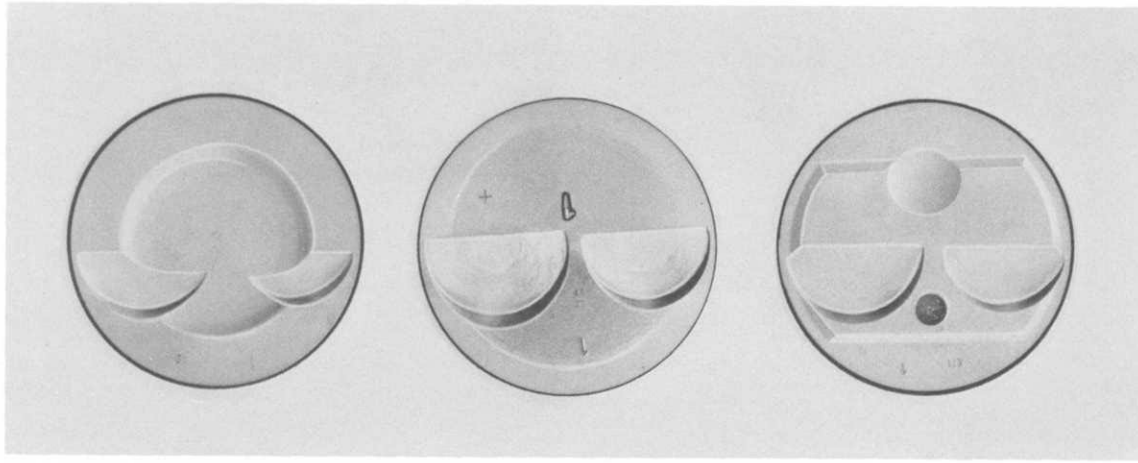
Repair size	Piston dia. Kolbenschmidt		Cylinder bore (mm)		Tolerance group identification
Standard	96,975		97,000		0
	96,985	± 0,007	97,010	± 0,005	1
	96,995		97,020		2
1st oversize	97,475		97,500		0 KD 1
	97,485	± 0,007	97,510	± 0,005	1 KD 1
	97,495		97,520		2 KD 1

Note

It is recommended that the stocks of the relevant piston tolerance group are checked before machining the cylinders. If necessary, hone to the piston size available.
In some cases, certain tolerance groups may be in short supply.

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PISTON ARRANGEMENT – 1980/1981/1982/1983 Models



Engine M 28/13 and M 28/14
M 28/19 and M 28/20
USA, Canada, Japan
Compression ratio 9 : 1
95 mm diameter (M 28/13, M 28/14)
97 mm diameter (M 28/19, M 28/20)

Engine M 28/11 and M 28/12

Europe and Rest of World
Compression ratio 10 : 1
97 mm diameter

Engine M 28/09 and M 28/10

Europe and Rest of World
Compression ratio 10 : 1
95 mm diameter

Piston Weight Tolerances

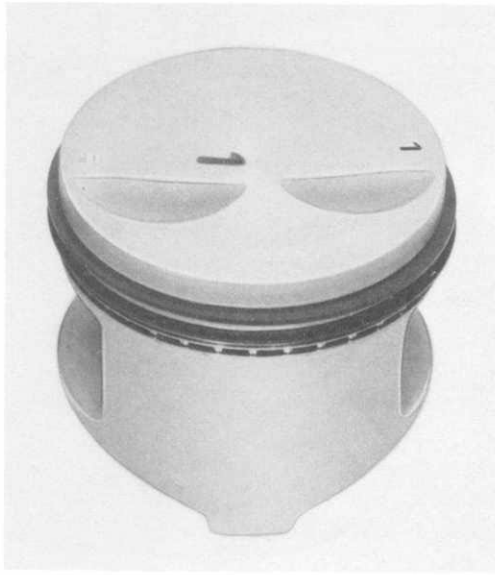
Since 1980 models pistons and piston pins are paired according to weight. Pistons are weighed with components (piston pins, piston rings, circlips).

Piston pins must always remain in the corresponding pistons and must not be mixed up within a set of pistons for one engine. This is important when disassembling and assembling an engine and pistons must be marked if necessary.

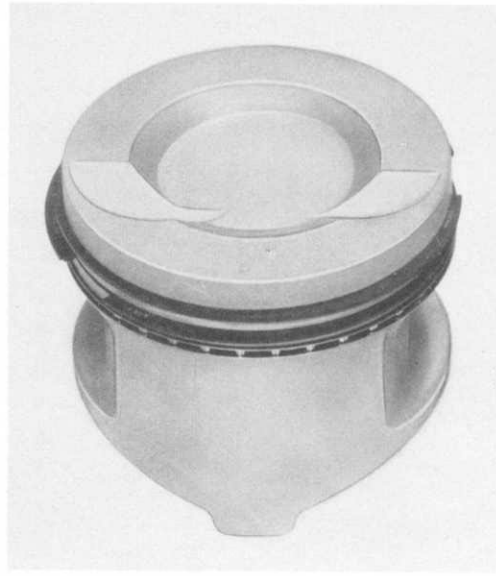
If pistons and pins are mixed up, they must be rearranged by checking the total weight.

Weight = 722 g
Permissible tolerance = $\pm$ 4 g

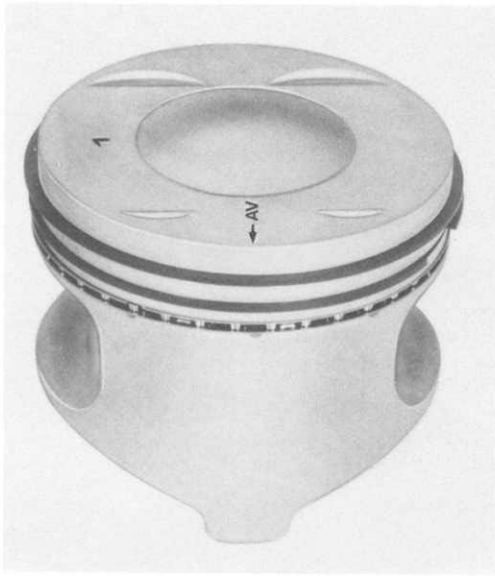
PISTON SIZES, 84/85/86 MODELS ONWARD



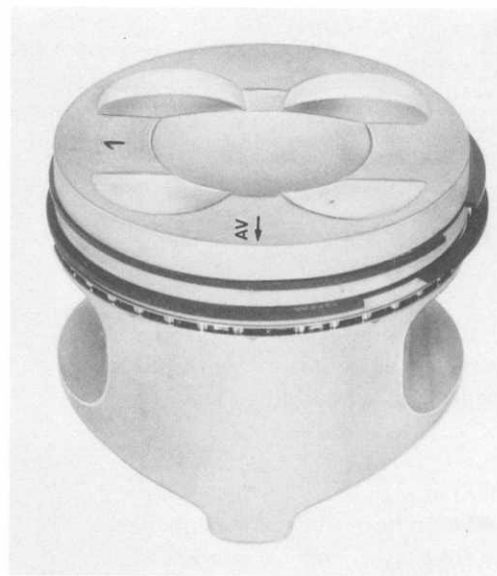
Engine M 28. 21/22, Europe and all other countries, compression ratio 10.4 : 1
Nominal diameter - 97.0 mm



Engine M 28. 21/22, Sweden, Switzerland and Australia, compression ratio 9.3 : 1
Nominal diameter - 97.0 mm



(32-VALVE ENGINES)
Engine M 28. 43/44 USA, Canada and Japan, Compression ratio 10.0 : 1
Nominal diameter - 100.0 mm



Engine M 28. 45/46 Australia, Germany, Austria and Switzerland, Compression 9.3 : 1
Nominal diameter 100.0 mm

NOTES FOR INSTALLING PISTONS
(32-VALVE ENGINES)

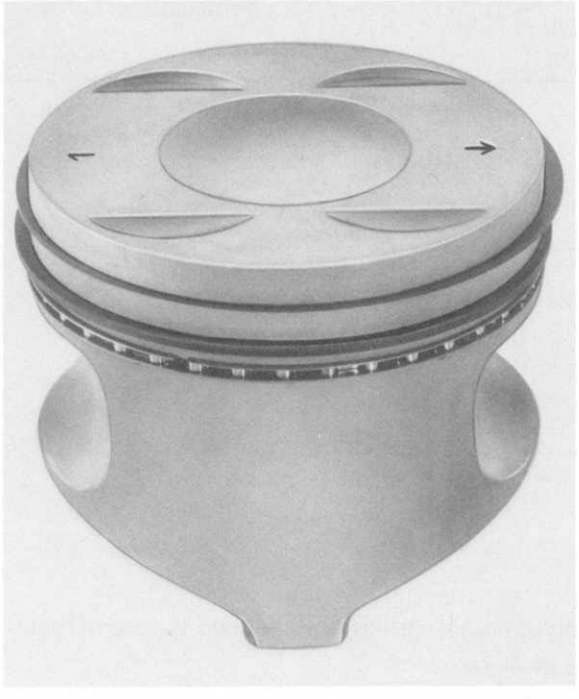
1. The "AV ⟶ " (exhaust valve) inscribed on the base of the piston indicates the installation position (arrow toward exhaust side). When pre-assembling pistons, check that the connecting rods are in the correct installation position.

N o t e :

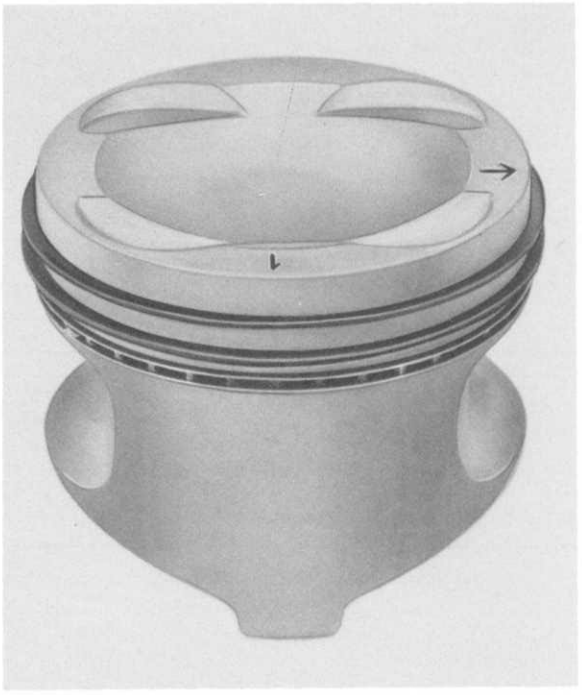
Modifed installation position for pistons as of engine numbers:

M 28.43 as of 81 G 00594 - 00622
M 28.44 as of 81 G 06311 - 06378

The valve cutouts for the valves are of equal size on both sides. The installation position is indicated by an arrow which points toward the belt pulley.



PISTONS, 87 MODELS ONWARD



M 28. 41/42 engines, worldwide
Compression ratio: 10.0 : 1
Nominal dia. 100.00 mm

The valve cutouts for the valves are the same size on both sides. The installation position is indicated by an arrow which points toward the belt pulley.

Checking pistons and cylinder bores (32-valve engine)

Engine Type M 28.43/44/45/46

Repair size	Piston dia. (mm) Kolbenschmidt	Cylinder bore (mm)	Tolerance group identification
Standard	99,975	100,000	0
	99,985 ± 0,007	100,010 ± 0,005	1
	99,995	100,020	2
1st oversize	100,475	100,500	1 0
	100,485 ± 0,007	100,510 ± 0,005	1 1
	100,495	100,520	1 2

Engine Type M 28.41/42/47

Repair size	Piston dia. (mm) Kolbenschmidt	Cylinder bore (mm)	Tolerance group identification
Standard	99,980	100,000	0
	99,990 ± 0,007	100,010 ± 0,005	1
	100,000	100,020	2
1st oversize	100,480	100,500	1 0
	100,490 ± 0,007	100,510 ± 0,005	1 1
	100,500	100,520	1 2

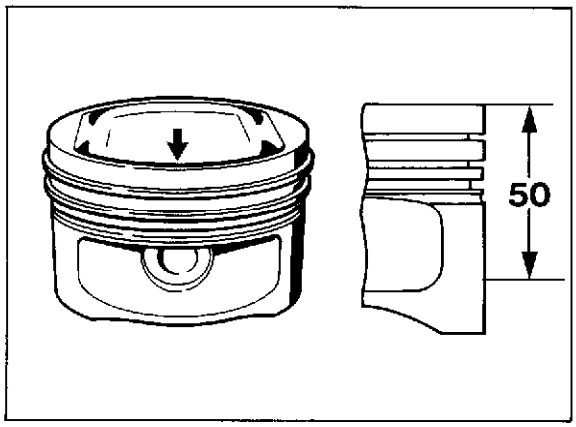
Note

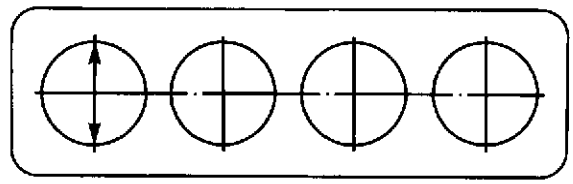
It is recommended that the stocks of the relevant piston tolerance group are checked before machining the cylinders. If necessary, hone to the piston size available.
In some cases, certain tolerance groups may be in short supply.

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Checking pistons and cylinder bores - Type 928 GTS (5,4 l)

Engine Type M 28.49/50





Repair size	Piston dia. (mm) Kolbenschmidt	Cylinder bore (mm)	Tolerance group identification
Standard	99,980	100,000	0
	99,990 ± 0,007	100,010 ± 0,005	1
	100,000	100,020	2
1st oversize	100,480	100,500	I 0
	100,490 ± 0,007	100,510 ± 0,005	I 1
	100,500	100,520	I 2

Checking the pistons

Measure approx. 50 mm from piston crown, 90 deg. offset to piston pin axis.

Checking the cylinder bores

Measure approx. 50 mm from upper edge of cylinder bore in transverse direction of cylinder block.
Prior to measuring, fit crankcase bottom section and tighten to specified torque.

Note

It is recommended that the stocks of the relevant piston tolerance group are checked before machining the cylinders. If necessary, hone to the piston size available.
In some cases, certain tolerance groups may be in short supply.

Printed in Germany – XXVII, 1991

REMACHINING CYLINDER BORES IN THE CRANKCASE TOP HALF

The crankcase top half is made of an aluminum alloy which contains minute particles of pure silicon.

In order to give the cylinder the proper surface qualities, the cylinder bores must be machined until the silicon particles protrude from the aluminum so that the pistons and rings only make contact with the silicon.

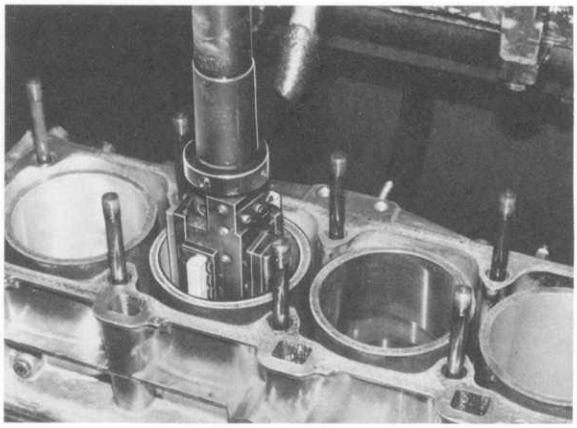
If it is necessary to remachine the cylinder bores, they can be regenerated with the SUMMEN CK - 10 / CV - 616 cylinder borer, so that oversize pistons can be installed.

Individual cylinder bores can be remachined as required, as the oversize pistons are of the same weight as the standard pistons.

Always check that pistons of the correct size are in stock before machining the cylinder, and if necessary, machine the cylinder to suit the size of piston available. Bottlenecks may arise in the delivery of individual tolerance groups.

The following operations are required:

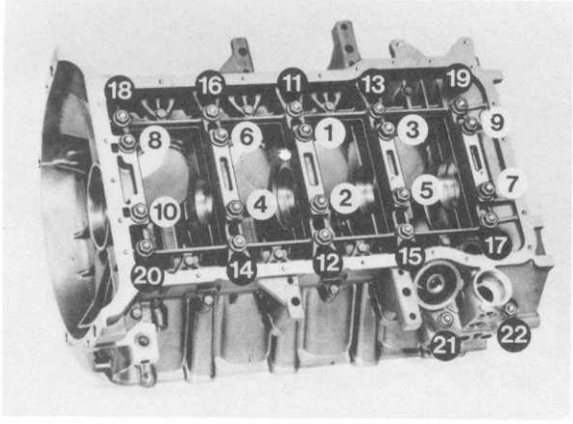
Rough-milling to 0.1 mm less than final size.
Dressing to 0.02 mm less than final size.
Polishing to final size
Lapping with Sunnen silicone compound.



ASSEMBLY INSTRUCTIONS

It is essential to tighten the bearing stud in bolts which hold the two halves of the crankcase together before machining.

Torqueing procedure	Tightening torque in Nm (ftlb)	Thread
3 Steps: 1st step	20 (14.6)	M 12 x 1.5
2nd step	40 (29.2)	
3rd step	75 (54.7)	
2 Steps: 1st step	20 (14.6)	M 10
2nd step	50 (36.5)	
	20 (14.6)	M 8



Tools

Drill	CK - 10 with filter
	CV - 616 " "
Grinding head	CK - 3000 or CK - 2600
Grinding oil	MB - 30 or MAN - 845
Felt inlay	C30 - F 85 1 Set
Silicone compound	AN - 30
Storage box for felt inlays	AN - 35 stone holder set
Set of stone holders for felt inlays instead of grindstones	CK - 3035 A 1 Set
Set of stone holders for grindstones for 3 different types of stone	CK - 3035 A 3 Set
Set of felt holders instead of guide shoe	CK - 3130 A 1 Set
Rough-milling set	C30 - J55 ++ shorten to 70 mm long
Finishing set	C30 - J84 ++ shorten to 70 mm long
Polishing set	C30 - C03 - 81

H o n i n g

Remove the upper guide shoe for all honing and lapping processes.

The excess must be removed from the bronze strip of main guide shoe No. 3 until the strip is flush with the guide shoe - base.

M a c h i n e S e t t i n g s

Rough milling - see settings in column 1 of table.

Finishing - see settings in column 2 of table.

Polishing - see settings in column 3 of table.

Lapping - to lay bare the silicon crystals.

1.Adjust the machine to the settings in column 4 of the test sheet.

2.Remove all abrasive particles from previous honing with filtered honing oil.

3.Wipe the cylinder bores dry and apply a thin coating of thoroughly mixed silicone compound.

N o t e

If the silicone compound is too thick, it can be thinned by adding fresh honing oil and mixing thoroughly.

4.Holders with felt strips are now set into the grinding head instead of the guide shoes and honing stones.

Use a setting gauge to adjust the head to the cylinder diameter in the same way as when working with guide rails and honing stones.

5.Soak the felt in filtered honing oil and apply a coating of silicone compound.

6.Turn off the supply of grinding oil, the cylinders are lapped without grinding oil.

M a c h i n e t h e c y l i n d e r s a s f o l l o w s :

Move the grinding head into the bore. Turn the adjusting wheel anti-clockwise until the felt strips touch the bore. Start the machine and continue turning the handwheel anti-clockwise until the load gauge shows approx. 20 - 30 %.

Set the advance wheel scale to 20.

The machine will switch off automatically after approx. 80 seconds. The cylinder surface is now matt and dull.

Before starting on the next cylinder apply another coating of silicone compound to the felt.

N o t e :

If the holders with the felt inlays are not in use, they must be kept in the storage box so as to remain absolutely clean.

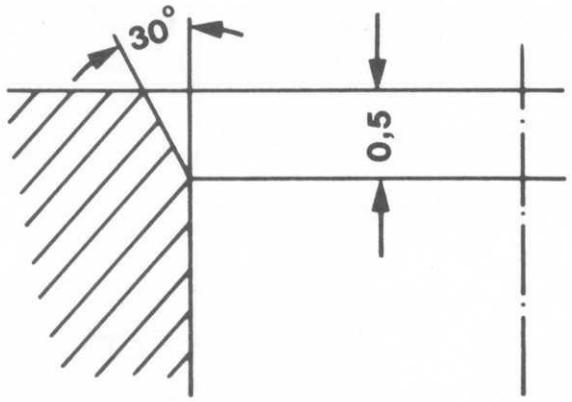
Never re-use the silicone compound.

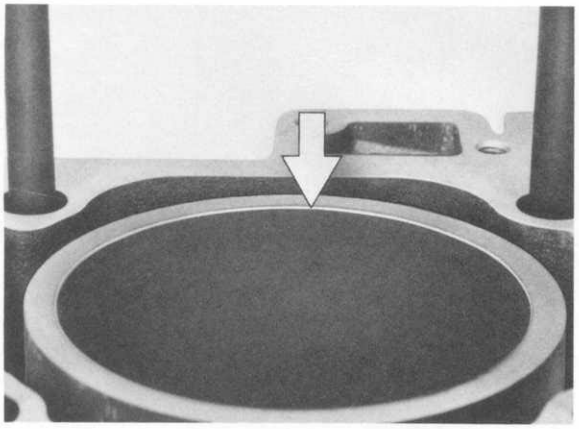
Machining cylinders with SUNNEN - 10 / CV 616 honer

E.g. Cylinder diameter Standard 100.00 mm	A	B	C	D
Cylinder diameter 1st oversize 100.50 mm	100.40 mm	100.48 mm	100.50 mm	100.50 mm
Cylinder length 145 mm				
Type of honing head	CK-3000 or CK-2600	dto.	dto.	dto.
Lift scale for stone length	70 mm	70 mm	70 mm	70 mm
Reading on scale	160 mm	160 mm	160 mm	125 mm
Speed in rpm	125 CK/CV	125 CK/CV	125 CK/CV	185 CK 230 CV
Strokes per min.	49 CK/57 CV	49 CK/57 CV	49 CK/57CV	73CK/80CV
Advance	5	4	3	2
Stone protruding by at top	21 mm	21 mm	21 mm	2 mm
Roughing stone	C 30 - J 55			
Finishing stone		C 30 - J 84		
Polishing stone			C 30-C03-81	
Felt stone				C30-F 85
Display %	30 - 40	30 - 40	20 - 30	20 - 30
Material removed	0.07 mm/	0.03 mm/	0.01 mm/	approx. 20 strokes
Advance wheel setting	10 strokes	10 strokes	10 strokes	80 sec. running time
Surface roughness	Approx. 7 - 8 my	Approx. 2 my	Approx. 0.6 - 0.8 my	Approx. 1-2 my

A=1st roughing to dia. B=finishing to dia. C=polishing to dia. D=Lapping

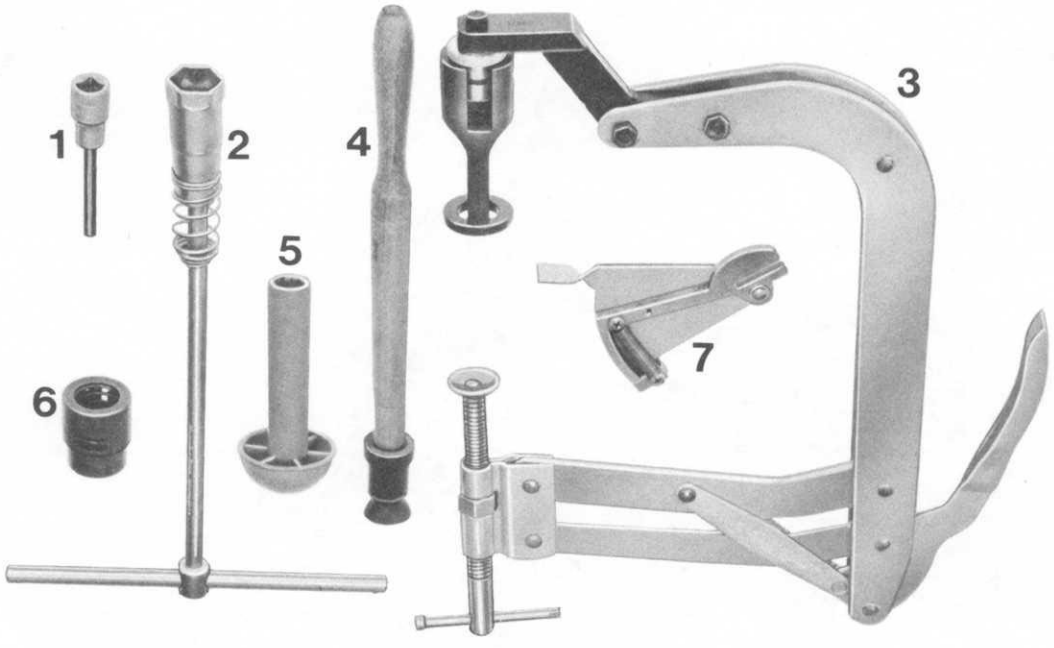
Once honing is finished, the upper 0.5 mm of the remachined cylin- der bores must be champfered to 30°.



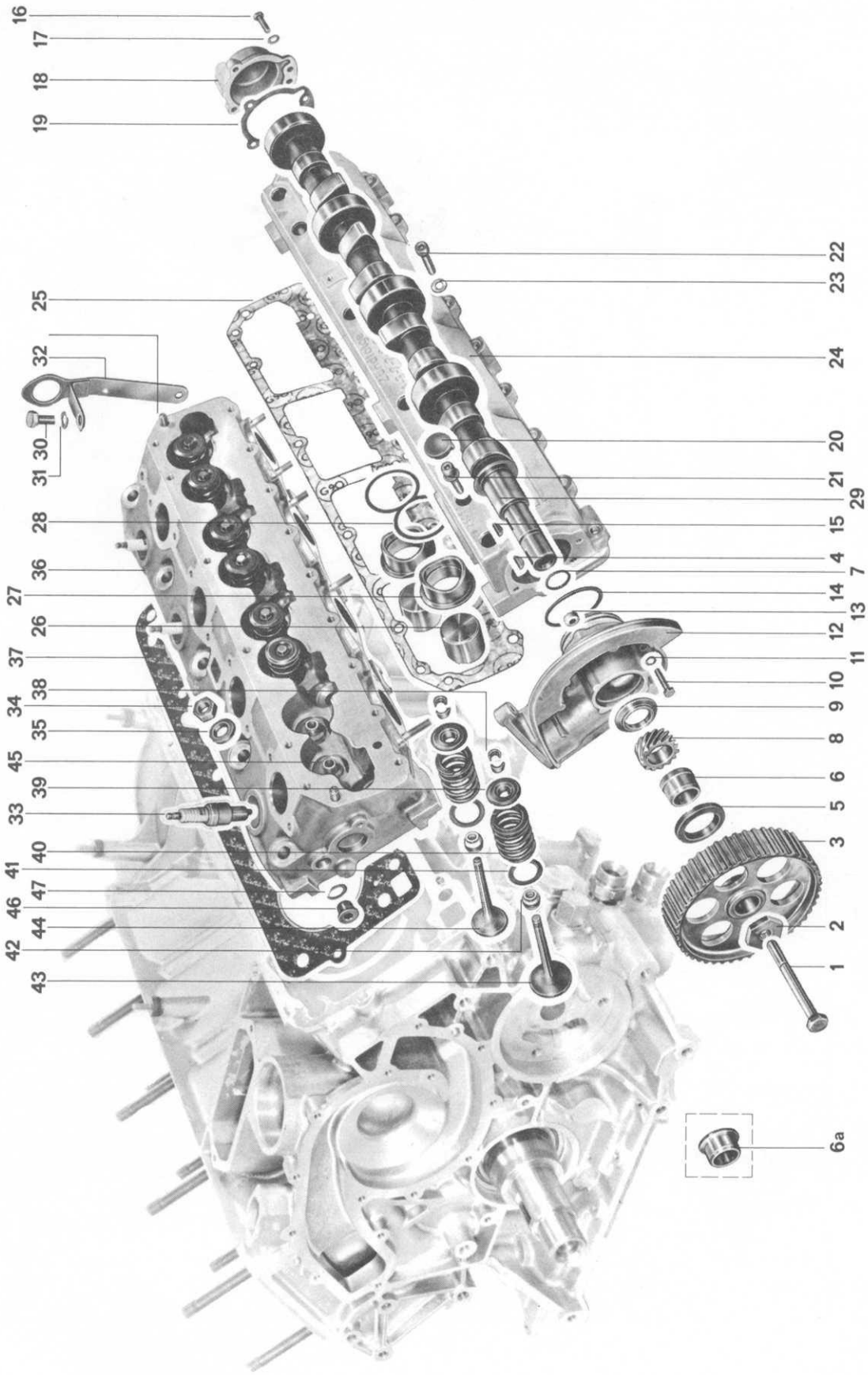


Before reassembly, thoroughly clean both halves of the crankcase so as to remove all trace of abrasive particles and silicone paste.

TOOLS



No.	Description	Special Tool	Remarks
1	Wrench socket	9133	
2	Spark plug wrench	-	Standard, e.g. Hazet 767 - 1
3	Valve spring compressor	US 1020 or P 200 a	
4	Valve grinder	-	Standard
5	Thrust plate for installation of valve shaft seal	10 - 101	
6	Valve spring adjuster	9138	
7	Toothed belt tightness tester	9131	


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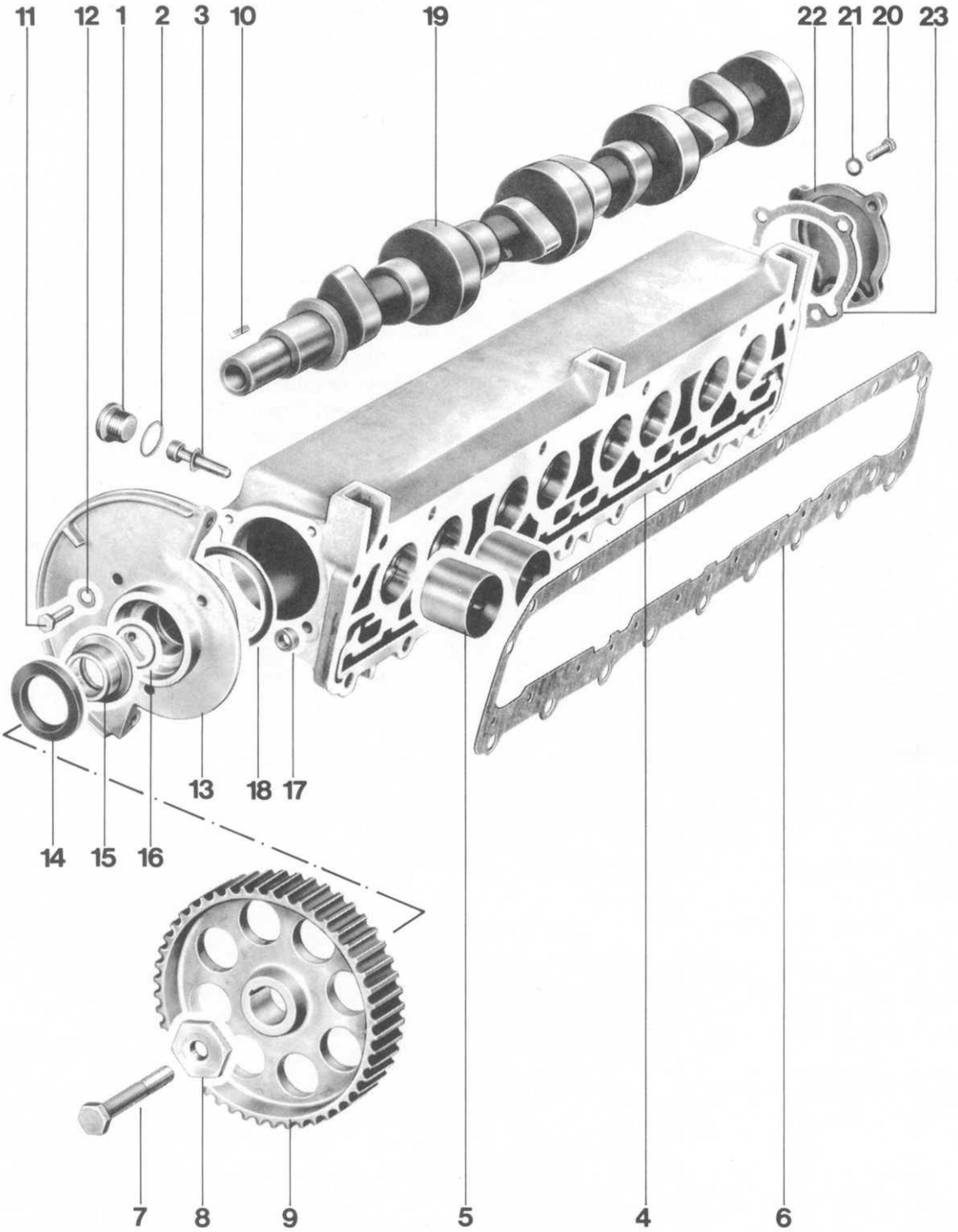
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	2		Tighten to specified torque	
2	Washer	2			
3	Camshaft sprocket	2		Watch position when installing camshaft drive	
4	Woodruff key	2			
5	Camshaft oil seal	2		Replace, drive in to stop	
6	Spacer	1			
6a	Spacer	1		Install on camshaft right side	
7	O-ring	2		Replace, lubricate slightly	
8	Distributor drive gear	1			
9	Spacer	1			
10	Bolt	6			
11	Washer	6			
12	Bearing carrier	1			
13	Seal	2		Replace	
14	O-ring	2		Replace, lubricate slightly	
15	Woodruff key	1			
16	Bolt	6			
17	Washer	6			
18	End cover	2			
19	Gasket	2		Replace	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
20	Plug	12	First remove lockplates, not shown (two)	Replace	
21	Bolt with washers	12			
22	Bolt	18			
23	Washer	18			
24	Camshaft housing	2			
25	Gasket	2		Replace, position correctly (do not cover oil feed bore)	
26	Hydraulic valve lifter	16	Position so that oil bore faces up	Check	
27	Lifter sleeve	16	Do not mix up lifters and sleeves		
28	Gasket	8		Replace	
29	Left camshaft	1		Note marks (on rear camshaft bearing) right side (cyl. 1 - 4) 155 ... left side (cyl. 5 - 8) 156 ...	
30	Bolt	2			
31	Washer	2			
32	Lifting eye	1			
33	Spark plug	8			
34	Nut	20		Tighten to specified torque	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
35	Washer	20			
36	Cylinder head	2			
37	Left gasket	1		Replace, position correctly	
38	Valve keeper	32		Position correctly	
39	Spring retainer	16			Note different versions (see page 15 - 8 d)
40	Outer valve spring	16		Position correctly. Springs with red dot face down and springs with green dot face up (to tappets). From 3.81 (928 S) springs with white dot face down or up.	
	Inner valve spring from 1980 models	16			
	Valve spring disc from 1980 models	16			Note different versions (see page 15 - 8 d)
41	Shim	X	Note quantity	Measure again if necessary	
42	Valve stem seal	16		Always replace	
43	Intake valve	8			
44	Exhaust valve	8			
45	Valve guide	16			
46	Plug	2			
47	Seal	2		Replace	
48	Dowel pin	4			

DISASSEMBLING AND ASSEMBLING VALVE DRIVE

Camshaft Housing for Cylinder Bank 1–4
Beginning with 1979 Models

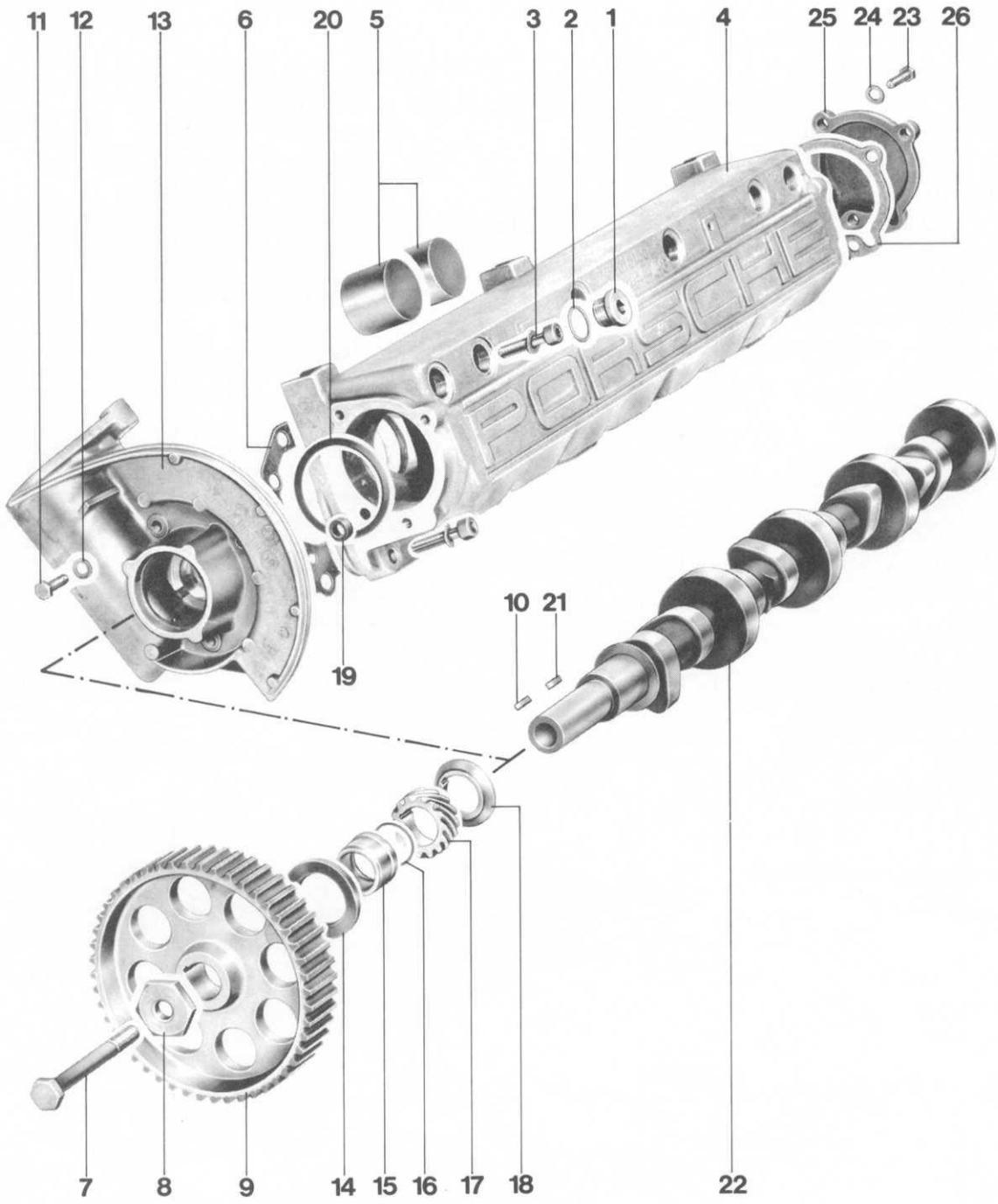


No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Plug M 18 x 1.5	6		Torque: 40 Nm (29 ftlb)	
2	Seal A 18 x 22	6		Replace	
3	Screw with attached washer M 8 x 35	15		Torque: 20 Nm (14 ftlb)	
4	Camshaft housing	1			
5	Hydraulic valve lifter	8	Do not mix up; store so that oil bores face up		
6	Gasket for camshaft housing	1		Always replace, TOP faces up when installed	
7	Bolt M 10 x 70	1		Torque: 65 Nm (47 ftlb); hold hexagon washer with wrench	
8	Hexagon washer	1		Position correctly, flat surface faces sprocket	
9	Camshaft sprocket	1		Check position when installing drive belt	See page 15 - 14
10	Woodruff key	1			
11	Bolt M 6 x 25	3			
12	Washer A 6.4	3			
13	Camshaft bearing	1			

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
14	Shaft seal	1		Replace, give sealing lip a light coat of oil, install together with spacer and drive in flush	
15	Spacer	1			
16	O-ring 23 x 2	1		Replace	
17	Seal	1			
18	O-ring	1		Replace	
19	Camshaft	1		Lubricate bearing surfaces with oil, check mark (on rear camshaft bearing)	
20	Bolt M 6 x 22	3			
21	Washer	3			
22	Cover	1			
23	Cork gasket	1		Replace	

DISASSEMBLING AND ASSEMBLING VALVE DRIVE

Camshaft Housing Cylinder Bank 5–8
Beginning with 1979 Model



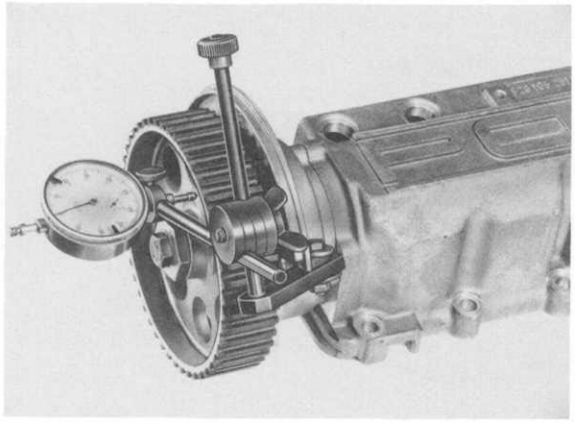
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Plug M 18 x 1.5	6		Torque: 40 Nm	
2	Seal A 18 x 22	6		Replace	
3	Screw with attached washer M 8 x 35	15		Torque: 20 Nm	
4	Camshaft housing	1			
5	Hydraulic valve lifter	8	Do not mix up; store that oil bore faces up		
6	Gasket for camshaft housing	1		Always replace; TOP faces up when installed	
7	Bolt M 10 x 95	1		Torque: 65 Nm; hold on washer with hexagon	
8	Washer with hexagon	1		Position correctly, flat surface faces sprocket	
9	Camshaft sprocket	1		Check position when mounting toothed belt	See page 15 - 14
10	Woodruff key	1			
11	Bolt M 6 x 25	3			
12	Washer A 6.4	3			
13	Flange bearing	1			

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
14	Shaft seal	1		Replace; give sealing lip a light coat of oil, install together with spacer and drive in flush	
15	Spacer	1			
16	O-ring 23 x 2	1		Replace	
17	Sprocket for distributor	1			
18	Spacer	1		Position correctly	
19	Seal	1		Replace	
20	O-ring	1		Replace	
21	Woodruff key	1			
22	Camshaft	1		Lubricate bearing surfaces with oil; check mark (on rear camshaft bearing)	
23	Bolt M 6 x 22	3			
24	Washer A 6.4	3			
25	Cover	1			
26	Cork gasket	1		Replace	

CHECKING AXIAL PLAY OF CAMSHAFT

Check axial play in conjunction with dial gauge holder VW 387.

New Part Play: 0.09 – 0.12 mm
Wear Limit: 0.20 mm



If necessary, replace flange bearing and/or camshaft bearing cover.

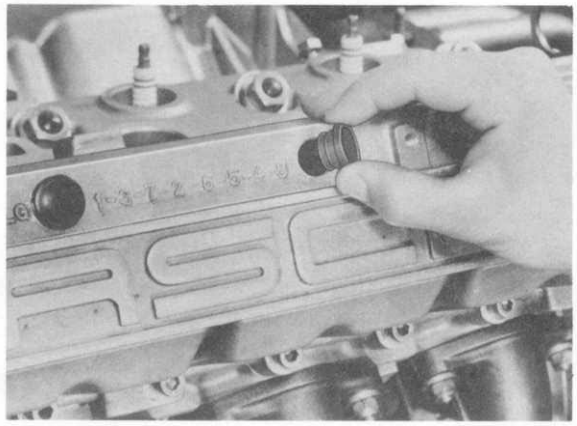
Type	Right Camshaft Cyl. Bank 1 – 4	Code Located on Rear Face of Camshaft
928 all 1978, 1979 models		
M 28.01/02/03/04	928.105.155.07	155.07
928 all 1980, 1981, 1982 models		
M 28.09/10/13/14/15/16	928.105.173.01	173.01
928 S R. o. W. 1980, 1981, 1982, 1983 models		
M 28.11/12	928.105.187.03	187.03
928 S USA, Japan, Canada 1980, 1981, 1982, 1983 models		
M 28.19/20	928.105.203.00	203.00
928 S R. o. W. 1984 models		
M 28.21/22	928.105.211.00	211.00
928 S USA, Japan, Canada 1984 models		
M 28.19/20	928.105.203.00	203.00

Printed in Germany

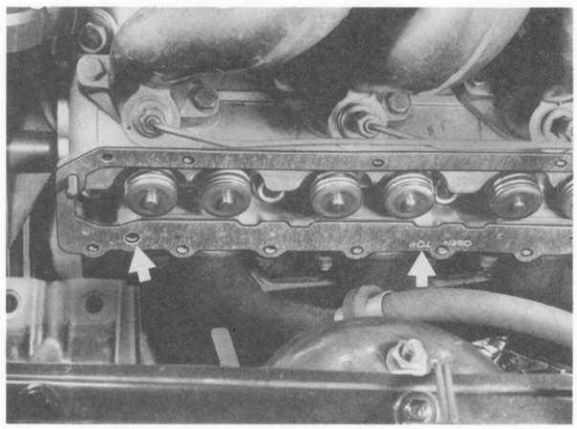
Left Camshaft Cyl. Bank 5 - 8	Code Located on Rear Face of Camshaft	Timing with 1 mm Lift and Zero Clearance
928.105.156.07	156.07	Intake opens 8° ATDC Intake closes 55° ABDC Exhaust opens 38° BBDC Exhaust closes 2° BTDC
928.105.174.01	174.01	Intake opens 12° ATDC Intake closes 48° ABDC Exhaust opens 32° BBDC Exhaust closes 6° BTDC
928.105.188.03	188.03	Intake opens 9° ATDC Intake closes 52° ABDC Exhaust opens 37° BBDC Exhaust closes 2° BTDC
928.105.204.00	204.00	Intake opens 11° ATDC Intake closes 46° ABDC Exhaust opens 25° BBDC Exhaust closes 2° ATDC
928.105.212.00	212.00	Intake opens 6° ATDC Intake closes 54° ABDC Exhaust opens 43° BBDC Exhaust closes 4° BTDC
928.105.204.00	204.00	Intake opens 11° ATDC Intake closes 46° ABDC Exhaust opens 25° BBDC Exhaust closes 2° ATDC

DISASSEMBLING AND ASSEMBLING VALVE TRAIN

Camshaft Housing



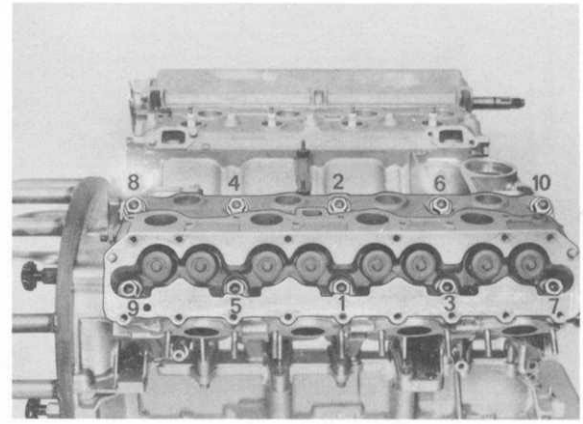
Lubricate plugs lightly and install by hand. For engine with aluminum plugs the torque is 40 Nm. Use new seals.



Note installed position of camshaft housing gasket. Camshaft oil bore must be clear (arrow).

Installing Cylinder Head

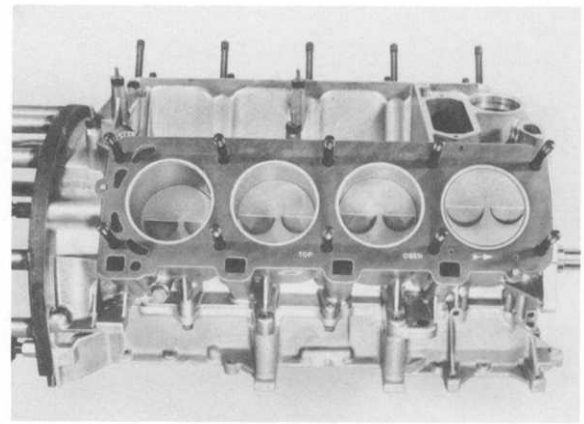
The cylinder head can be removed from an engine in the car.



Tightening sequence: see figure
Loosening sequence: opposite

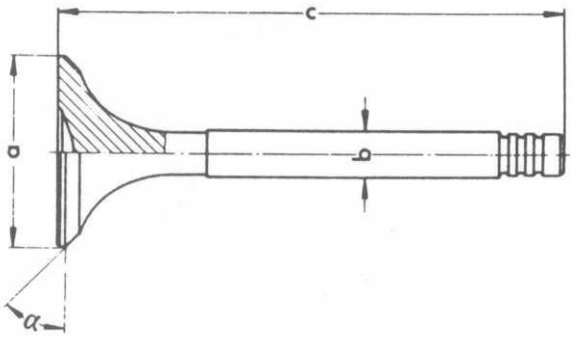
Note

Never use any lubricant for the installation of cylinder head nuts and washers. Only the threads of the studs must be given a light coat of engine oil.
Washer must not turn when tightening cylinder head nuts! Control by making paint marks if necessary. On the repair sector the washer can be made reusable by roughening the bearing surface facing the cylinder head with a rough grain sandpaper.



Position of installed cylinder head gasket.
Watch marks, "TOP" and arrow, when installing.
Arrow faces forward (see figure).

Valve Sizes



Valve Sizes 928

Distance	Intake	Exhaust
a	43.00 mm	38.00 mm
b	8.97 mm	8.95 mm
c	110.50 mm	110.90 mm
α	45°	45°

Valve Sizes 928 S

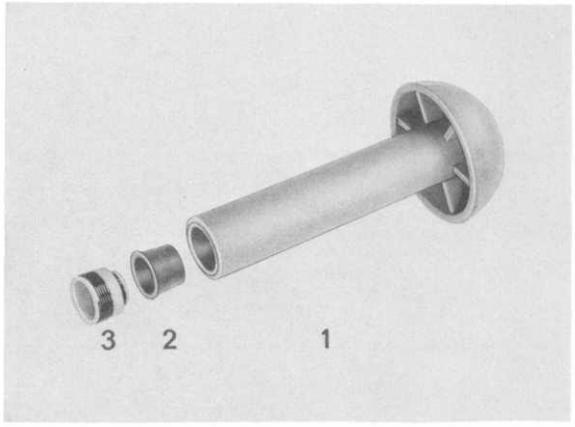
Distance	Intake	Exhaust
a	45.00 mm	40.00 mm
b	8.97 mm	8.95 mm
c	110.50 mm	110.90 mm
α	45°	45°

Removing and Installing Valve Stem Seal
(cylinder head removed)

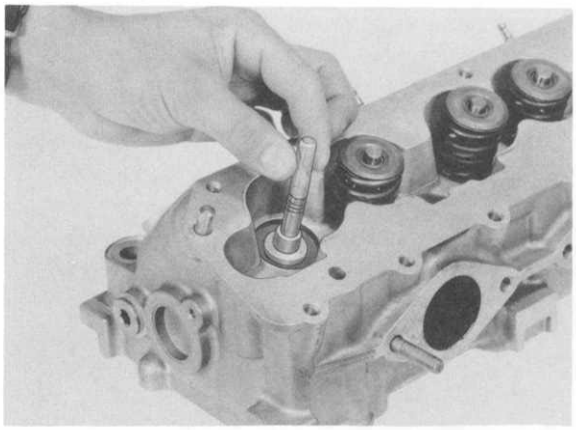
Pull off valve stem seals with Special Tool 3047



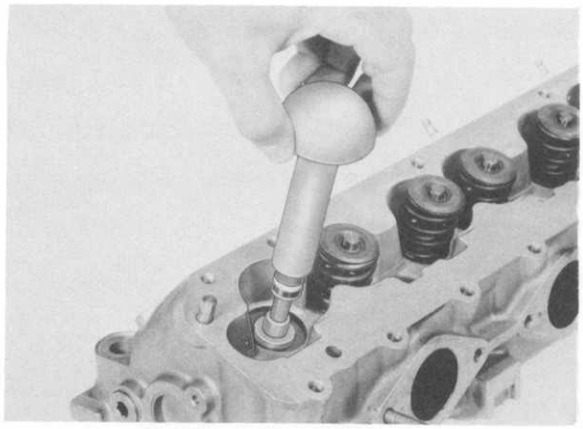
1 - Pressure pad to install valve stem seal
2 - Valve stem seal 924 as intermediate part
3 - Original valve stem seal



Shorten plastic sleeve from Type 924 by approx. 10 mm and place on valve stem.



Lubricate valve stem seal and push on to valve guide carefully with the pressure pad.

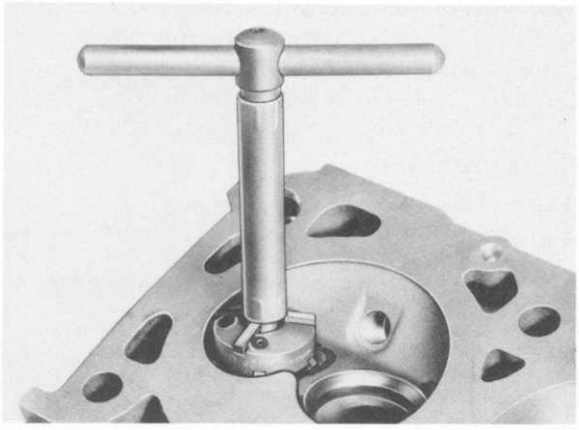


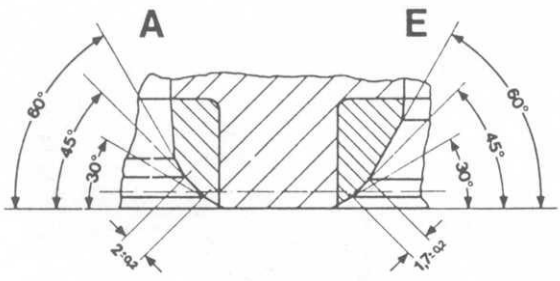
Plastic Sleeve Source: Cartool
Alfred-Brehm-Str. 5
D-8070 Ingolstadt/Donau

Machining valve seats

Note

Before refacing the valve seats, check dimension "A" to avoid carrying out work that may be unnecessary if the wear limit has been exceeded.

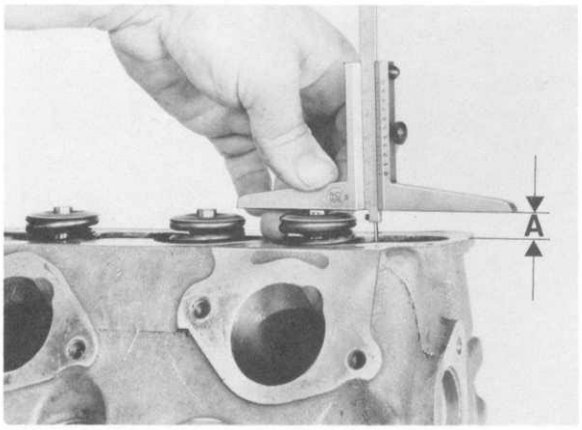




Valve seats may be machined down to the wear limit "A" = 14,5 mm
(size new 13.65 ± 0.45).

Check with a new valve.
Distance "A" must not be exceeded, as otherwise the function of the hydraulic valve tappet would not be assured.

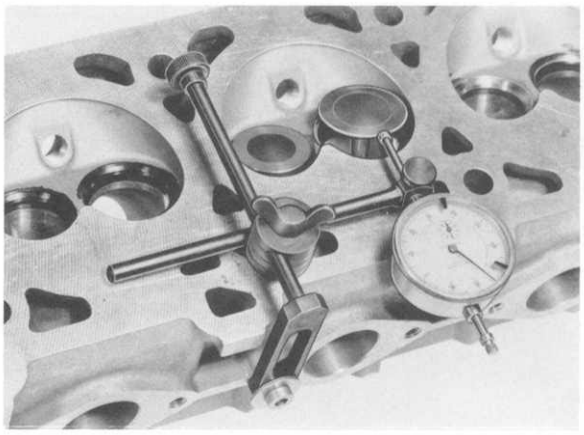
Remove no more than the absolute minimum amount of metal in order to prevent premature wear.



Checking valve guides

1. Remove deposits with a cleaning reamer.

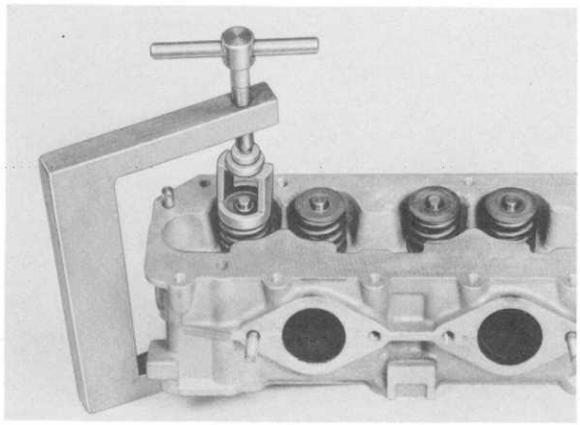
2. Place new valve in valve guide and check that valve stem end is flush with cylinder head/camshaft housing mating face.



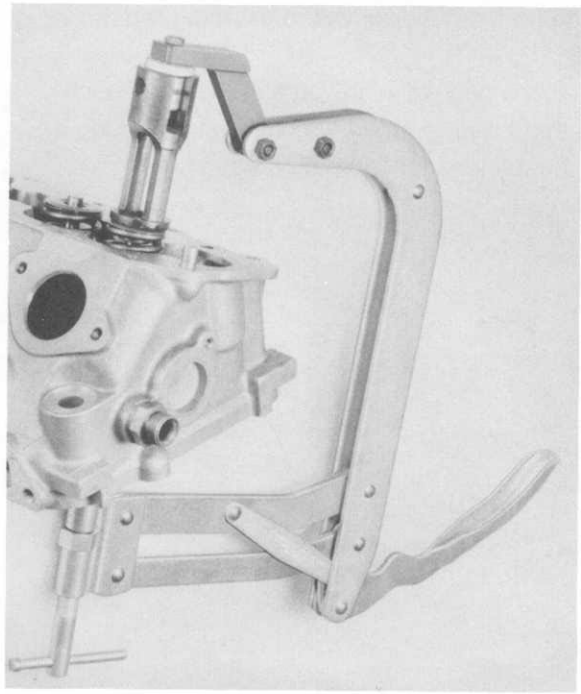
3. Check clearance with dial gage holder VW 387 and dial gage.
   Wear limit = 0.80 mm.

Printed in Germany – XXVII, 1991

Removing and Installing Valve Springs



Remove and install valve springs with P 200 a.



Remove and install valve springs with US 1020 (only applicable for USA).

Checking Installed Length of Valve Springs

1. Install Special Tool 9138 with shims belonging to a pertinent valve, spring retainer and both keepers.

2. Read distance from Special Tool 9138 and, if necessary, correct by adding or removing shims. Shims are available in thicknesses of 0.5 and 1.0 mm.

928 Models 1978/1979

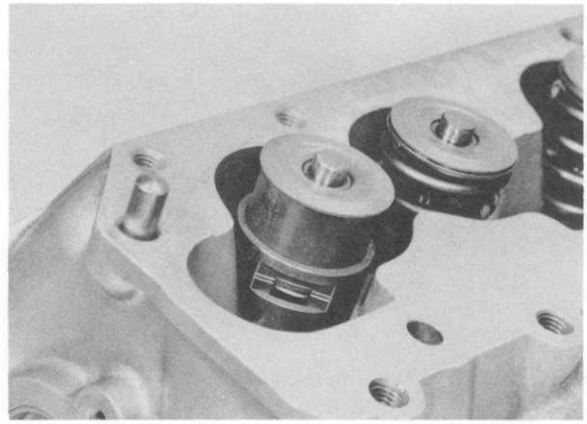
Intake valve	39.6 + 0.5 mm
Exhaust valve	38.6 + 0.5 mm

928 Models 1980

Intake valve	38.2 ± 0.3 mm
Exhaust valve	38.2 ± 0.3 mm

928 S

Intake valve	38.5 + 0.5 mm
Exhaust valve	37.5 + 0.5 mm



Example: 928 Models 1980

Special Tool 9138 shows 38.6 mm. In this case install one more 0.5 mm shim.

Example: 928 S (Exhaust Valve)

Special Tool 9138 shows 38.6 mm. In this case install additional 1.0 mm shims.

CHECKING INSTALLED LENGTH OF VALVE SPRINGS
928 S Beginning with 3.81

Valve Springs

Valve springs sets with progressive outside springs on both sides (formerly only one side) were introduced beginning with

Engine No. 821 0516 M 28/11 or
821 5503 M 28/12 Automatics.

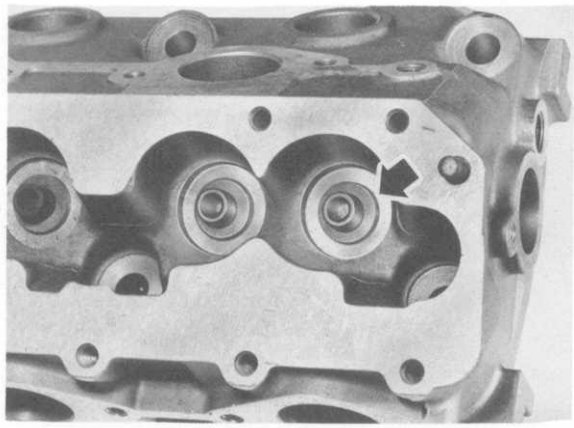
This change made it necessary to have large valve spring bearing surfaces on the cylinder heads.



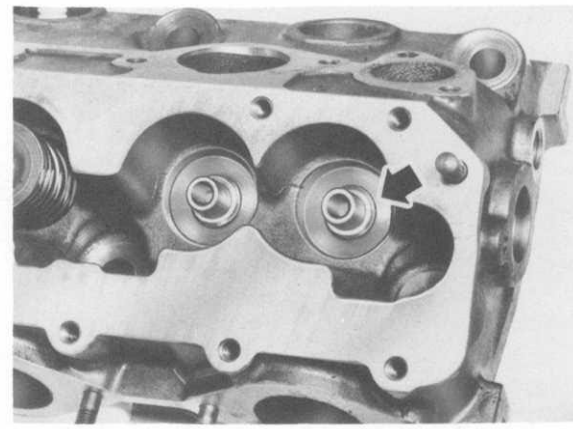
Old



New



Old Version



New Version

The new cylinder heads can be installed in pairs on older engines or only on one engine side together with the old version. The progressive valve springs with accessories must always be used on the new cylinder heads on both sides.

Old valve springs, discs, stem seals, guides and washers are still availabe.

Installed Length of 928 S Valve Springs with 1 White Stripe Beginning with 3.81

Note:
Use Special Tool 9138/1.

	New Valve Springs — White Dot —
Intake valve	41.5 + 0.5 mm
Exhaust valve	40.5 + 0.5 mm

Installed Length of 928 S Valve Springs with 2 or 3 White Stripes Beginning with 3.82

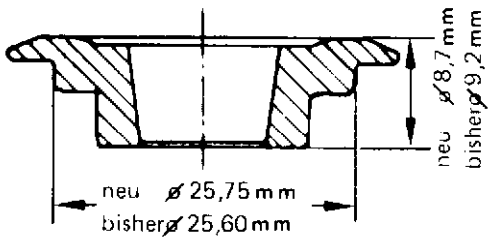
	New Valve Springs — 1 or 2 White Stripes —
Intake valve	41.0 + 0.5 mm
Exhaust valve	40.0 + 0.5 mm

New installed lengths are not given on Special Tool 9138/1 "Valve Spring Adjuster", so that when reaching "41.5 or 40.5 mm" one more 0.5 mm shim has to be added.

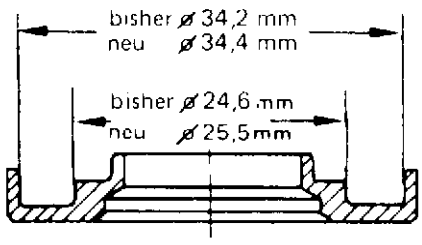
Note:

New valve springs with 2 or 3 white stripes may only be used together with new spring retainers and guides.

Spring Retainer

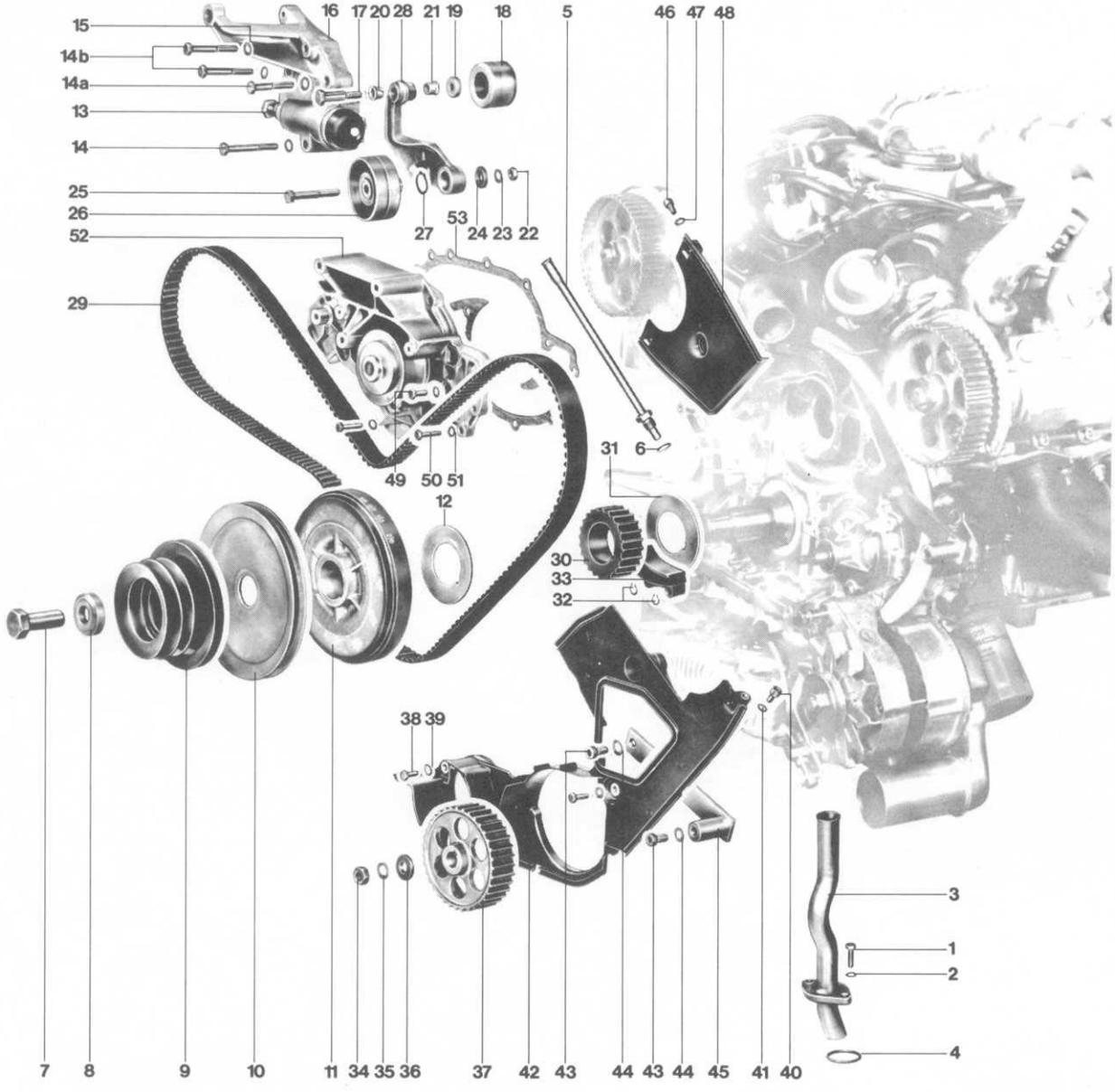


Guide Disc



REMOVING AND INSTALLING CAMSHAFT DRIVE BELT AND WATER PUMP

REMOVING AND INSTALLING CAMSHAFT DRIVE BELT AND WATER PUMP



No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Bolt M 6 x 20	2			
2	Washer	2			
3	Oil tube	1			
4	Seal	1		Replace	
5	Guide tube for oil dipstick	1			
6	Seal 14 x 18, aluminum	1		Replace	
7	Bolt	1			
8	Thrust washer	1			
9	Pulley	1			
10	Pulley	1			
11	Vibration damper	1			
12	Collar washer	1			
13	Adjusting screw	1			
14	Bolt M 8 x 62	1			
14a	Bolt M 8 x 45	1		Install with Loctite 574	
14b	Bolt M 8 x 55	2			
15	Washer	4			
16	Tensioning roller housing	1			see Page 15-24
17	Shaft bolt	1			
18	Roller	1		Check for easy movement, turning by hand. Roller must turn easily without restriction at any point	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
19	Washer	1			
20	Nylon bushing	1		Check, replacing if necessary	
21	Nylon bushing	1		Check, replacing if necessary	
22	Nut	1			
23	Washer	1			
24	Washer 9 x 25 x 3,5	1			
25	Bolt M 8 x 55	1			
26	Tensioning roller	1		Check for easy movement, turning by hand. Tensioning roller must turn easily and without restriction at any point.	
27	Circlip 20 x 1.75	1		Position correctly	
28	Tensioning roller carrier	1			
29	Camshaft drive belt	1		Check, replacing if necessary	
30	Sprocket	1			
31	Collar washer	1			
32	Circlip 8 x 0.8	2			
33	Slide	1			
34	Nut M 10	1			
35	Washer	1			
36	Washer 10.5	1			
37	Oil pump sprocket	1			
38	Bolt	2			
39	Washer	2			

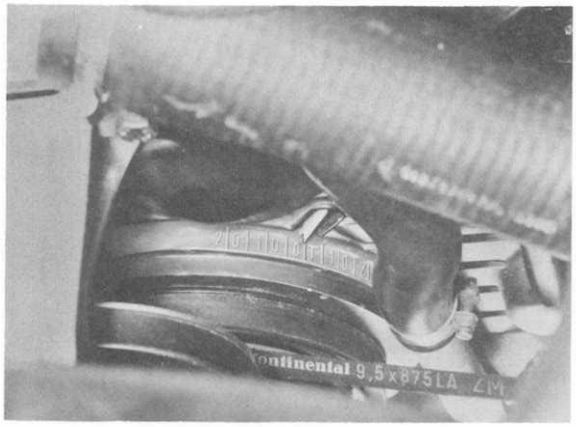
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
40	Bolt M 6 x 12	1			
41	Washer	1			
42	Camshaft drive belt cover	1			
43	Bolt	2			
44	Washer	2			
45	Pump brace	1			
46	Bolt M 6 x 12	2			
47	Washer	2			
48	Camshaft drive belt cover	1			
49	Bolt M 6 x 20	5		Install in recess of housing	
50	Bolt M 6 x 25	8			
51	Washer	13			
52	Housing with water pump	1			
53	Gasket	1		Replace	

INSTALLING CAMSHAFT DRIVE BELT AND ADJUSTING TIMING

Note:
Make sure new drive belts are retightened after driving car approx. 1,000 km.

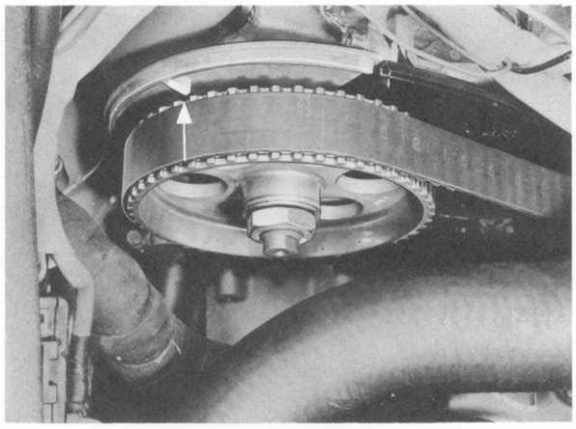
Installing Camshaft Drive Belt

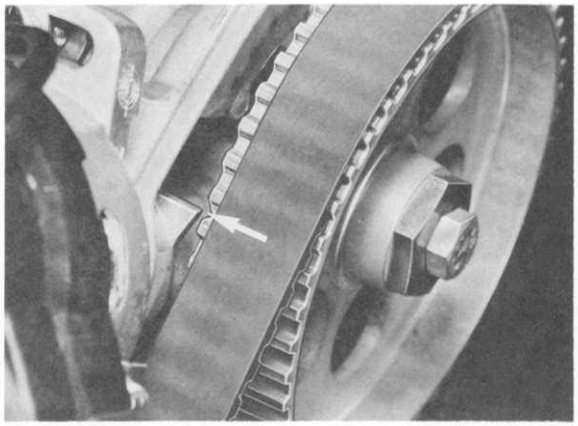
1. Line up TDC mark on vibration damper with red indicator on cover by turning crankshaft clockwise.



Note:
Vibration damper must be removed again for installation of the camshaft drive belt afterwards.

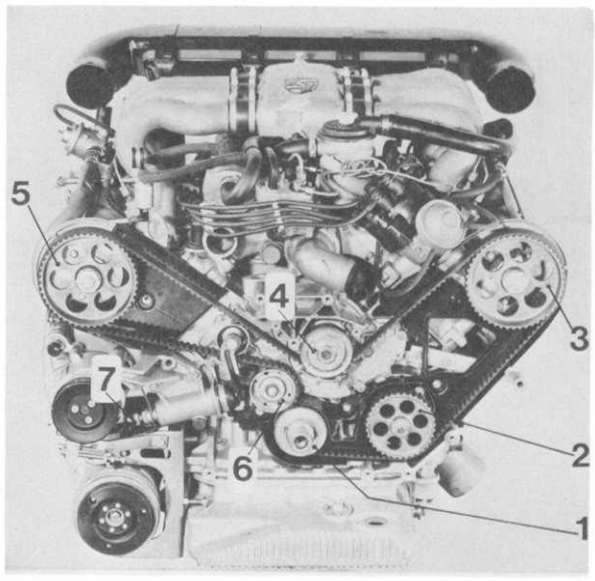
2. Turn both camshafts until notches in both camshaft sprockets are aligned with marks cast on the camshaft bearing caps.





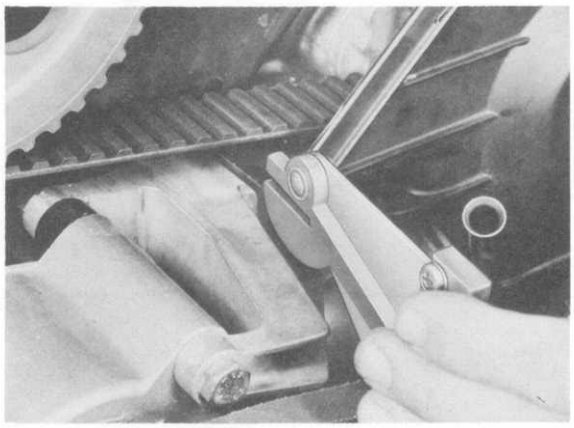
3. Install camshaft drive belt, always pre-loaded by hand, in the following order.

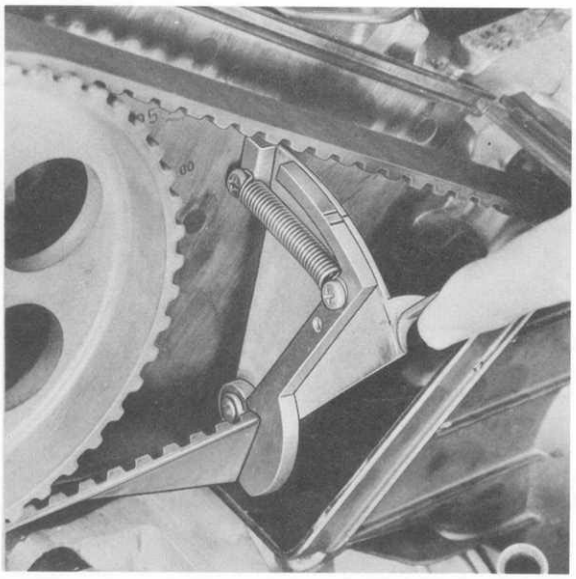
   First on sprocket (1), oil pump sprocket (2), then over sprocket (3) of left camshaft (cyl. 5 through 8), bottom of water pump sprocket (4) and on sprocket (5) of cyl. 1 through 4, and finally over camshaft drive belt tensioning roller (6).



Note:
Should the teeth of a hand-tightened camshaft drive belt not match the sprocket pitch accurately enough, turn pertinent camshaft sprocket counterclockwise carefully until teeth match.

4. Tighten camshaft drive belt to specifications with special tool 9131.





5. Turn engine clockwise two turns to align red indicator and TDC mark.

Note:

Never turn engine anticlockwise, since this could destroy the camshaft drive belt tensioner.

6. Check position of marks.

7. Now tighten camshaft drive belt again.

8. Turn engine clockwise two turns to align red indicator and TDC mark.

9. Recheck.

TOOTHED DRIVE BELTS WITH HTD TEETH
Beginning with 1983 Models

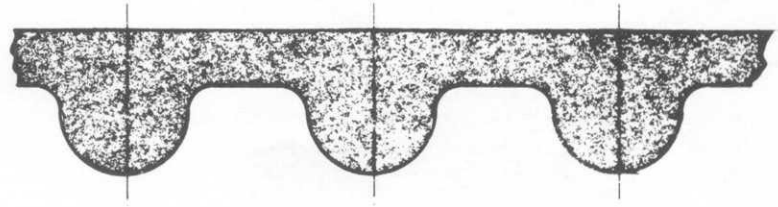
Note:

The shape of teeth on drive belts for camshaft sprockets, oil pump sprocket and crankshaft sprocket has been changed to High Torque Drive (HTD).

Old Tooth Shape

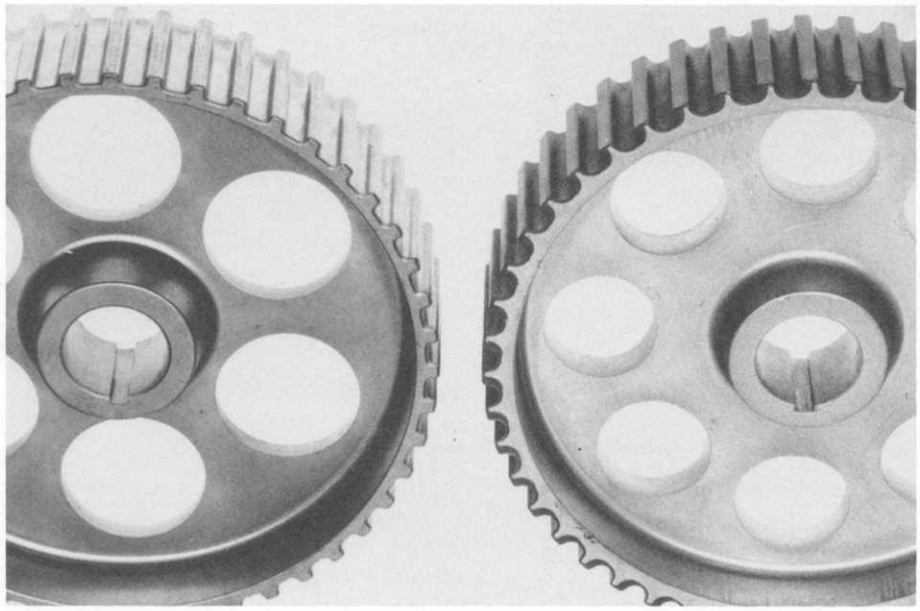


HTD Tooth Shape



Old Camshaft Sprocket

HTD Camshaft Sprocket

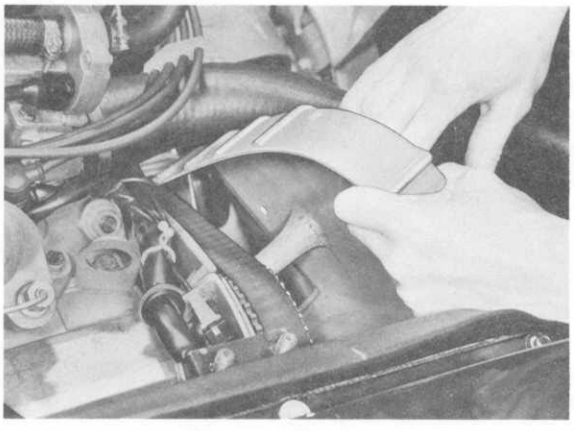


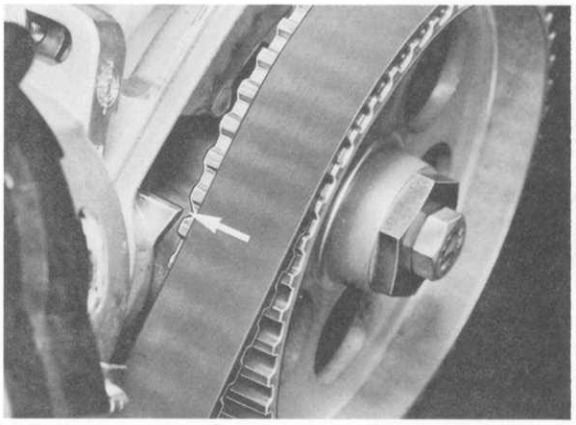
Note: New HTD drive belts can also be used on older engines, if above mentioned sprockets with new tooth shape are used at same time.
Sprockets with different teeth shape should never be mixed.

CHECKING AND ADJUSTING DRIVE BELT

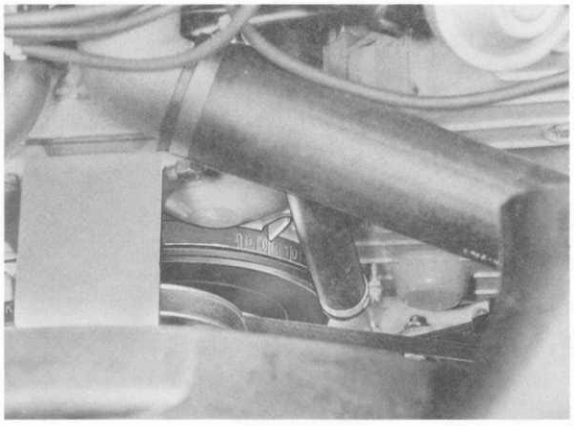
Checking

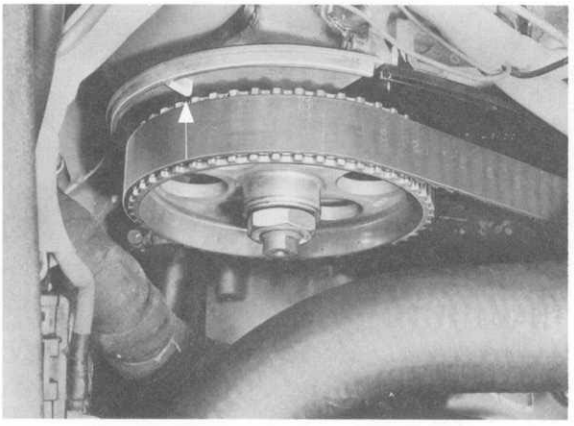
1. Loosen and remove drive belt cover upper sections on both sides.





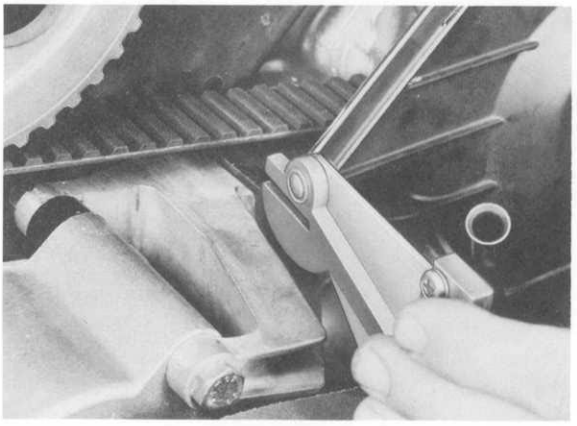
2. Turn engine in direction of rotation to TDC (cylinder 1). In this position marks on camshaft sprockets must be aligned with marks on flange bearings.

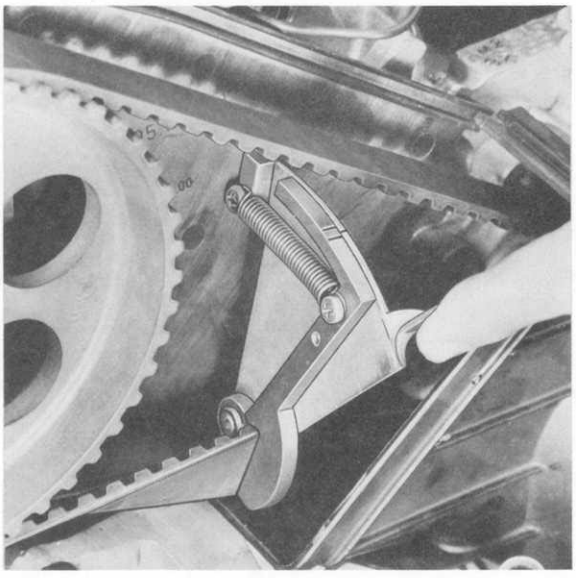




3. Turn engine two more turns until TDC mark is reached again and check drive belt for damage and wear at the same time.

4. Check drive belt tightness between tension roller and camshaft sprocket on relaxed section of belt with Special Tool 9131.
Drive belt tightness is correct when right mark is between both left marks and special tool rests on rear drive belt cover. (Engine must be positioned for this test as described in point 2.)

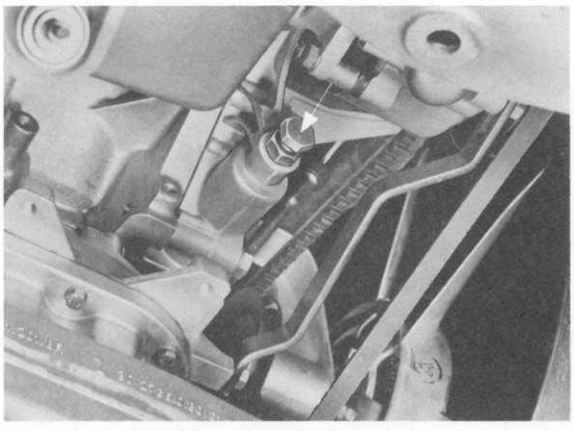




Adjusting

Note

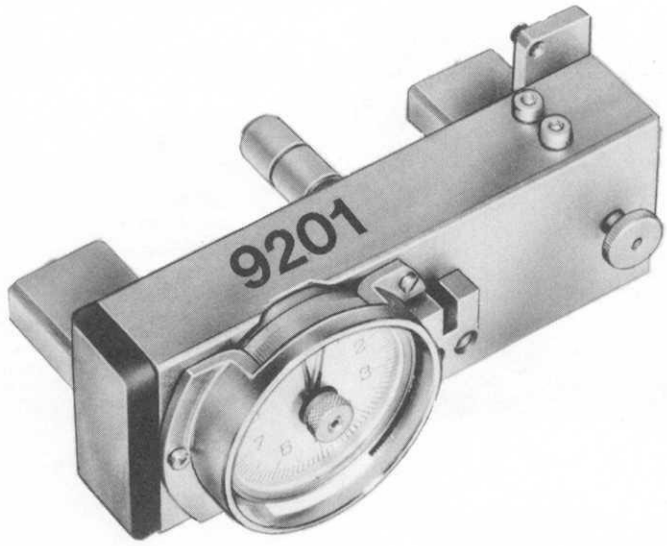
Drive belt adjusting screw is located on bottom of engine at front right-hand side.



Loosen locknut of adjusting screw and turn adjusting screw until drive belt tightness is correct. Tighten locknut. Turn engine two turns and recheck tightness of drive belt.

Screw tightened — tightens belt
Screw loosened — loosens belt

TOOLS



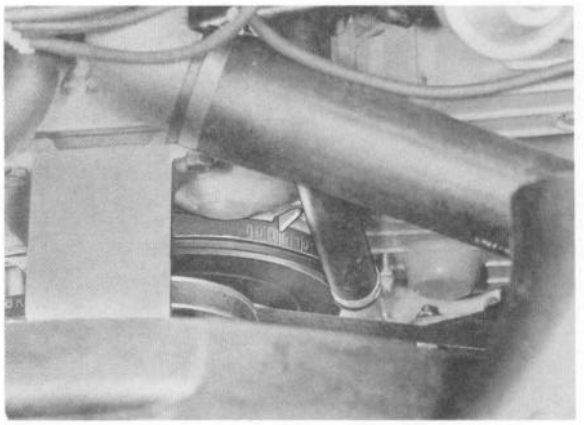
No.	Description	Special Tool	Remarks
1	Belt tightness tester	9201	

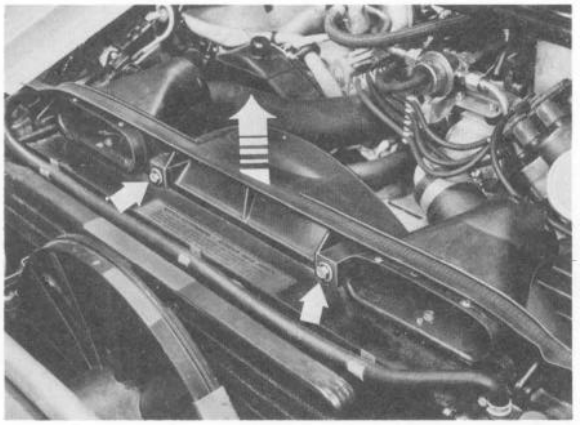
CHECKING AND ADJUSTING DRIVE BELT

Checking

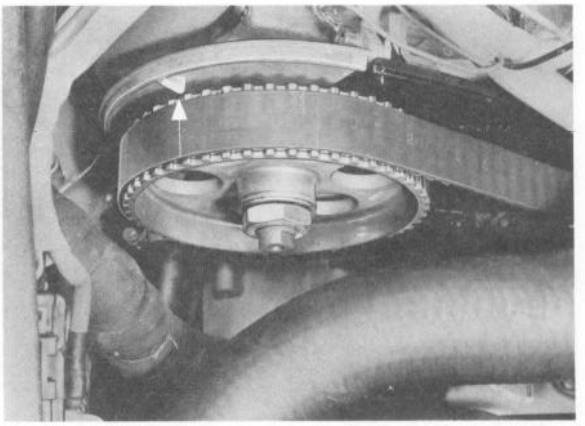
1. Remove air guide hoses.

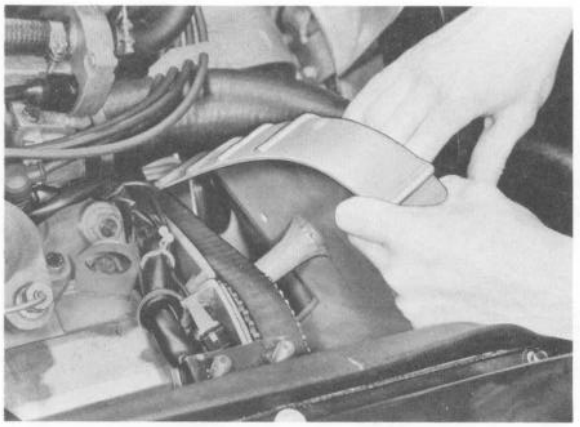
2. Unscrew two hexagon head metal screws and remove air guide upper section from above.

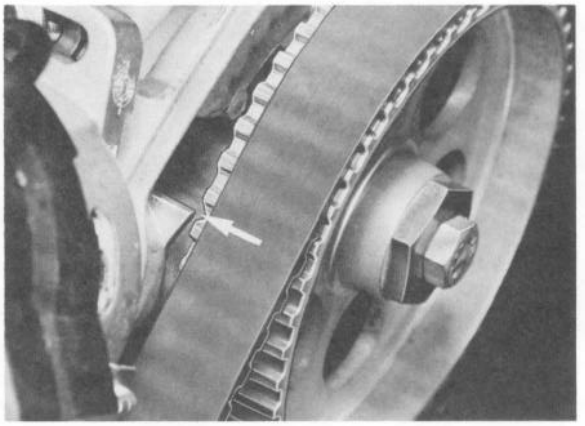




3. Unscrew drive belt guard upper section on both sides and remove.



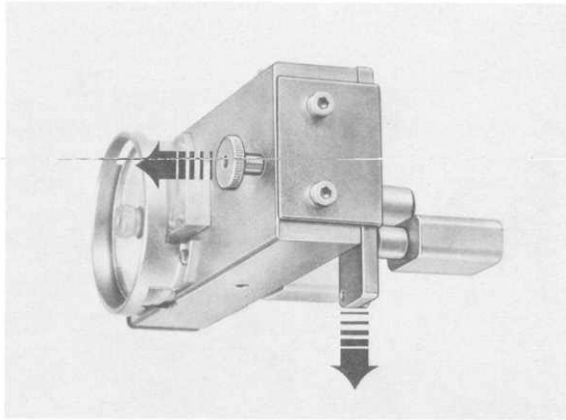




4. Turn engine in direction of rotation to TDC (cylinder 1). In this position marks on camshaft sprockets should conform with marks on flange bearings.

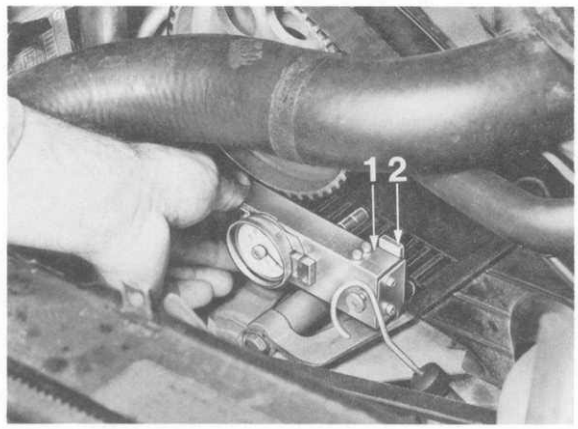
5. Turn engine two more turns until TDC mark is reached again and check drive belt for damage and wear at same time.

6. Prepare Special Tool 9201 for checking. Pull out lockpin on special tool and slide out gauge pin opposite the lockpin fully. Line up maximum indicator with gauge indicator.



7. Slide special tool on to relaxed section of drive belt (sliding shoes on smooth surface, rollers in tooth gap).

8. Press down tester on case (arrow 1) slowly until gauge button (arrow 2) resting on the air pump bracket engages.



Line up maximum indicator with gauge indicator (in anticlockwise direction).

Read value while keeping the tester free of tension, i. e. horizontal to the drive belt.
Tester must not contact plastic cover.

Note:

Sliding shoes must rest on belt with their complete surface. The special tool must not be turned or moved on the belt while checking.

9. Pull out lockpin to have the gauge button disengage again.

Important:

This test requires the engine in the position described in point 4.

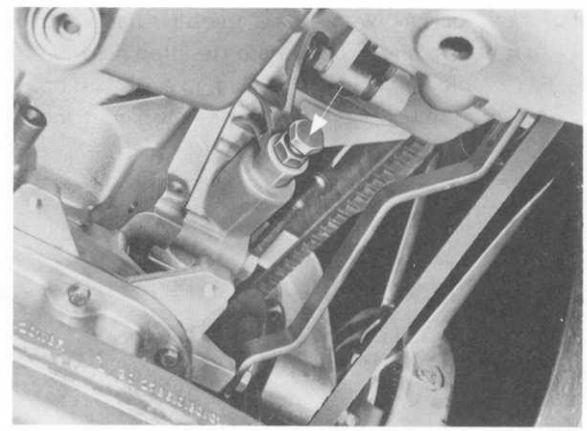
Repeat test one or two times!

Adjusting value: 4.5 scale units.

Correct belt tightness if necessary.

Adjusting

The drive belt adjusting screw is located on bottom of engine at front right.



Loosen nut on adjusting screw and turn adjusting screw until the drive belt tightness is correct. Tighten nut again. Turn engine two more turns and recheck drive belt tightness.

Tightening screw = tightening belt

Loosening screw = loosening belt

Note

Never turn engine anticlockwise, since drive belt could jump out if its tightness is insufficient.

Machining the cylinder head mating surface

Checking the cylinder head for distortion

Check the sealing surface of the cylinder head for distortion using a feeler gauge and straightedge.

Distortion limit of mating surface: 0.05 mm. Warped cylinder heads may be repaired by machining the mating surface. Admissible distortion after machining: 0.03 mm

Machining the cylinder heads

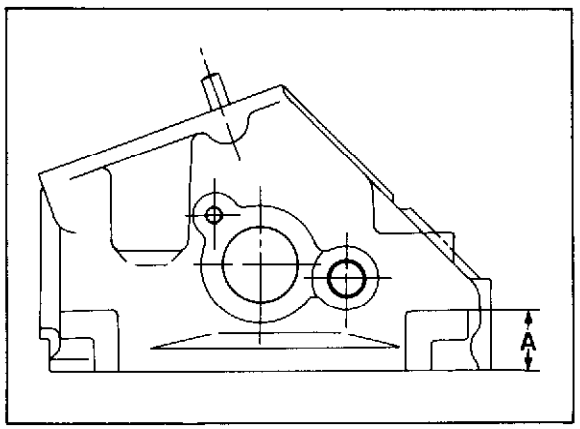
As a rule, both cylinder heads must be machined by the same amount to ensure correct seating of the regulator housing.

Machine sealing surface of the cylinder head only until a straight surface is obtained. Max. wear limit: 23.6 mm.

Note for machining of the sealing surface: Max. roughness = 0.015 mm

If machining causes the actual value to be below the tolerance applicable to new parts, use a 1.4 mm thick cylinder head gasket (available from the parts service) when fitting the cylinder head.

New-part size A = 24 ± 0.1 mm
Wear limit A = 23.6 mm



Note

When machining the sealing surface facing the combustion chamber, also check the mating surface on the camshaft end and machine if required.
Admissible distortion of camshaft mating surface
when checking: 0.1 mm
after machining: 0.03 mm
Before machining the mating surface facing the camshaft housing, check dimension "A" to avoid unnecessary work.
Plug oil passage of check valve before machining. Remove roll pins.

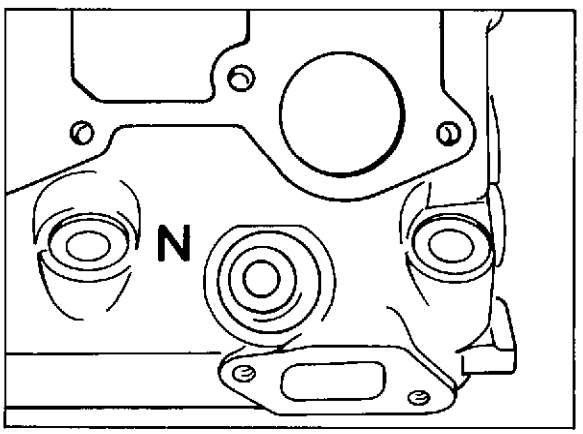
Cylinder head refacing dimensions and identification

New dimension	: 24 ± 0.1 mm
Gasket	: 1.1 mm
Identification	: none
Refacing dimension	: 23.8 to 23.6 mm
Gasket	: 1.4 mm
Identification	: N

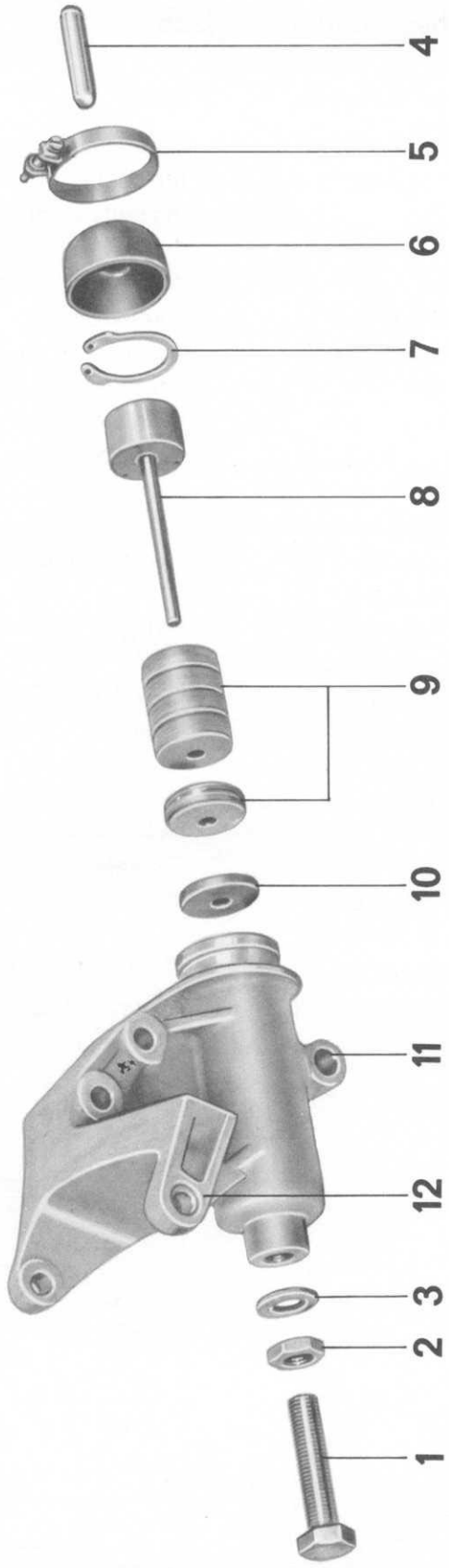
Identification: N

Engrave at cylinder 1 and 4 as well as 5 and 8, respectively.

Height of "N" character: 10 mm



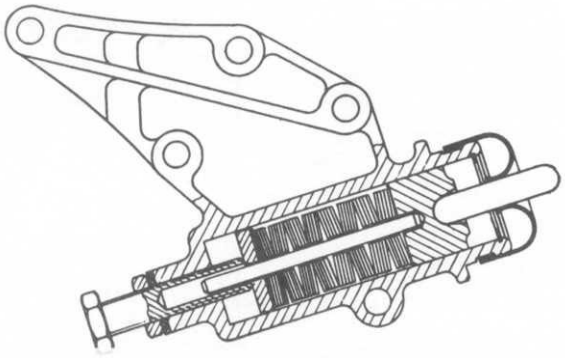
Printed in Germany – XXIX, 1992

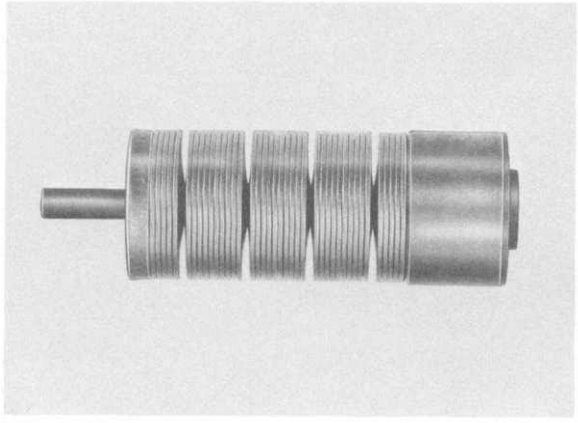

4
5
6
7
8
9
10
11
12
3
2
1

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Adjusting screw	1			
2	Nut M 12 x 1.5	1		Lock after adjusting	
3	Unitec circlip	1		Check, replacing if necessary	
4	Push rod	1			
5	Hose clamp	1			
6	Bellow	1		Check, replacing if necessary	
7	Circlip	1	Position correctly		
8	Piston	1			
9	Bimetal plate (8 plate sets of 5 each, coated alternately)	40			
	(7 plate sets of 5 each, coated alternately)	35		Watch arrangement	see page 15 - 12
10	Support disc	1			
11	Tensioning roller housing	1		Fill one third of housing with transmission oil SAE 90	
12	Key	1			

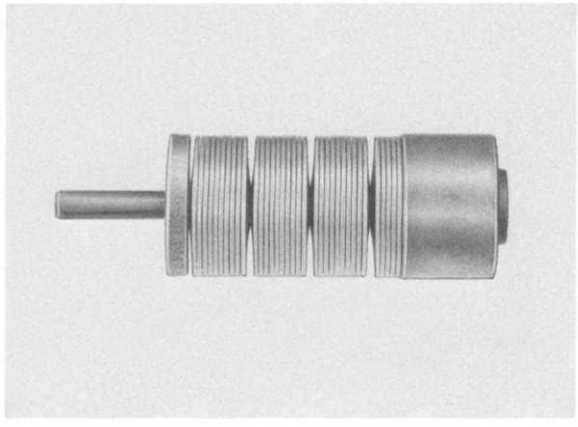
INSTALLATION NOTES

Arrangement of Bimetal Plate Sets for Tensioning Roller





Install 8 plate sets of 5 each with coated surface alternately.



Install 7 plate sets of 5 each with coated surface alternately.

Note

Use correct adjusting screw to match number of plate sets.
8 plate sets = adjusting screw 928.105.075.00
7 plate sets = adjusting screw 928.105.075.01

Installing Tensioning Roller Housing

1. Fill one third of housing with SAE 90 transmission oil.

2. Hold housing at an angle and slide in entire piston with bimetal plate sets and support disc.

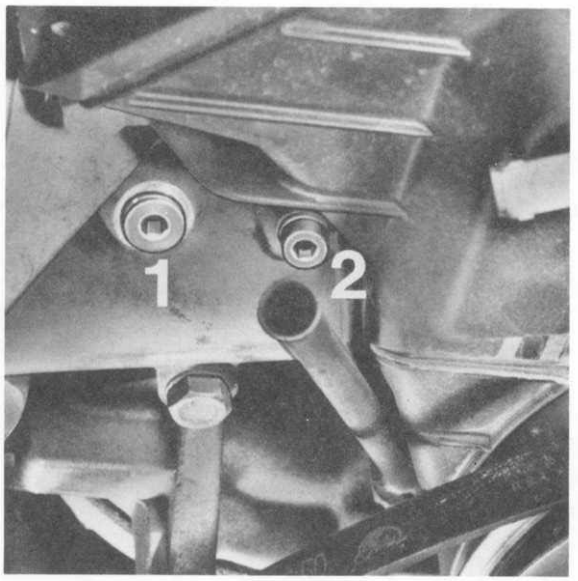
3. Push piston in housing until oil leaves the discharging bore and piston is felt to be against the stop.

4. Oil level should reach upper edge of tensioning roller housing. Add oil while holding the tensioning roller housing upright, if necessary.

BLEEDING TENSIONING ROLLER HOUSING (TOOTHED BELT TENSIONER)

1. Tighten toothed belt as specified.

2. Remove oil filler plug (1) and bleeder screw (2).

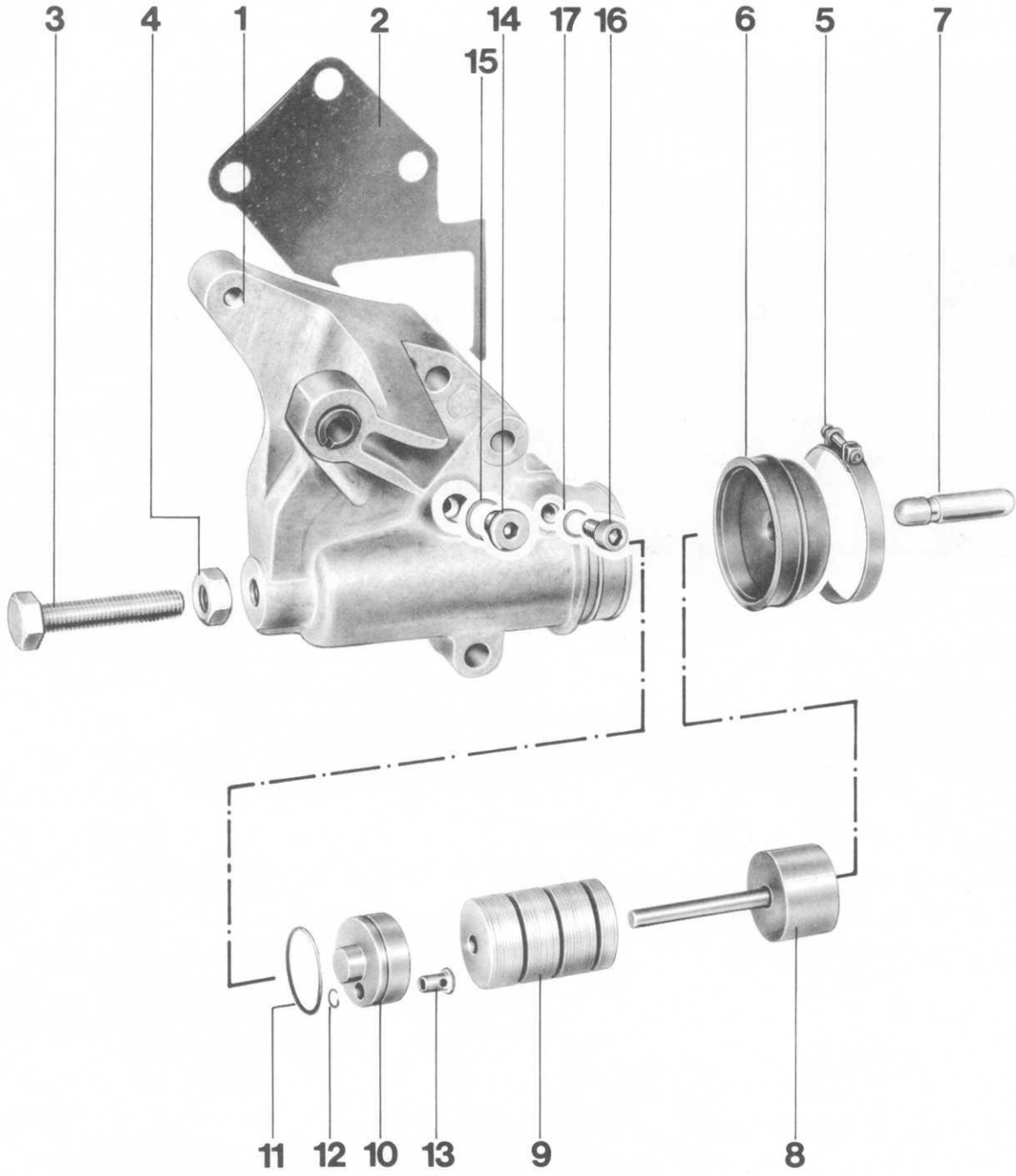


3. Pour oil from oil can into oil filler opening, slowly, until oil runs out of bleeder screw bore.

4. Screw in and tighten oil filler plug and bleeder screw.

DISASSEMBLING AND ASSEMBLING TENSIONING ROLLER HOUSING

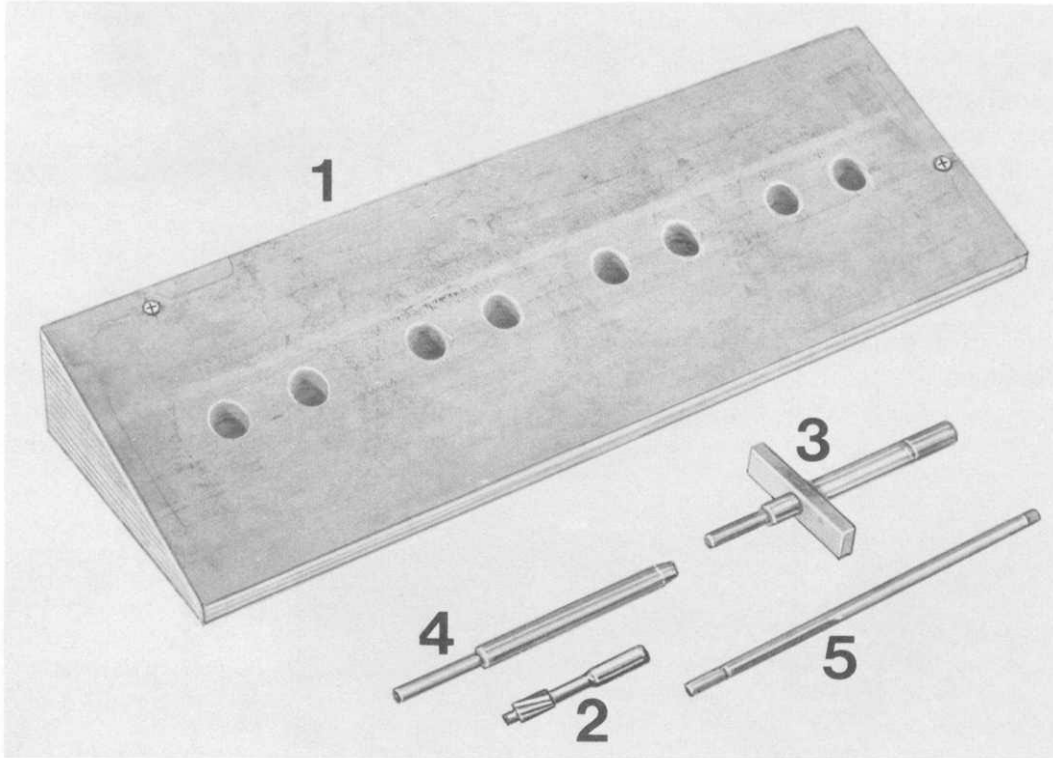
Beginning with 1983 Models



No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Tensioning roller housing	1		Lubricate guide sleeve with oil	
2	Gasket	1		Replace	
3	Adjusting screw	1			
4	Nut M 12 x 1.5	1		Lock nut after adjusting, while holding adjusting screw	
5	Hose clamp	1			
6	Dust cover	1			
7	Push rod	1		Install in dust cover while still removed; make sure of correct fit in groove	
8	Piston	1			
9	Bimetal disc set	35		7 sets of 5 each, coated alternately	
10	Valve carrier	1			
11	O-ring 27.5 x 1.5	1		Replace	
12	Snap ring	1		Position correctly	
13	Valve	1		Check that valve carrier moves easily	
14	Oil filler plug M 10 x 1	1			
15	Seal A 10 x 13.5	1		Replace	
16	Bleeder screw M 6 x 10	1			
17	Seal A 6.5 x 9.5	1		Replace	

REPLACING VALVE GUIDES

TOOLS



No.	Description	Special Tool	Remarks
1	Pressing out base	9220	
2	Countersink	9220/1	
3	Pressure pad	9221	
4	Driver	9224	
5	Reamer	3015	

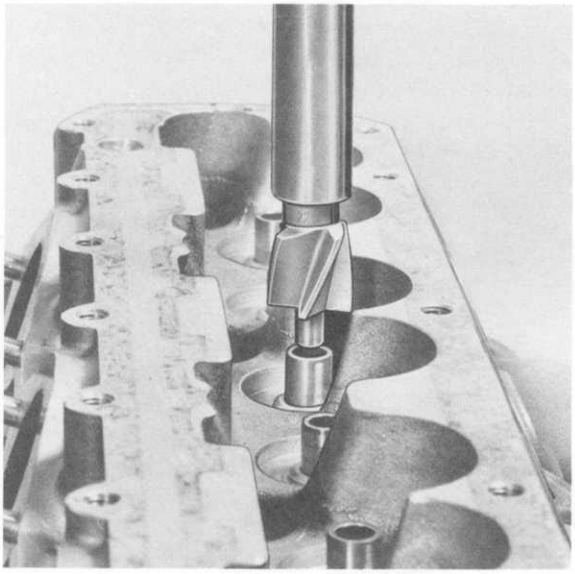
REPLACING VALVE GUIDES

1. Clean and inspect cylinder head. Cylinder heads are not suitable for replacement of valve guides, if their valve seats and sealing surfaces can no longer be machined.

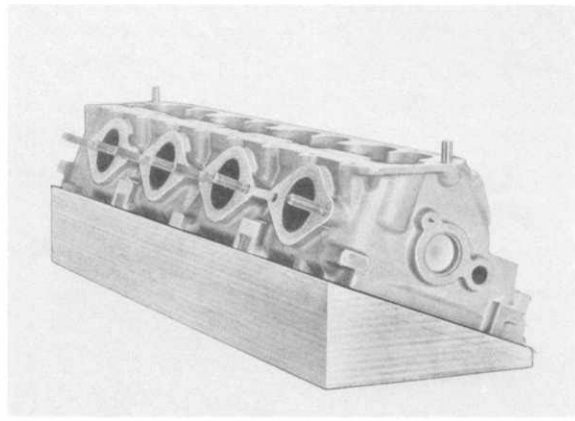
2. Machine off protruding valve guides from the camshaft side with a countersink, Special Tool 9220/1, until guides are flush with the cylinder head.

Note:

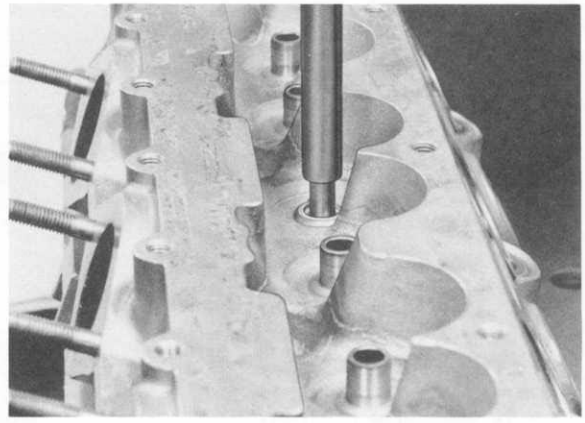
Be careful not to damage guide collar for spring retainers.



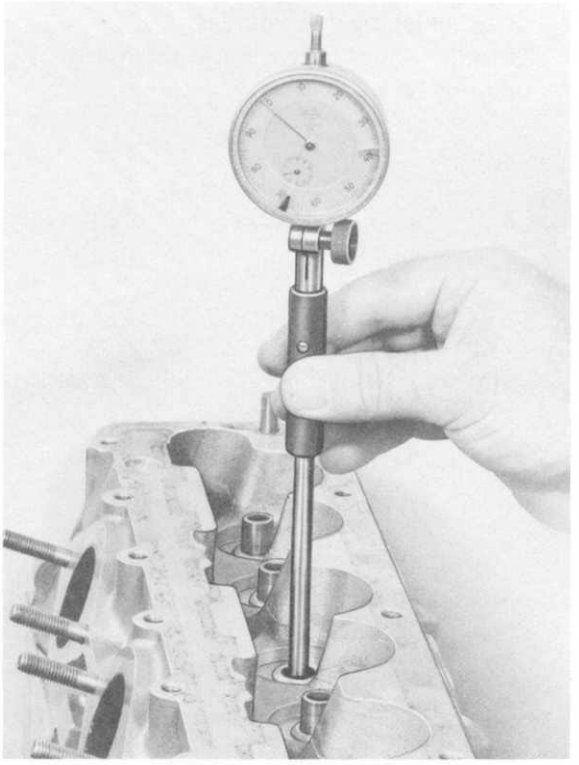
3. Place cylinder head on Special Tool 9220.



4. Loosen valve guides from camshaft end with brief hammer knocks on Special Tool 9224 and press out rest of guides toward combustion side with a press.



5. Check bores in cylinder head with an internal gauge.



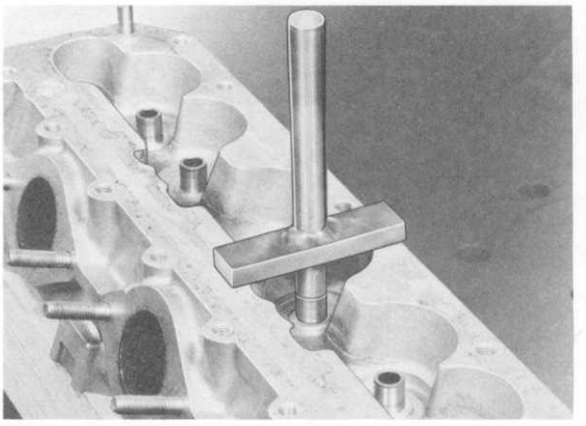
6. Grind off service valve guide, Part No. 928 104 328 52 (13.27 mm outside dia.), accordingly.

   Press-fit for intake and exhaust valve guides must be 0.06 to 0.08 mm.

Example:

Measured bore diameter in cylinder head = 13.01 mm. Outside diameter of service valve guide ground accordingly to 13.07 . . . 13.09 mm.

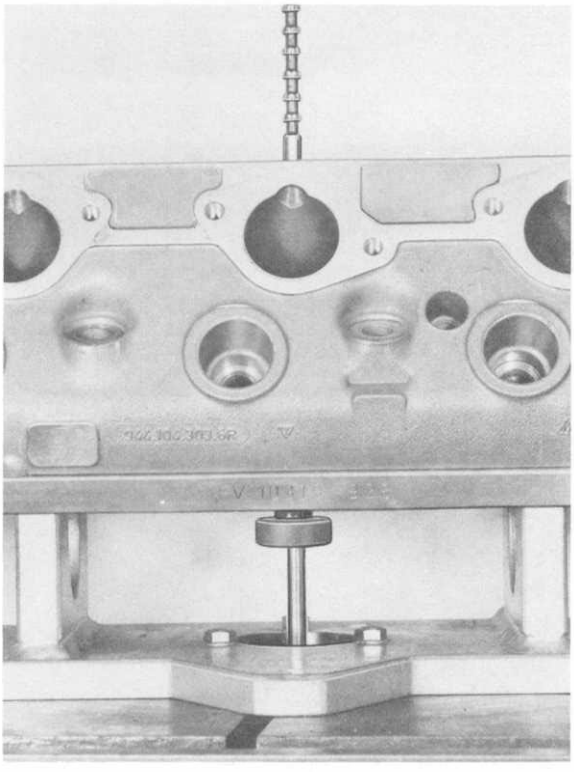
7. Coat valve guides with tallow, insert with a light knock, align and press into cylinder head against stop from camshaft side with Special Tool 9221.



Note:

If pertinent workshop equipment is available, valve guides can be chilled in liquid air and pressed into a cylinder head heated to 190 °C/375 °F.
Cylinder head may be kept at temperature of 190 °C/375 °F for max. 90 minutes.

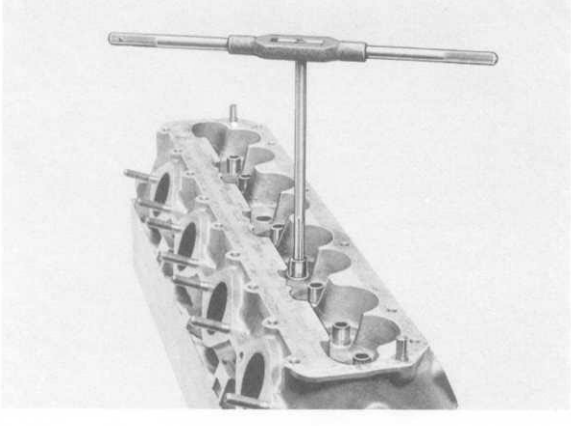
8. Ream out valve guides to size 9.00 – 9.015 (9 H 7) with a reamer.



9. If absolutely necessary, valve guides can be reamed out with Special Tool 3015.

   Procedures:

   Always ream out valve guides with "petroleum" as a lubricant. Back out reamer frequently to remove burrs. Check reamed bore with limit gauge P 206 and, if necessary, ream out bore again with a dry reamer.



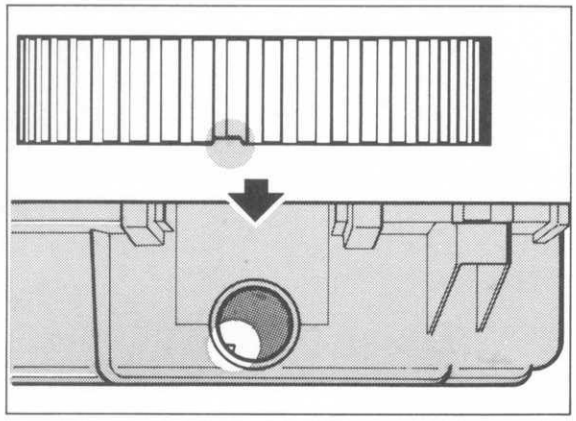
10. Valve seat inserts must be machined after replacing valve guides. Grinding in valves with grinding paste will not be sufficient.

CHECKING TDC MARKS ON CAMSHAFT SPROCKETS
(Do not remove toothed belt cover)

'86 MODELS ONWARD

ENGINE TYPE M 28. 21/22
M 28. 43/44/45/46/41/42

The covers fitted as of model year '86 have cast noses at the air-bleed ports for the intake hoses; with the crankshaft at the ignition TDC for cylinder no.1, these noses must be aligned with the recesses in the camshaft sprockets.



Note:

Maintenance (toothed belt)

During servicing (job: toothed belt), it is not necessary to remove the left-hand toothed-belt cover to check that the setting is correct.

TOOLS (32 VALVE ENGINE)



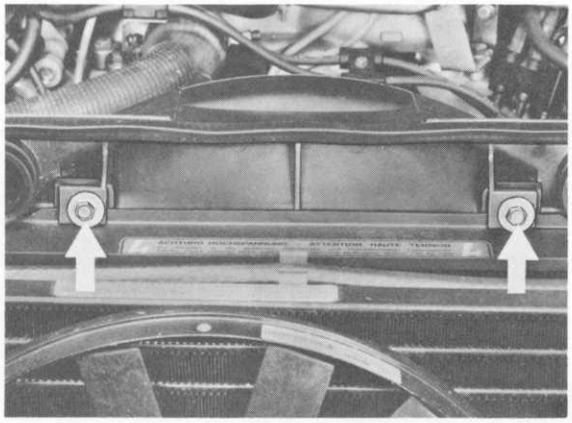
No.	Description	Special Tool	Remarks
	Belt tightness tester	9201	

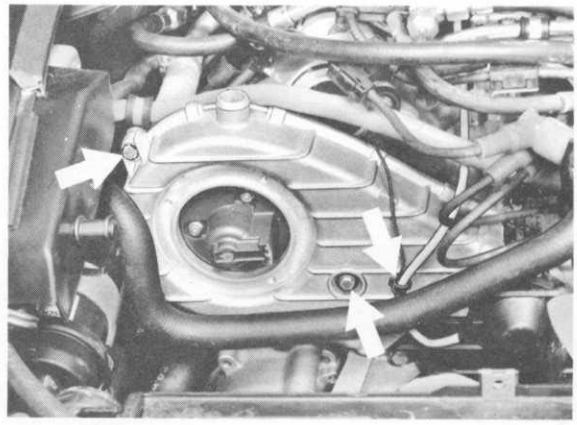
CHECKING AND ADJUSTING TOOTHED BELT (32 VALVE ENGINE)

Checking

1. Remove air guide hoses.

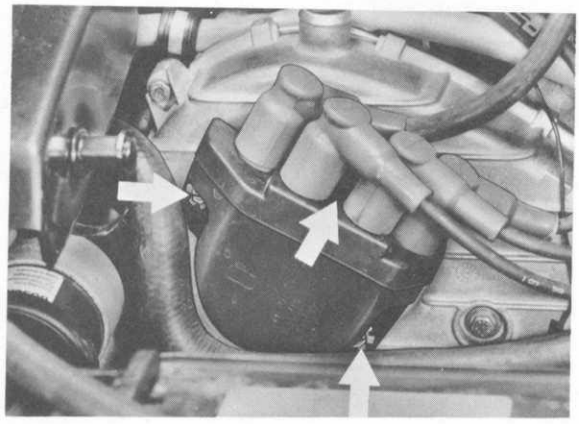
2. Unscrew two self-tapping screws and take off upper air guide section from above.



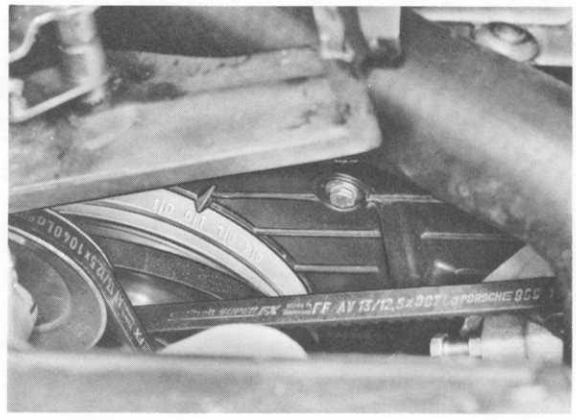


3. Unscrew and take off distributor caps and toothed belt cover upper section on righthand side.

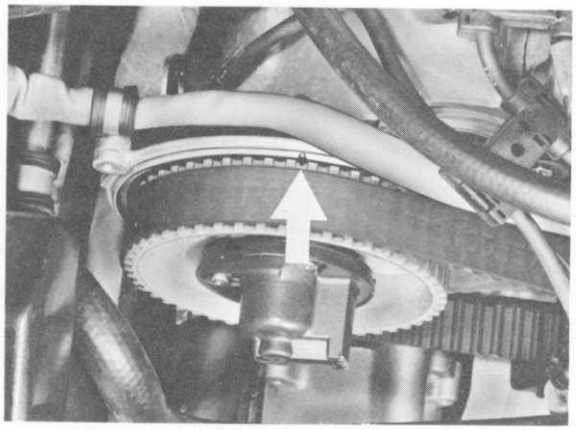
4. Unscrew and push toothed belt cover upper section on lefthand side forward.

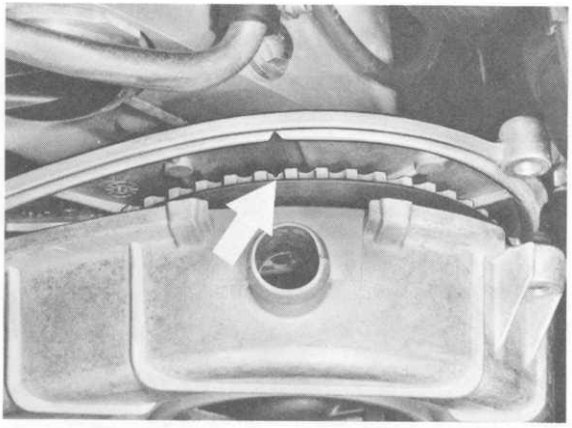


5. Turn engine in direction of rotation to TDC (cyl. 1). Marks on camshaft and flange bearings must be aligned in this position.



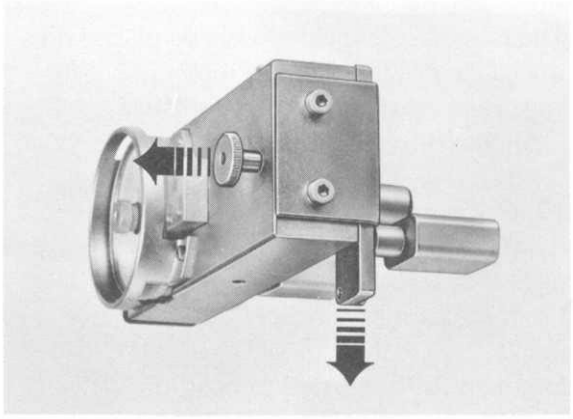
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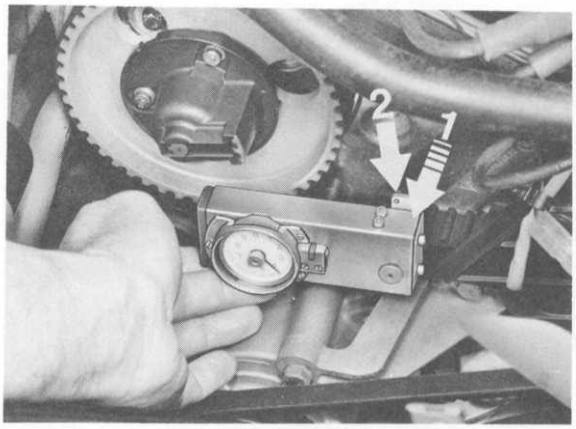
6. Turn engine two more turns until TDC mark is reached again and then continue turning while checking toothed belt for wear and damage.

7. Prepare Special Tool 9201 for checking. Pull out lock pin on special tool and move testing pin opposite the lock pin to starting position. Place drag needle on gauge needle.



8. Slide special tool on released belt section of toothed belt (sliding shoe on smooth surface, roller must fit in tooth gap).

9. Press down tester on housing (arrow 1) slowly until gauge tip resting on air pump bracket (arrow 2) engages.



Read test value without tension in tester, i.e. tester must be kept horizontal to the toothed belt. Tester must not rest on the plastic cover.

Sliding shoes must rest on belt with their entire surface. Special tool must not be turned or moved on the belt during the entire checking procedures.

Note

The drag needle must always be placed on the gauge needle after the lock pin has engaged to exclude erroneous gauge readings (turn anticlockwise).

10. Pull out lock pin to have gauge tip disengage.

Important

Engine must be turned to position described in point 5 for this test.

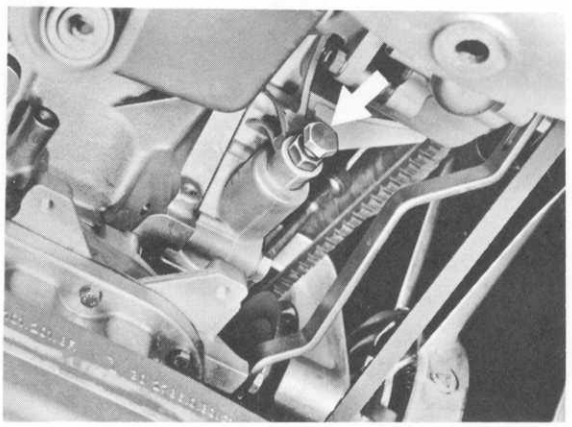
Repeat test one or two for checking!

Adjusting value: 5.0 + 0.3.

Correct belt tightness if necessary.

Adjusting

The toothed belt adjusting screw is located on bottom of engine at front righthand side.



Loosen lock nut of adjusting screw and turn adjusting screw until correct toothed belt tightness is reached. Tighten lock nut. Turn engine two more turns and recheck belt tightness.

Screw tightened - belt tightened.

Screw loosened - belt loosened

Note

Never turn engine anticlockwise, because toothed belt could jump off if tightness were insufficient.

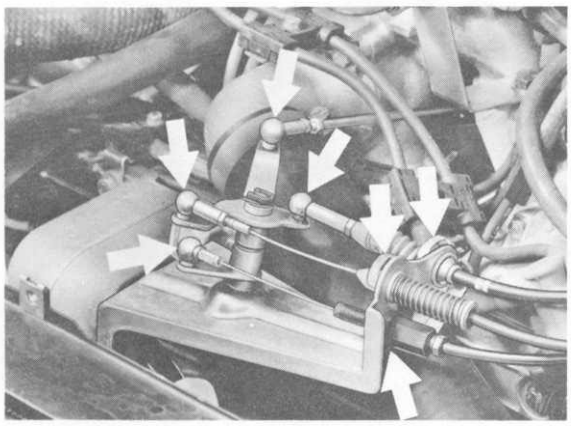
REPLACING TOOTHED BELT (32 VALVE ENGINE)

1. Remove air cleaner intake hoses.

2. Unscrew air guide on radiator at top and bottom, and remove.

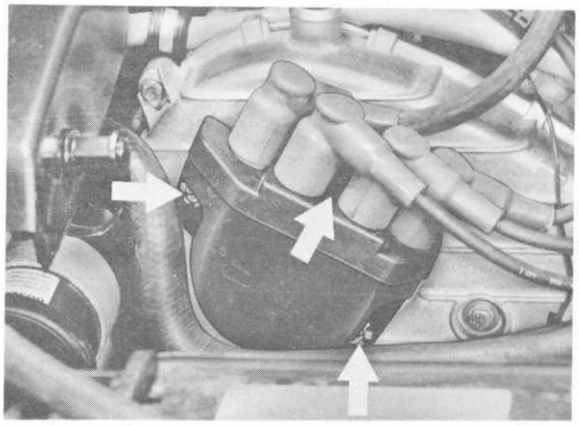
3. Loosen and take off drive belts for alternator, power pump, air pump and air conditioner compressor.

4. Disconnect cables for throttle, cruise control and automatic transmission. Remove retainers and clamp on console and place cables outside.



5. Loosen and remove fan console on engine.

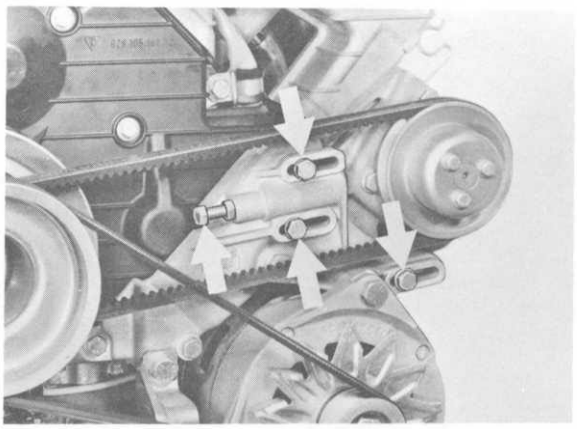
6. Pull off left and right ignition leads on distributor cap. Unscrew and place distributor cap aside.



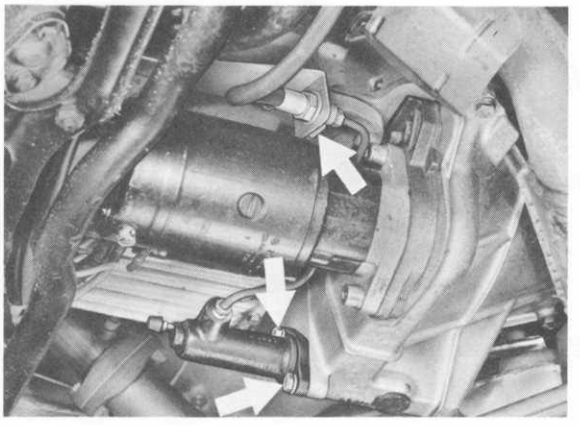
7. Take off both distributor rotors. Disconnect plugs for A/C compressor and toothed belt tightness indicator.

8. Unscrew toothed belt cover upper section on both sides and take off righthand upper section.

9. Unscrew power pump on console and let it hang down on its hoses.



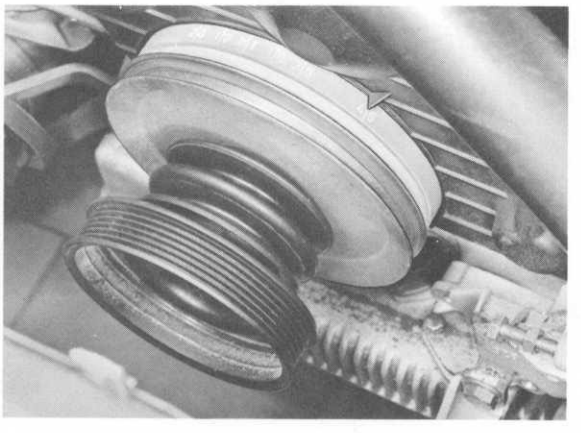
10. Remove clutch slave cylinder. Take off clamp on clutch hose holder and remove push rod. Let cylinder with connected line hang down.



Note

Never operate clutch pedal after removing the slave cylinder.

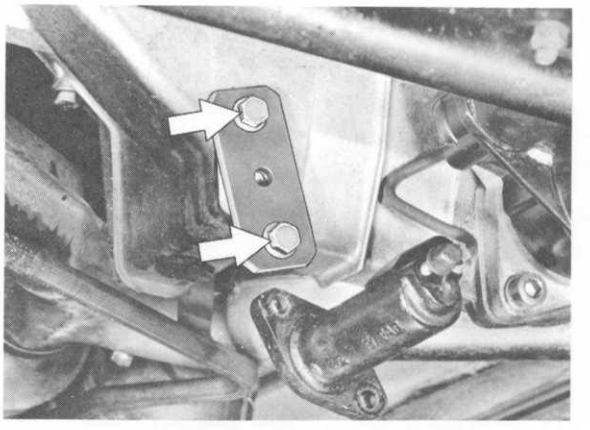
11. Align mark for 45° before TDC (cyl. 1) on vibration damper with red needle by turning crankshaft clockwise.



Note

Camshafts may be turned without damaging the valves after aligning the 45° mark.

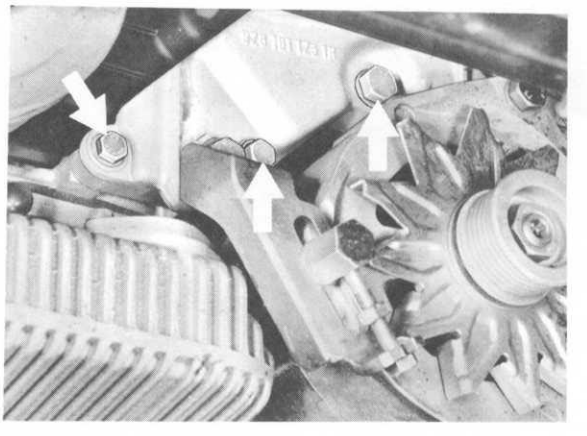
12. Mount Special Tool 9161 / 1 with original screws to hold the crankshaft.



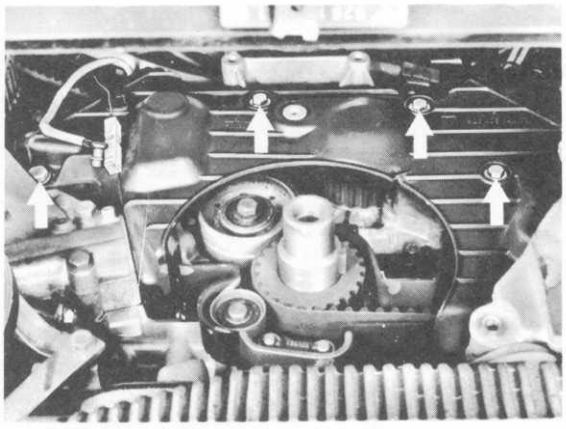
13. Unscrew bolt (wrench size 27 mm) on crankshaft and take off both pulleys, vibration damper and collar.

14. Loosen and unscrew guide tube for oil dipstick.

15. Unscrew console with alternator on engine.

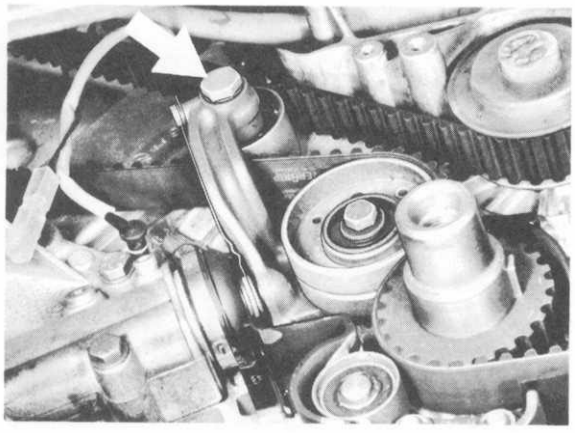


16. Undo center toothed belt cover, remove left-hand upper section and center toothed belt cover.



17. Slacken toothed belt by turning toothed-belt tensioner.

18. Unbolt and remove tensioning roller bracket.



19. Remove toothed-belt from right-hand side over cylinder 1 - 4 camshaft sprocket, water-pump sprocket, cylinder 5 - 8 camshaft sprocket, oil-pump sprocket and crankshaft sprocket.

Installing

1. Installation of toothed belt is the reverse of the above sequence.

2. Turn camshafts to mark and hold firmly in this position.

3. Then turn engine in direction of rotation to ignition TDC (cyl. no. 1).

Note

Damage may be caused to the valves if the camschafts move suddenly.

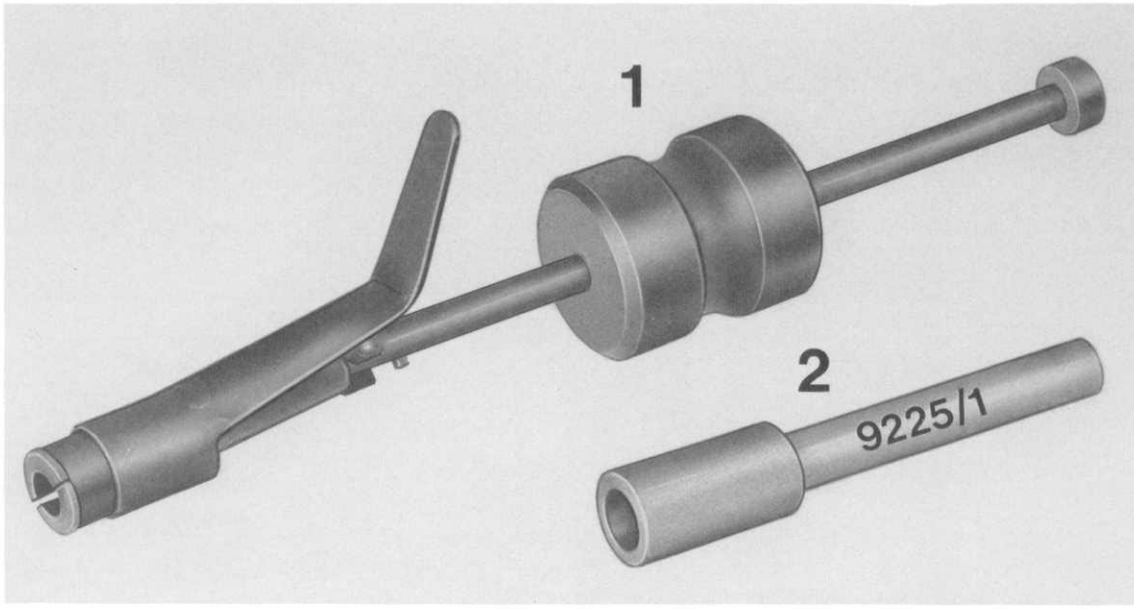
4 Once the toothed belt is in position, adjust the settings. See page 15 - 101 to 15 - 104.

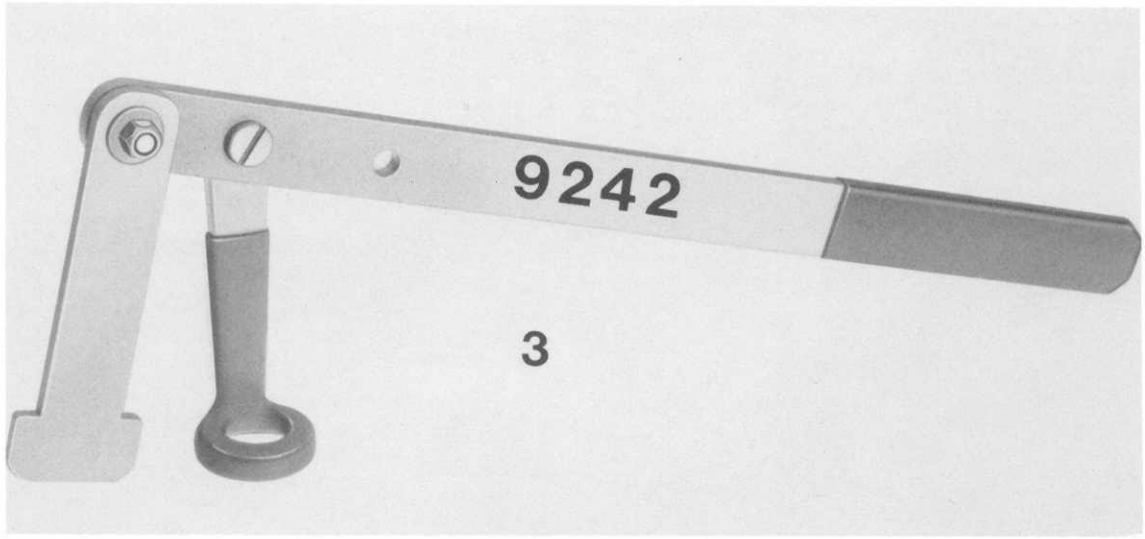
Special note on toothed belt and drive belt

As a rule, make sure the toothed belt and drive belt are **not kinked** during assembly, packing and storage. Improper handling may cause preliminary damage to the camshaft toothed belt that may be the cause for incipient damage.

Printed in Germany – XXXI, 1993

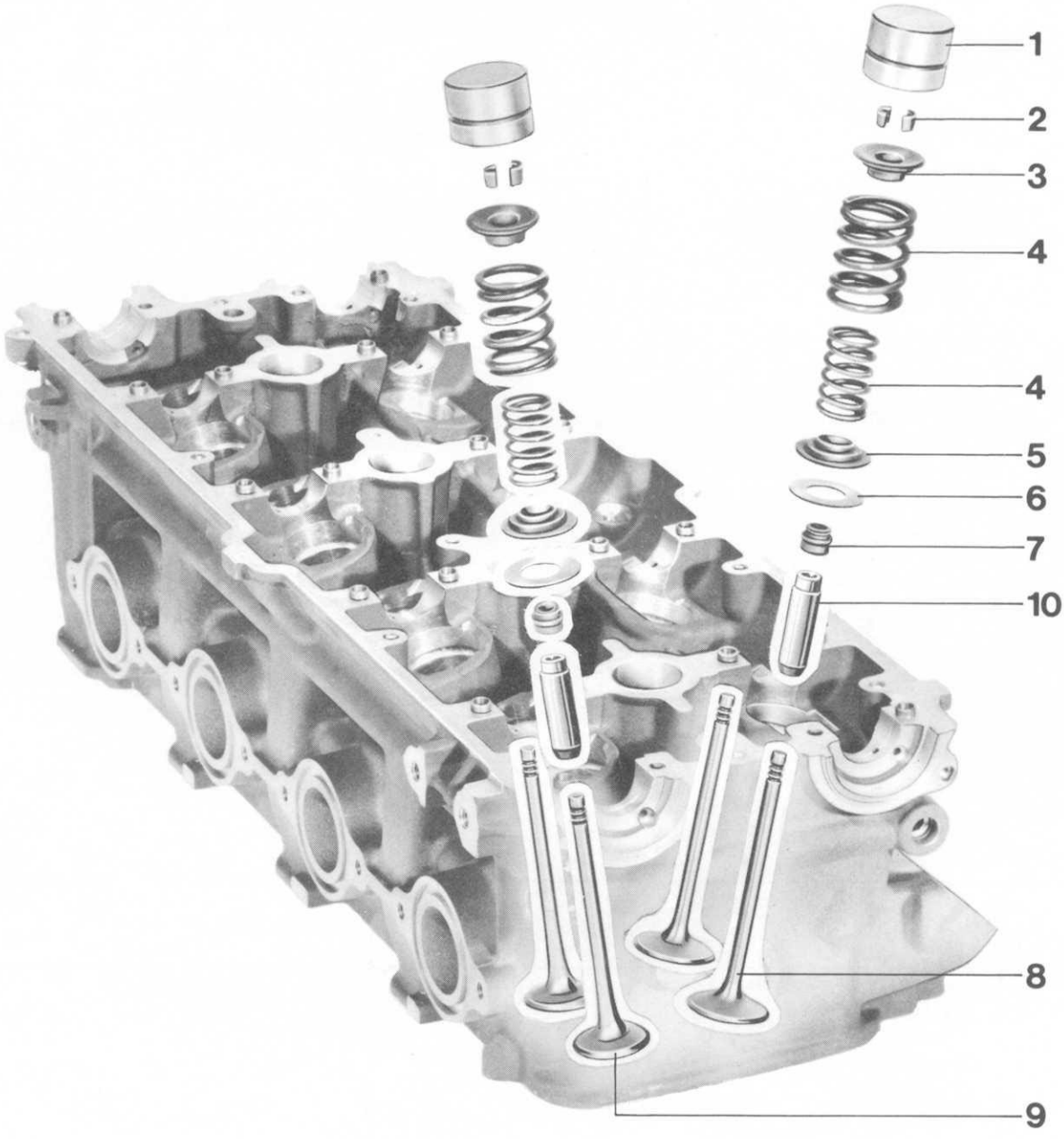
TOOLS - CYLINDER HEAD (32-VALVE ENGINES)





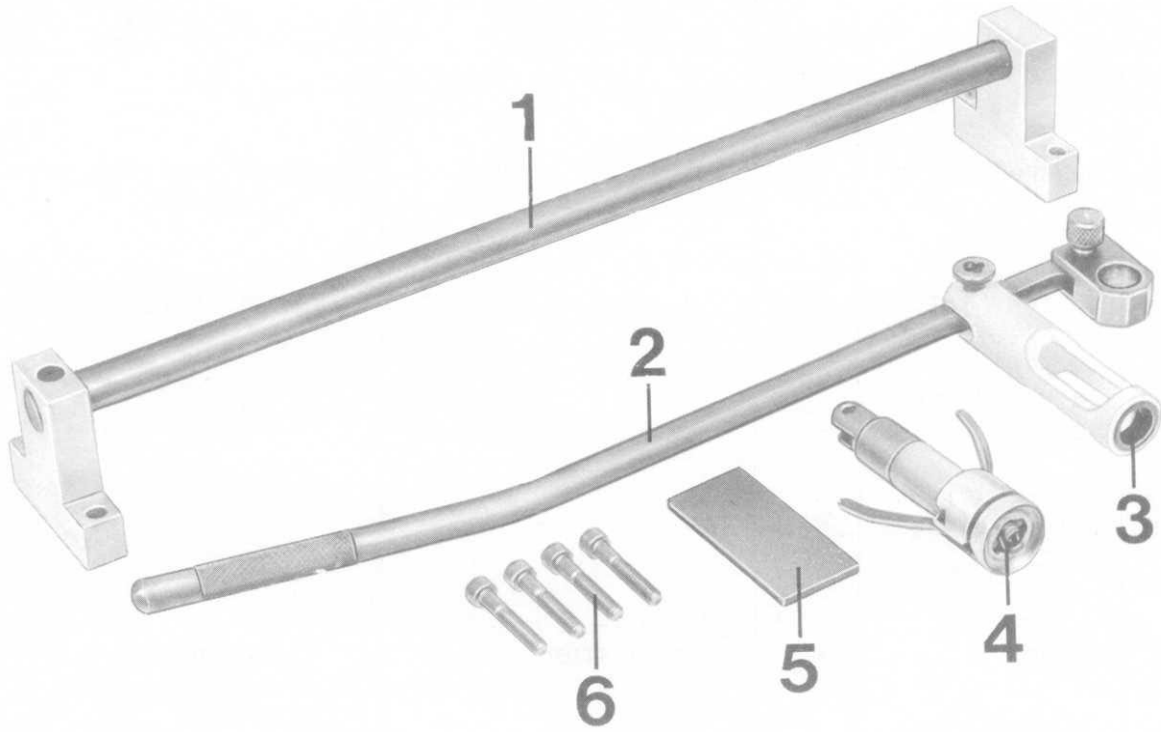
No.	Designation	Special Tool	Remarks
1	Puller for valve stem seals	9237	
2	Press-in tool for valve stem seals	9225/1	
3	Valve spring installation device	9242	or US 1020 + US 1020/1

DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (32-VALVE ENGINES)



No.	Description	Qty.	Note When: Removing	Installing
1	Hydraulic valve tapet	16	Remove with the aid of a magnet, do not mix up	Oil
2	Conical valve keeper	32		Check that seating is correct
3	Spring plate	16		
4	Valve spring set	16		
5	Valve spring retainer	16		
6	Washer	X	Note number	Redetermine if necessary
7	Valve stem seal	16		Always renew, press in with press-in tool, Special Tool 9225/1, oil sealing lip
8	Intake valve	8		Oil valve stem
9	Exhaust valve	8		Oil valve stem
10	Valve guide	16		

TOOLS - CYLINDER HEAD (32-VALVE ENGINES)



No.	Description	Special Tool	Remarks
1	Assembly bridge		Supplier: Sauer Hamburg
2	Lever		" "
3	Magnetic disassembly head		" "
4	Assembly head		" "
5	Base		Improvised tool
6	Bolts		Commercially available M 8 x 40

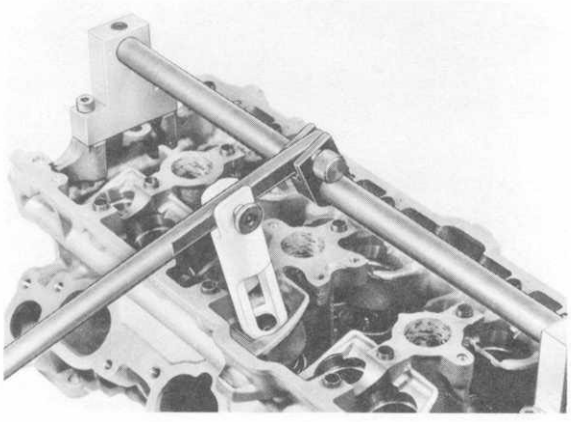
NOTE ON ASSEMBLY (32-VALVE ENGINES)

REMOVING AND INSTALLING VALVE SPRINGS WITH SPECIAL TOOL MADE BY SAUER

1. Improvise a set of 4 bases from wood or hard rubber for the valves. Length 90 mm, width 40 mm, thickness 6 mm.

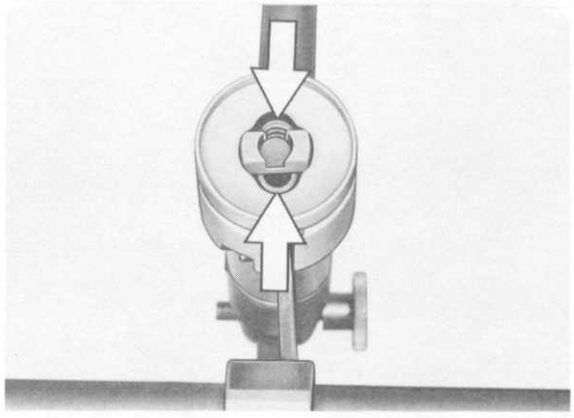
2. Position assembly bridge on cylinder head. Use a clamp to secure cylinder head to bench and prevent it tilting.

3. Attach magnetic disassembly head to lever. Compress valve spring in cylinder head and use a small screwdriver to pry taper valve keepers from valve stem.

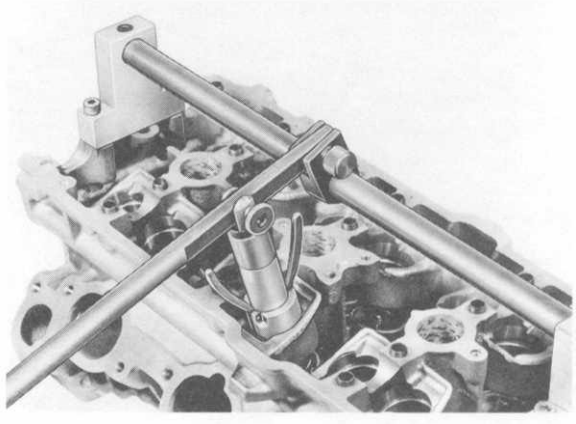


4. Use the magnetic disassembly head to withdraw all the valve spring parts.

5. Attach assembly head to lever. Press clamping arms together and insert taper valve keepers in assembly head.



6. Place washer, valve spring stop, valve spring and valve spring plate in cylinder head and compress with assembly head. Engage taper valve keepers by moving lever up and down slightly. This action automatically positions the taper valve keepers correctly.



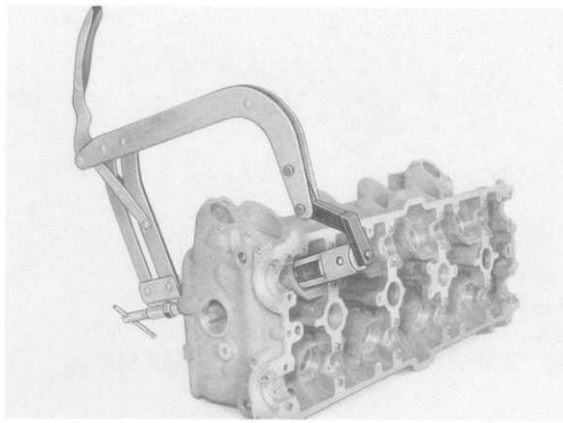
7. When the taper valve keepers are engaged, the clamping arms of the assembly head point out.

NOTES ON ASSEMBLY (32-VALVE ENGINES)

REMOVING AND INSTALLING VALVE SPRINGS

Cylinder head removed

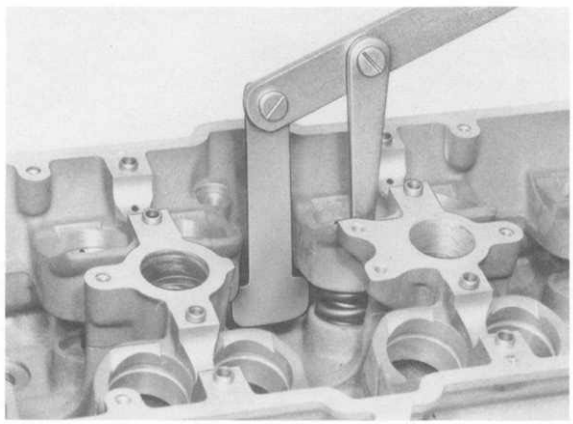
Remove and install valve springs with USA 1020 + US 1020/1.



REMOVING AND INSTALLING VALVE SPRINGS

Cylinder head installed

Remove and install valve springs with Special Tool 9242.

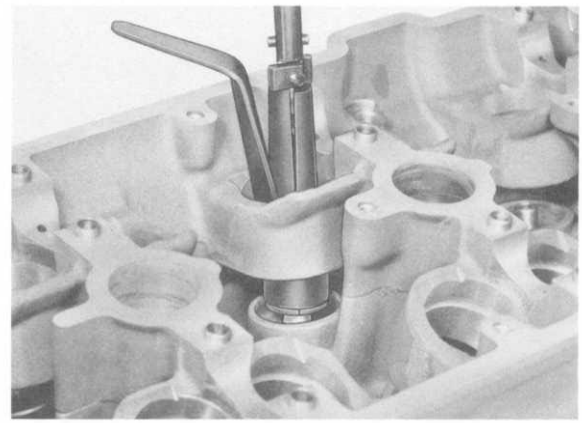


REMOVING AND INSTALLING VALVE STEM SEAL

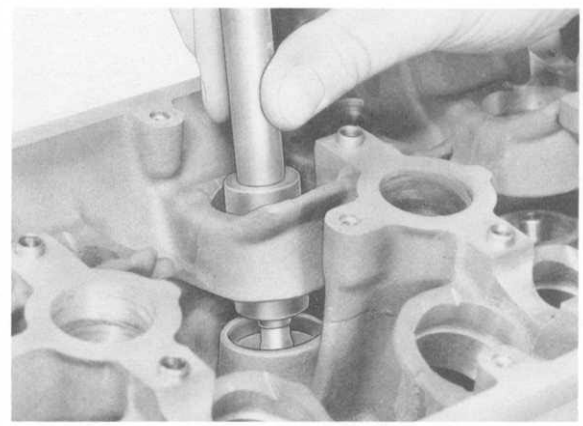
'85/'86 MODELS ONWARD

ENGINE TYPE M 28. 43/44/45/46

Pull off valve stem seal with Special Tool 9237.



Oil valve stem and install valve. Push assembly sleeve over valve stem. Oil sealing lip of valve stem seal and position on assembly sleeve. Using Special Tool 9225/1 carefully and gently press seal onto valve guide until it is seated.

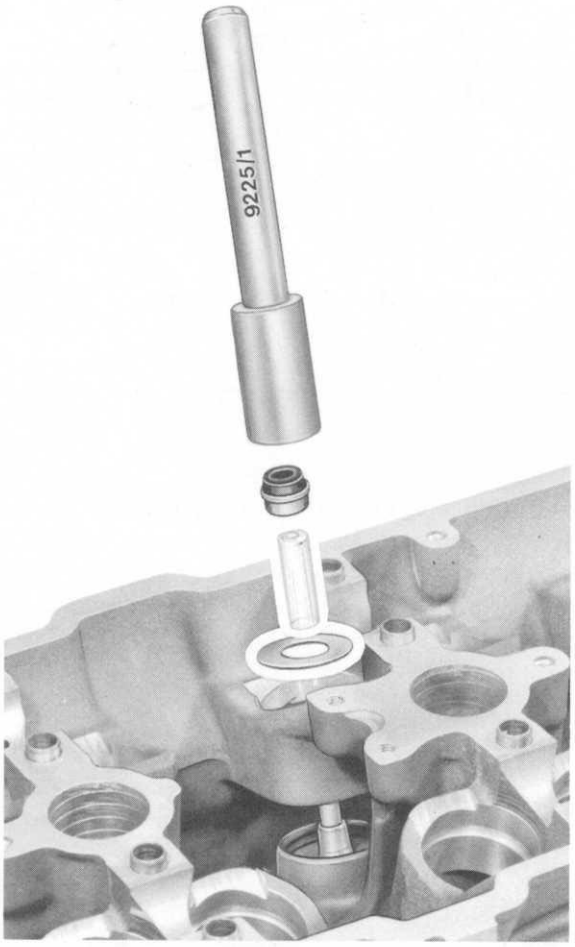


INSTALLING VALVE STEM SEAL
'87 MODELS ONWARD

ENGINE TYPE M 28. 41/42

Note:

It is essential to place a 1 mm washer on the cylinder-head mating face before installing the valve stem seal.



1. Oil valve stem and install valve. Place 1 mm thick washer on the cylinder-head mating face. Push assembly sleeve over valve stem. Oil sealing lip of valve stem seal and position on assembly sleeve. Using Special Tool 9225/1, push seal carefully and gently onto valve guide until seated.

2. The valve stem seal is correctly seated when Special Tool 9225/1 and washer make contact.

Note:

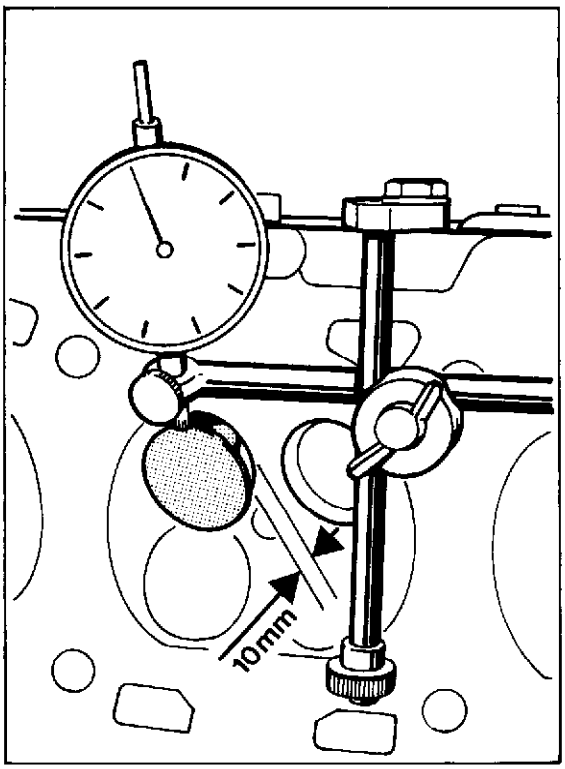
The assembly sleeves are available as spare parts.

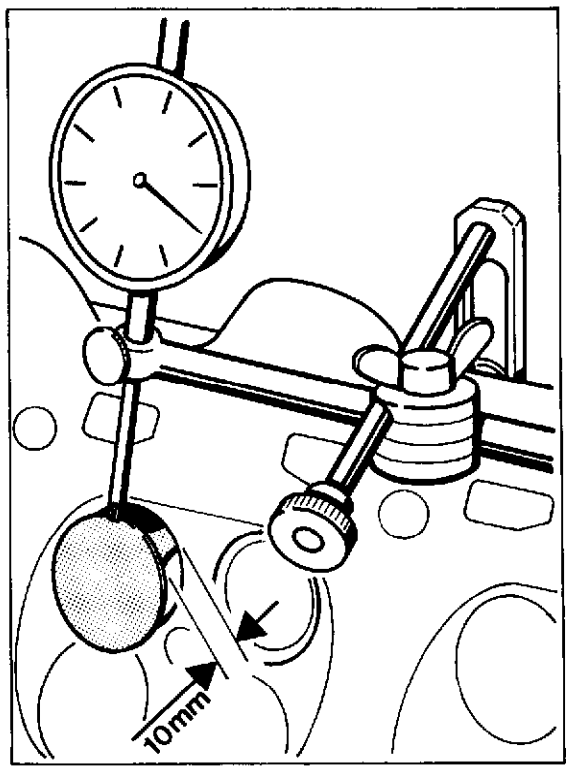
CHECKING VALVE GUIDES (32-VALVE ENGINES)

1.Clean valve guides thoroughly.

2.Use a new valve to measure the rocker clearance.

3.Attach dial-gage holder VW 387 to cylinder head. Align dial gage parallel to valve head.

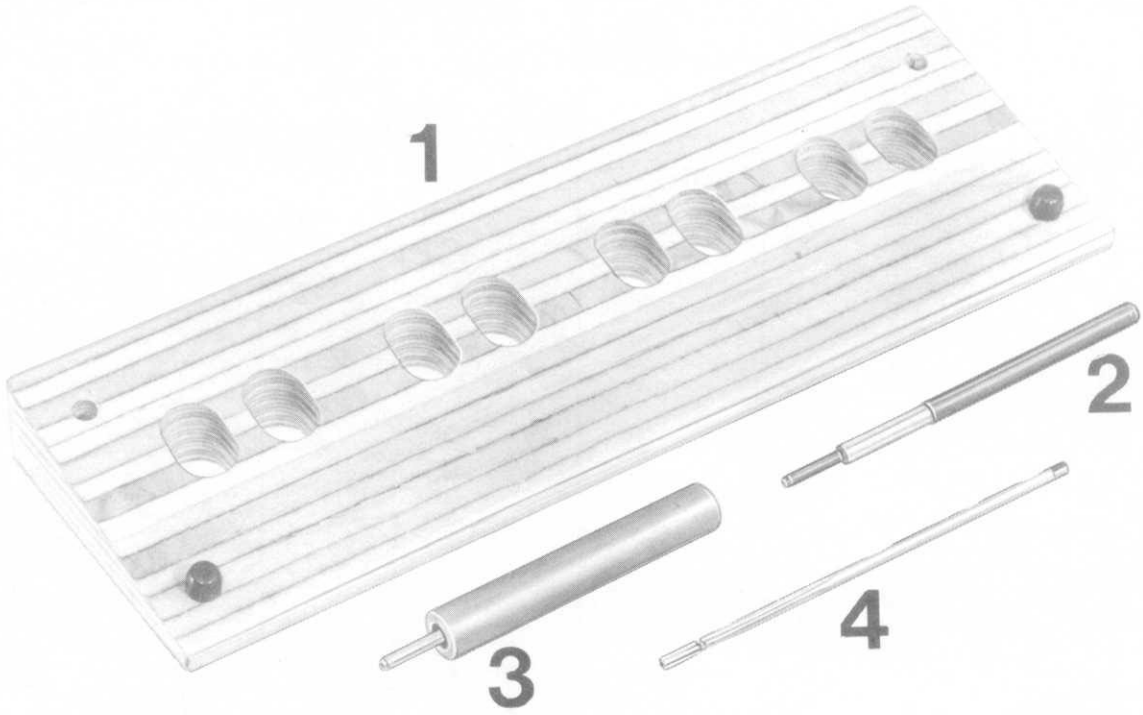




4.Measure rocker play at 10 mm valve lift (distance between valve head and valve seat). Wear limit for intake and exhaust valve guides = 0.80 mm.

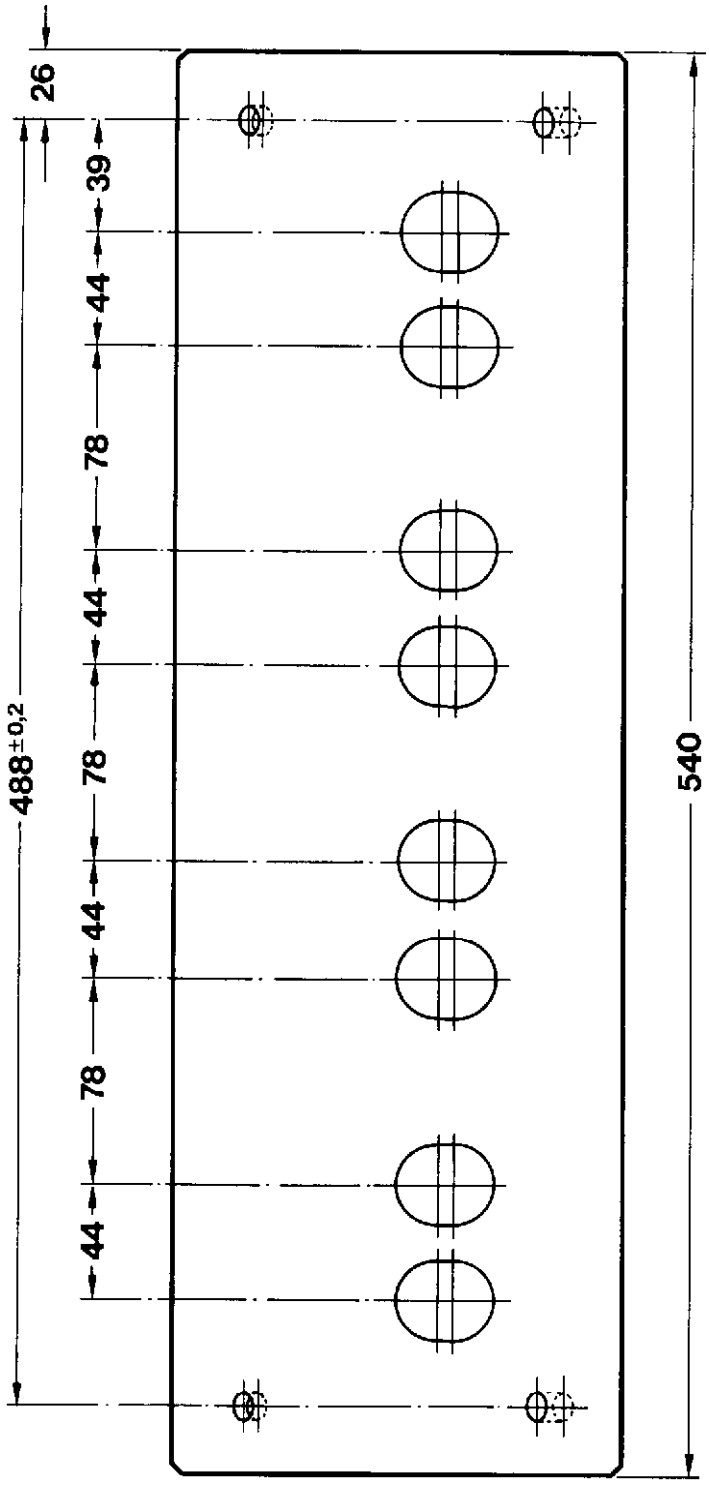
REPLACING VALVE GUIDES

TOOLS

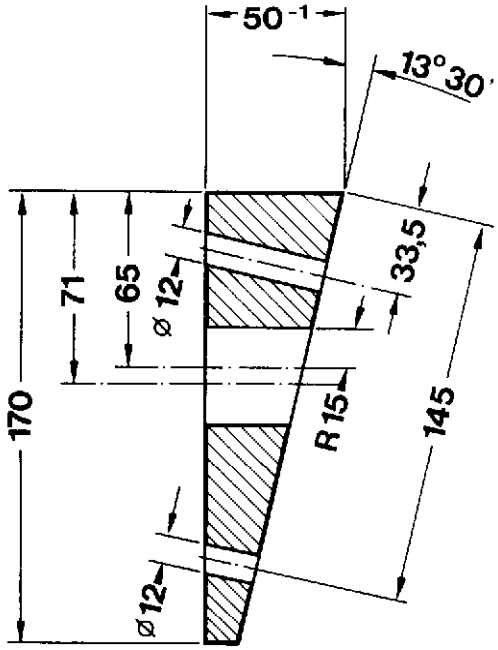


No.	Description	Special Tool	Remarks
1	Press-out base		See drawing
2	Thrust piece		" "
3	Thrust piece		" "
4	Reamer	3120	VW Special Tool

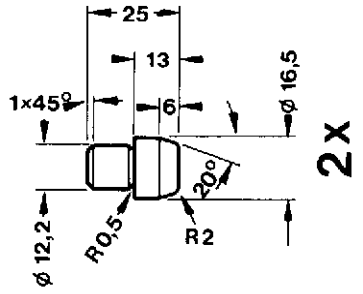
DRAWING:
Press-out device for valve guides



Material: wood



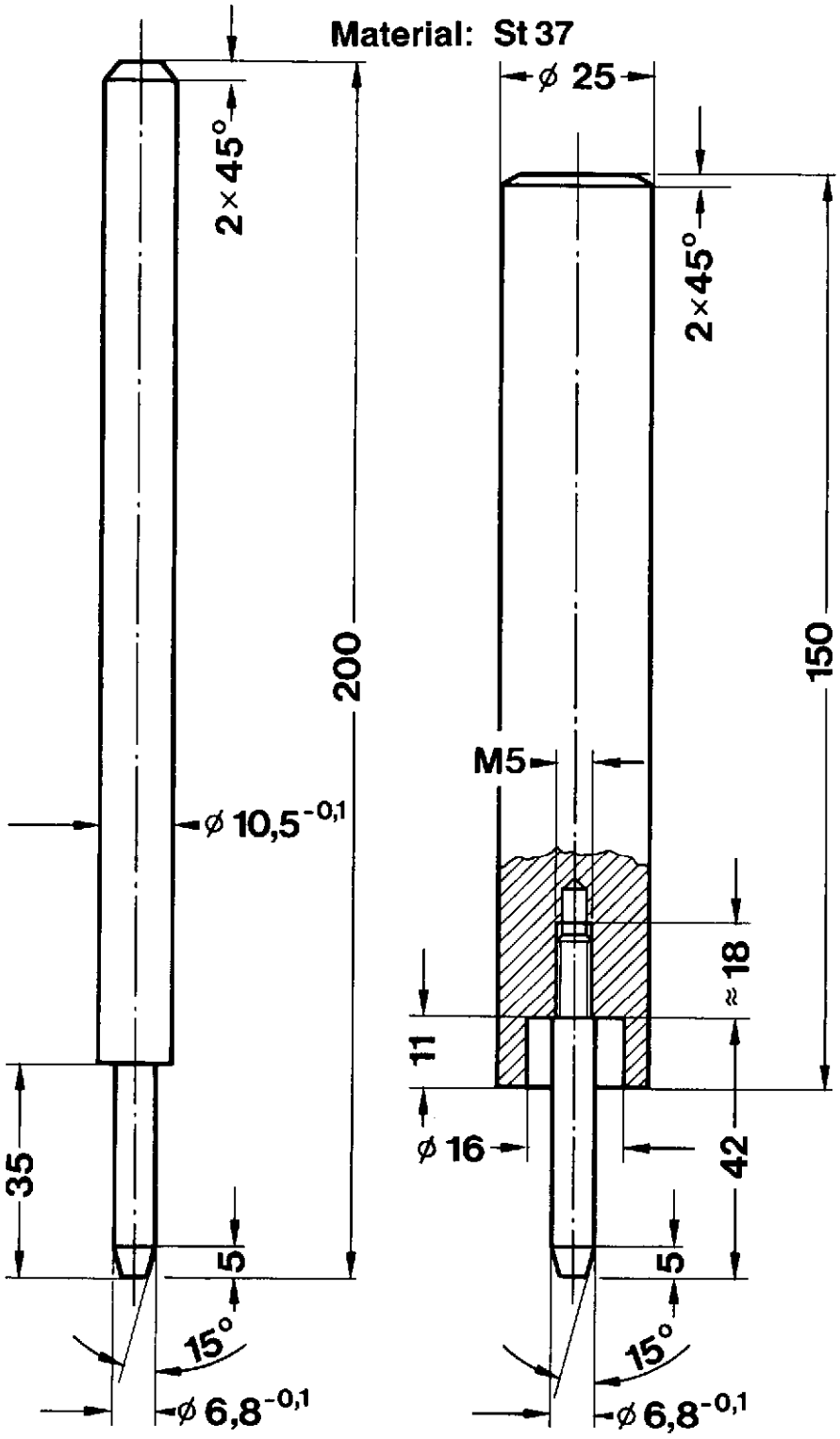
Material: St 37



DRAWING:

Thrust piece for pressing out valve guide

Thrust piece for pressing in valve guide

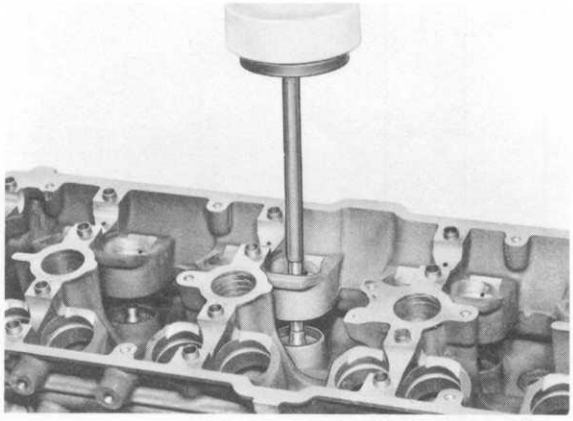


REPLACING VALVE GUIDES

1. Clean cylinder head and check. If the valve seats or mating faces of the cylinder heads cannot be remachined, the cylinder heads are not suitable for replacement valve guides.

2. Position cylinder head on press-out base.

3. Working from the camshaft side to the combustion-chamber side, press out valve guides with a press.



4. Use internal calipers to measure bores in cylinder head.



5. Machine KD valve guide, part no. 944 104 327 51 (external diameter 11.26 mm) to correct size.

   Loading must be 0.06 - 0.08 mm for both intake and exhaust valve guides.

Example:

Bore in cylinder head measured 11.020 mm. Machine outside diameter of KD valve guide to 11.080 or 11.10 mm.

Note:

Replacing valve guides, ENGINE TYPE M 28. 41/42, '87 MODELS ONWARD

It is essential to place a 1 mm thick washer on the cylinder-head mating face before installing the valve guide.

6. Heat cylinder head to 170°C. Coat valve guides with talcum powder, tap lightly into position, align and, using a thrust piece and working from the camshaft side, press into cylinder head until seated.

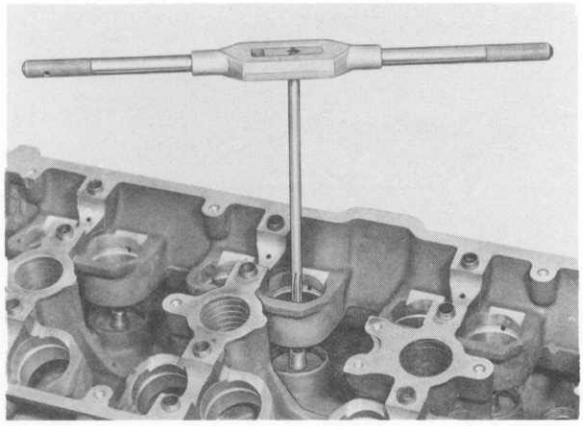
   Caution:

Do not maintain the temperature of 170°C for more than a maximum of 90 minutes.

7. Roughen valve guides with Special Tool 3120.

Proceed as follows:

It is essential to use petroleum as a lubricant when roughening valve guides. During this operation, withdraw reamer frequently to remove chips. Once bore has been reamed, finish with dry reamer.



8. The valve-seat rings must be remachined when the valve guides have been replaced. It is not sufficient to grind in the valves with grinding paste.

Note:

Distinguishing feature, cylinder head

'85/'86 models M 28.43/44/45/46	'87 models onward M 28.41/42
Bearing bridge attachment, M 6	M 8
Exhaust manifold attachment 2-bolt flange	3-bolt flange

Machining cylinder-head mating face (32-valve engines)

Checking the cylinder head for distortion

Check the sealing surface of the cylinder head for distortion using a feeler gauge straightedge.

Distortion limit of mating surface: 0.05 mm

Cylinder heads with distorted mating faces can be remachined and reused. Admissible distortion after machining: 0.03 mm.

Machining cylinder heads

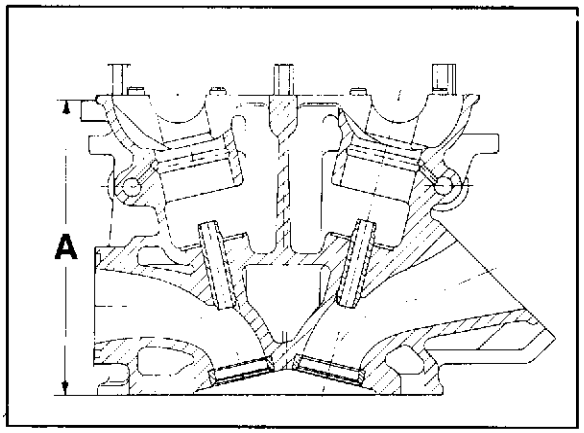
As a rule, both cylinder heads must be machined by the same amount to ensure correct seating of the regulator housing.

Machine sealing surface of the cylinder head only until a straight surface is obtained.
Max. wear limit: 146.6 mm.

Note for machining of the sealing surface:
Max. roughness = 0.015 mm

If machining causes the actual value to be below the tolerance applicable to new parts, use a 1.4 mm thick cylinder head gasket (available from the parts service) when fitting the cylinder head.

New-part size A = 147 ± 0.1 mm
Wear limit A = 146.6 mm



1126-15

Cylinder head refacing dimensions and identification

New dimension	: 147 ± 0.1 mm
Gasket	: 1.1 mm
Identification	: none
Refacing dimension	: 146.8 to 146.6 mm
Gasket	: 1.4 mm
Identification	: N

Identification: "N"

Engrave on exhaust side between cylinder 2 and 3 as well as 6 and 7, respectively, on the casting lug below the cylinder head cover sealing surface.

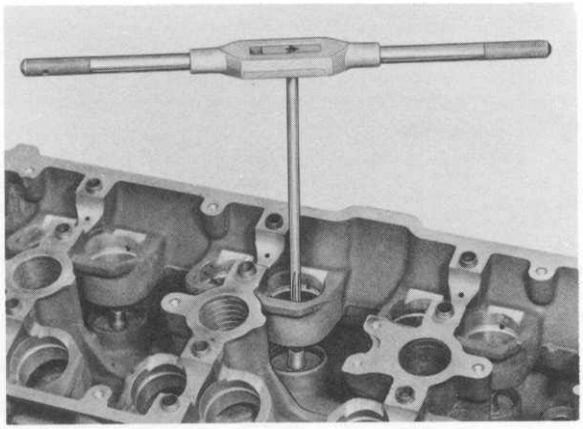
Height of "N" character: 6 mm

Printed in Germany – XXIX, 1992

7. Roughen valve guides with Special Tool 3120.

Proceed as follows:

It is essential to use petroleum as a lubricant when roughening valve guides. During this operation, withdraw reamer frequently to remove chips. Once bore has been reamed, finish with dry reamer.



8. The valve-seat rings must be remachined when the valve guides have been replaced. It is not sufficient to grind in the valves with grinding paste.

Note:

Distinguishing feature, cylinder head

'85/'86 models M 28.43/44/45/46	'87 models onward M 28.41/42
Bearing bridge attachment, M 6	M 8
Exhaust manifold attachment 2-bolt flange	3-bolt flange

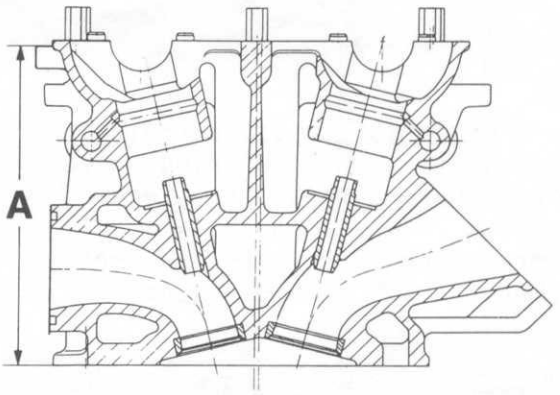
Machining cylinder-head mating face (32-valve engines)

Checking the cylinder head for distortion

Check the sealing surface of the cylinder head for distortion using a feeler gauge straightedge.

Distortion limit of mating surface: 0,05 mm

Cylinder heads with distorted mating faces can be remachined and reused. Admissible distortion after machining: 0.03 mm.



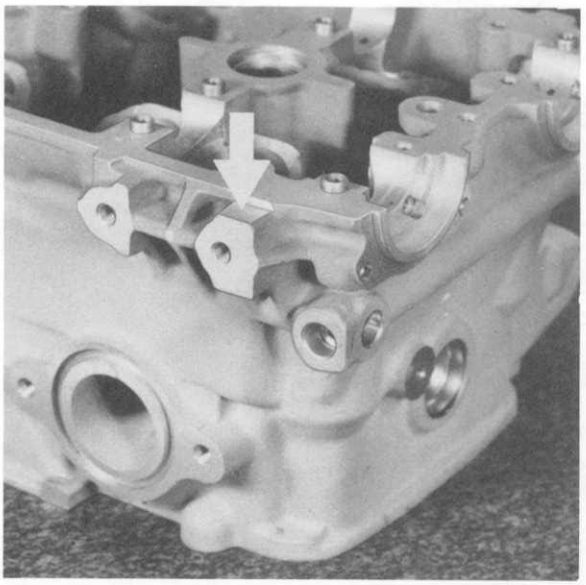
Machining cylinder heads

As a rule, both cylinder heads must be machined by the same amount to ensure correct seating of the regulator housing.

Machine sealing surface of the cylinder head only until a straight surface is obtained.
Max. wear limit: 146,6 mm.

Note for machining of the sealing surface:
Max. roughness = 0.015 mm

If machining causes the actual value to be below the tolerance applicable to new parts, use a 1.4 mm thick cylinder head gasket (available from the parts service) when fitting the cylinder head.



New-part size A = 147 ± 0.1 mm
Wear limit A = 146.6 mm

OLD PAGE BUT THIS PICTURE MIGHT BE USEFUL

Printed in Germany – XXVII, 1991

CS cylinder head seals as from Model 89

Thicker cylinder head seals **(CS cylinder head seals)** must be fitted to compensate for the removed material when facing the cylinder heads.

The CS cylinder head seals can be recognized by means of the changed part numbers.

These cylinder head seals can also be installed in 4-valve engines as from Model 85.

The reworking tolerances have **not** changed as a result.

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CHECKING VALVE SEAT WEAR LIMIT

Note:

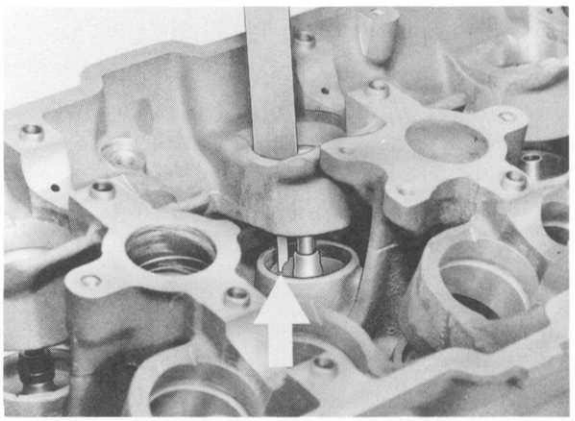
Distinguishing feature, cylinder head

'85/'86 models M 28.43/44/45/46	'87 models onward M 28.41/42
Bearing bridge attachment M 6	M 8
Exhaust manifold attachment, 2-bolt flange	3-bolt flange

1. The valve seats of the 4-valve-per-cylinder heads can be machined. Do not machine past the wear limit, as otherwise the function of the hydraulic valve tappets is no longer assured.

Size worn	Intake valve	Exhaust valve
'85/'86 mod.	43.0 mm	42.1 mm
'87 mod.	44.4 mm	43.4 mm

2. Use the valve to be installed and measure from the end of the valve stem to the contact face of the valve spring stop in the cylinder head.



3. While measuring, hold the valve firmly against the valve seat.

CHECKING AND MACHINING VALVE SEATS (32-VALVE ENGINES)

Visual inspection

1. Check that valve seat is tight in cylinder head.

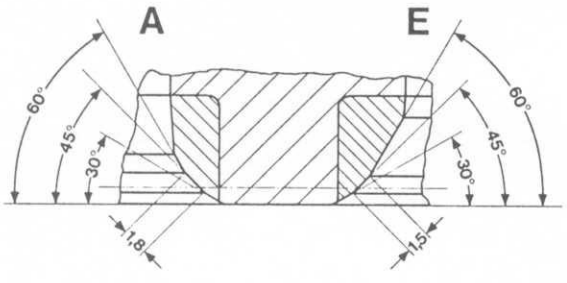
2. Check contact pattern. If valve does not contact entire area of valve seat, the seat must be machined slighty.

Machining

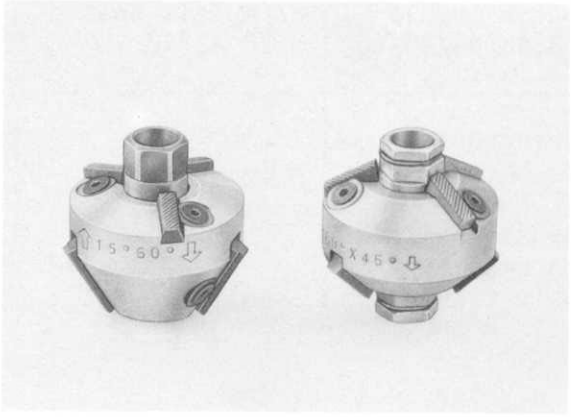
1. Valve seat may be machined with, for example, a Neway valve grinder or a Hunger valve-seat machining tool.

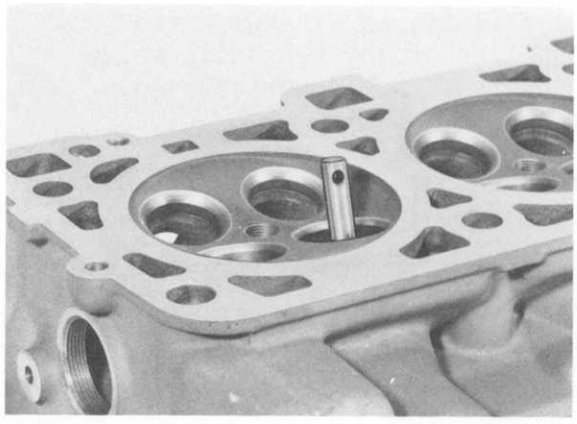
2. Machine the valve seats with a 45° valve reseating tool. Afterwards, machine the face to the specified face width with a 60° reseating tool. It is no longer necessary to finish with a 30° reseating tool.

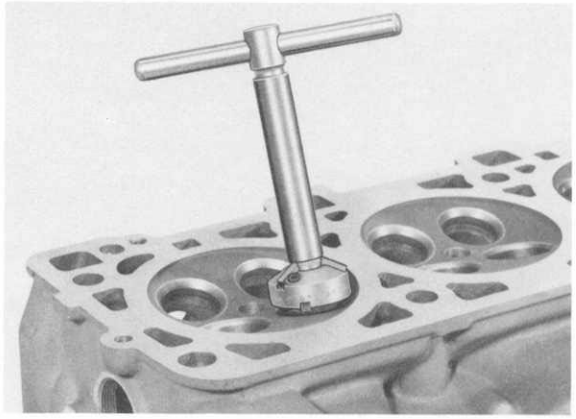
Intake-valve face width	1.5 mm
Exhaust-valve face width	1.8 mm



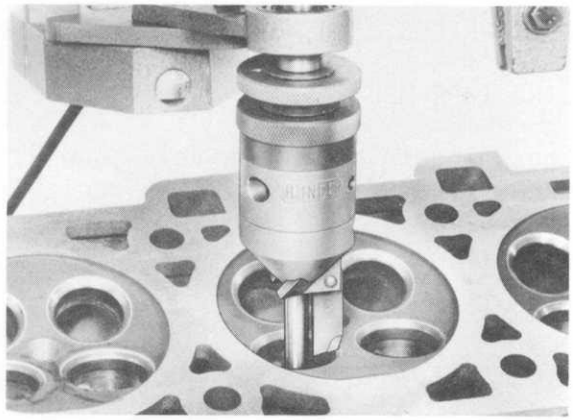
3. Valve reseating tools, e.g.
Neway 234 45°
Neway 213 60°





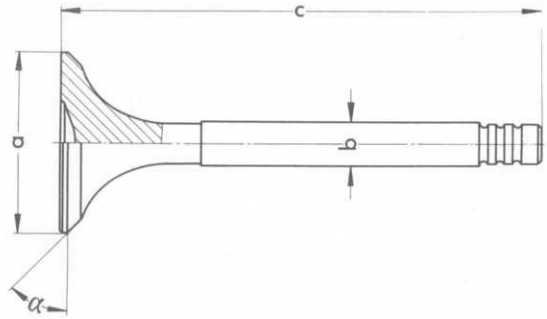


4. Valve reseating tool, e.g. Hunger VDSNL 1/45 I.K.



5. After the valve seats have been machined, use a grinding paste to lightly grind in valve seats. Check contact pattern of valve seat surface.

VALVE DIMENSIONS



VALVE DIMENSIONS 928 S

'85/'86 MODELS ONWARD

ENGINE TYPE M 28. 43/44/45/46

Dim.	Intake	Exhaust
a	35 mm	32 mm
b	6.97 mm	6.94 mm
c	112.2 mm	111.2 mm
α	45°	45°

VALVE DIMENSIONS 928 S

'87 MODELS ONWARD

ENGINE TYPE M.28 41/42

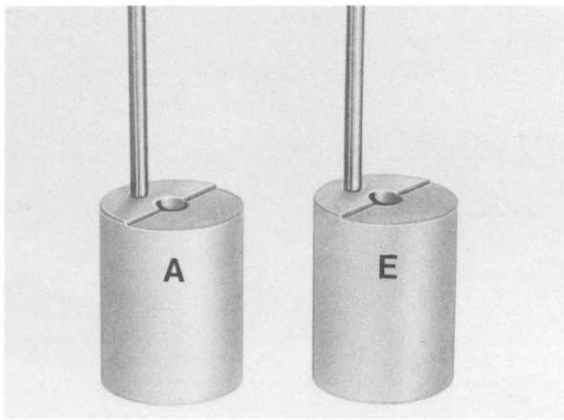
Dim.	Intake	Exhaust
a	37 mm	33 mm
b	6.97 mm	6.94 mm
c	114.7 mm	113.7 mm
α	45°	45°

CHECKING AND ADJUSTING INSTALLATION LENGTH OF VALVE SPRINGS (32-VALVE ENGINES)

VALVE SPRINGS, '85 MODELS ONWARD

ENGINE TYPE M28.43/44

1. Check length of intake-valve and exhaust-valve springs with Special Tool 9240.



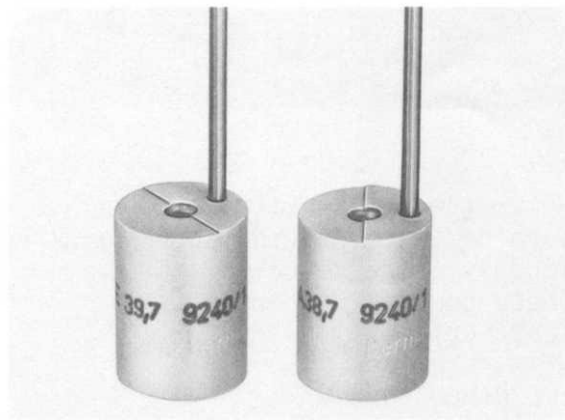
Measuring tools with installation length marked:

I n t a k e	42.6 + 0.5 mm
E x h a u s t	41.6 + 0.5 mm

VALVE SPRINGS, '86 MODELS ONWARD

ENGINE TYPE M28. 45/46

2. Check length of intake-valve and exhaust-valve springs with Special Tool 9240/1.



Measuring tools with installation length marked:

I n t a k e	39.7 + 0.5 mm
E x h a u s t	38.7 + 0.5 mm

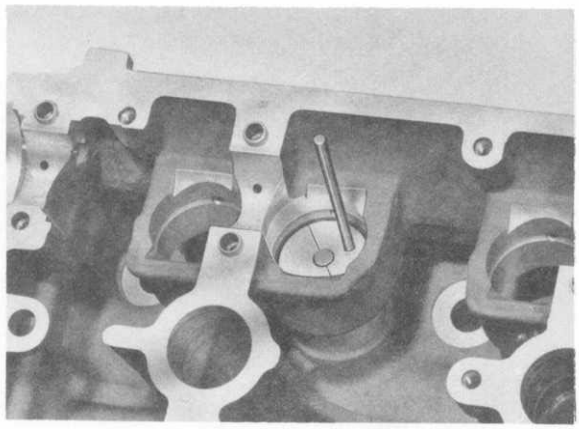
VALVE SPRINGS, '87 MODELS ONWARD

ENGINE TYPE M28. 41/42

Note:

Do not use Special Tool 9240 or 9240/1 to measure the installation length of valve springs as of model year '87. Checking and adjusting length of valve springs, see page 15 - 116 b.

3. Install valve and hold against valve seat. Once installed, the end of the valve stem should be between the end of the upper edge and the offset surface of the special tool. If the valve stem protrudes beyond the upper edge of the special tool, install shims to take up the excess. 0.5 mm thick shims are available.



4. Do not mix up the valves after adjustment.

Valve spring	85 models	86/86 models
Free length		
Outer spring	40.00 mm	43.5 mm
Wire dia.		
Outer spring	4.1 mm	3.6 mm
Inner spring	2.9 mm	2.7 mm

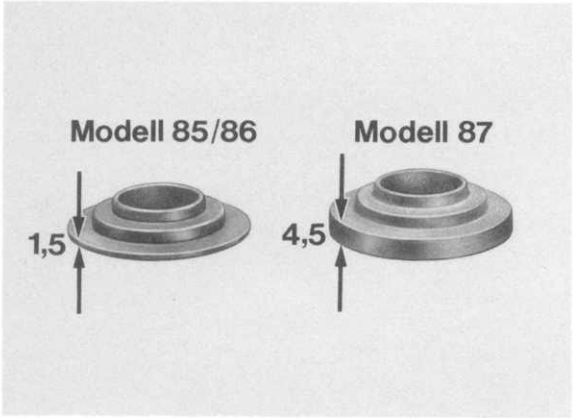
CHECKING AND ADJUSTING INSTALLATION LENGTH OF VALVE SPRINGS (32-VALVE ENGINES)

VALVE SPRINGS, '87 MODELS ONWARD

ENGINE TYPE M 28. 41/42

Note:

It is essential to ensure that the correct valve springs are installed in cars of the various model years.



TOOLS (IMPROVISED)

Valve spring plate SP No. 944.105.467.03

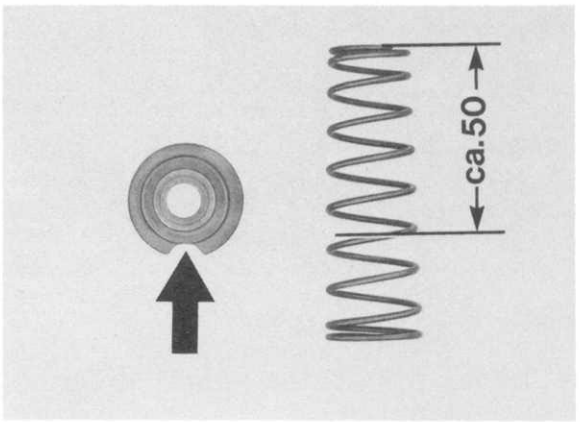
Secondary spring SP No. 928.107.171.01

Note:

When selecting the valve spring plate (improvised) it is essential to ensure that the valve spring plate is 2.0 + 0.2 mm thick.

1. Grind a face approx. 10 mm broad on valve spring plate. Install spring plate for measurement only.

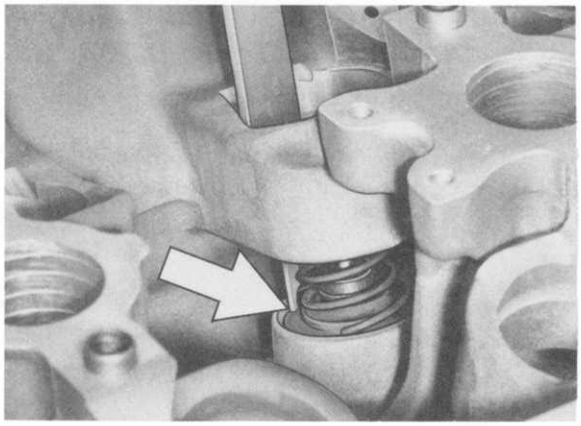
2. To facilitate installation shorten secondary spring to approx. 50 mm.



3. Install valve and press against valve seat. Install plate, valve spring retainer, secondary spring and spring plate with ground surface.

4. Install conical valve keepers with Special Tool 9242.

5. Using a depth gage, measure from surface of valve spring plate vertically through gap to outer spring bearing surface.



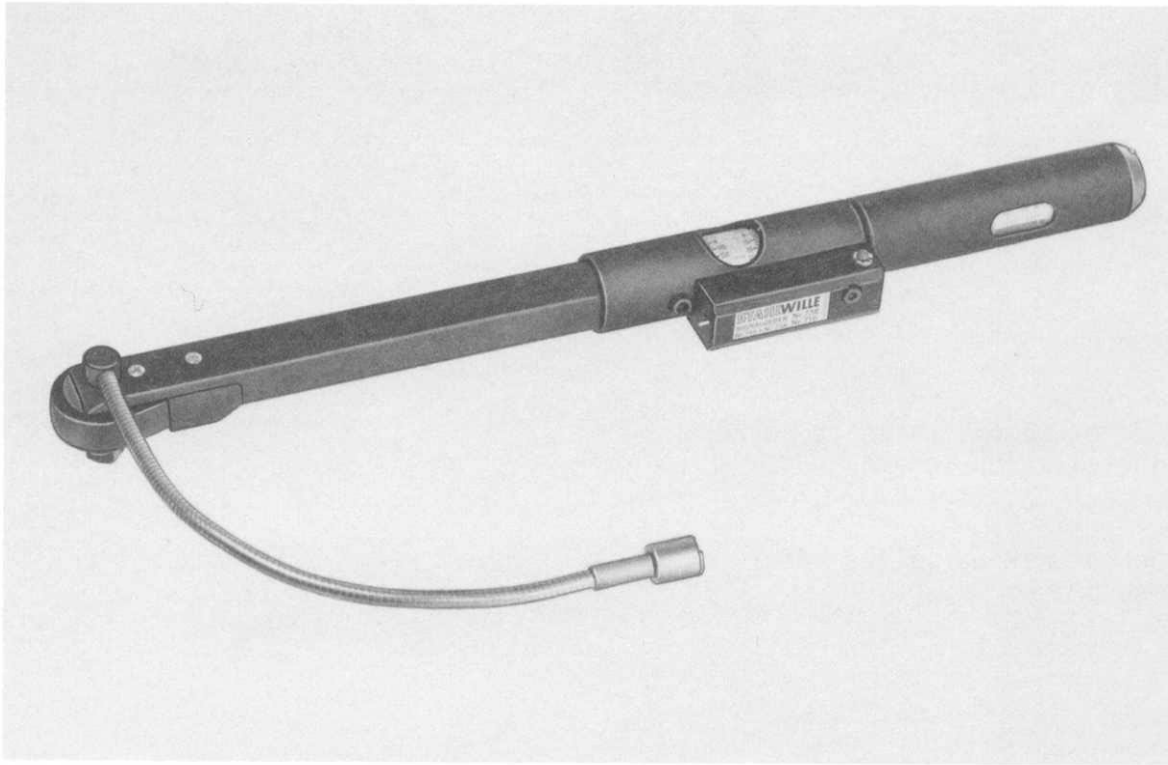
Installation length

Intake	35.5 + 0.5 mm
Exhaust	34.5 + 0.5 mm

6. Add or remove shims to correct installation length.

7. Do not mix up valves after measuring.

TOOLS - INSTALLING CYLINDER HEAD (32-VALVE ENGINE)
TORQUING BY ANGLE OF ROTATION



No.	Description	Special tools	Remarks
	Angle of rotation meter		commercially available, e.g. Stahlwille No. 715/20

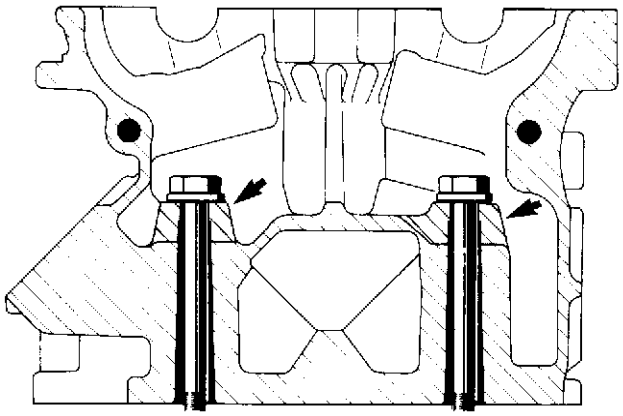
Modifications to the cylinder head (32 valve)

From Model 89
Engine type M 28.41/42

Note

Only the reinforced cylinder heads will be available as spare parts for all vehicles from Model 87 onwards. The unfinished part number, in the casting, is 928.104.413.2R

1. The cylinder head has been reinforced by 20 mm in the area of the bearing surfaces for the cylinder head bolts (arrow).



88-509

2. The new 20 mm longer hexagon head bolts must be used for assembly.

3. New bolt length
M 12 x 199
M 12 x 149

The tightening sequence remains unchanged.

1st stage	20 Nm (15 ft. lb.)
2nd stage	90° torque angle
3rd stage	90° torque angle

Note

If oil and water have been mixed, the cylinder heads must be subjected to a thorough visual inspection (hairline cracks). The cooling system must also be checked for leaks. Use test unit VW 1274 above the expansion tank for the leak test (max. 1 bar). The camshaft covers must be removed for visual inspection.

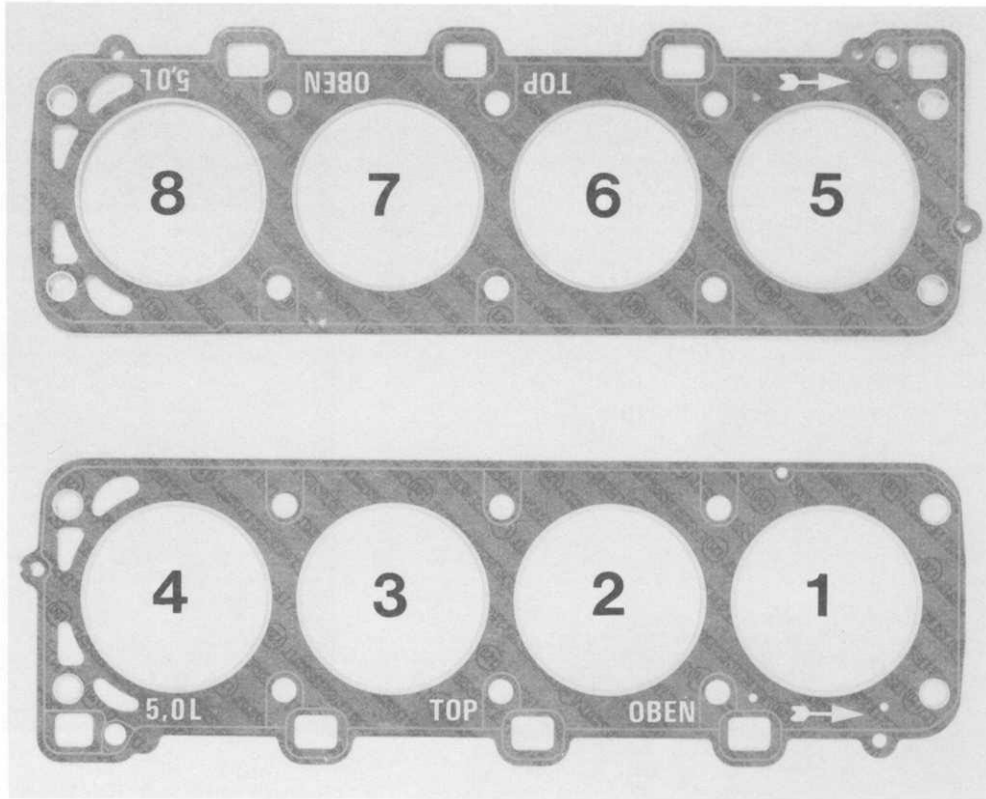
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CYLINDER HEAD, INSTALLING (32-VALVE ENGINES)
Cylinder head attached by means of threaded studs

N o t e

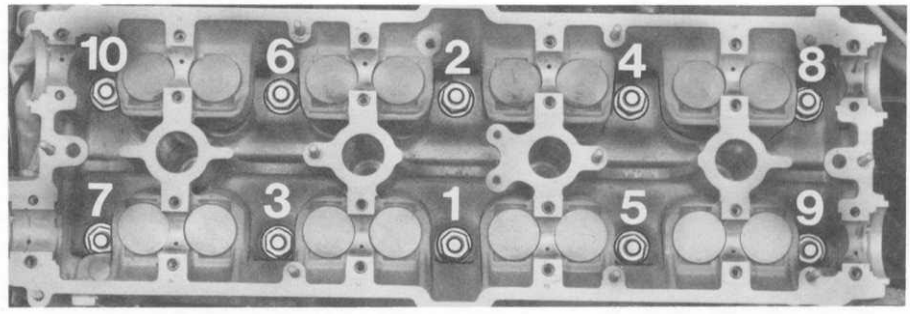
The cylinder head can only be installed with the engine removed from the vehicle.

1.Place cylinder head gasket in correct position.



2.Install cylinder head

Torquing sequence (4 steps) see Fig.	1st step	20 Nm
	2nd step	90°of rotation
Sequence for removal: reverse	3rd step	90°of rotation
	4th step	90°of rotation



INSTALLING CYLINDER HEAD (32 VALVE ENGINE)
Hexagon cylinder-head bolts

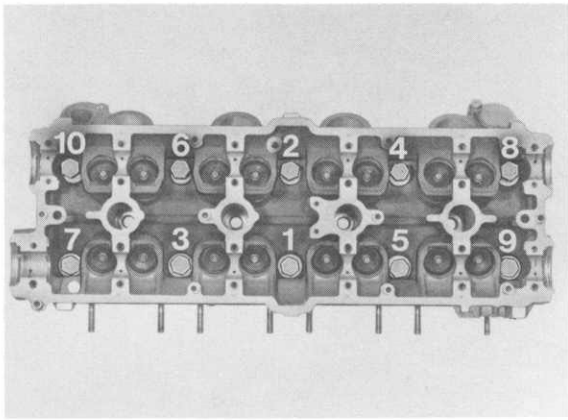
Note:

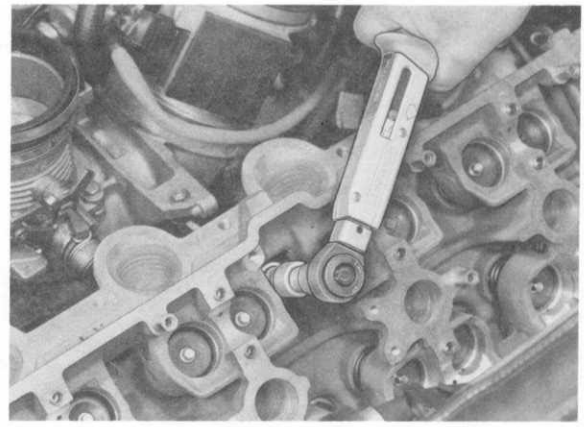
The cylinder head can also be installed with the engine in place. If both cylinder heads are to be removed and installed, it is advisable to remove the engine first.

1. Place cylinder-head gasket in position right way round.

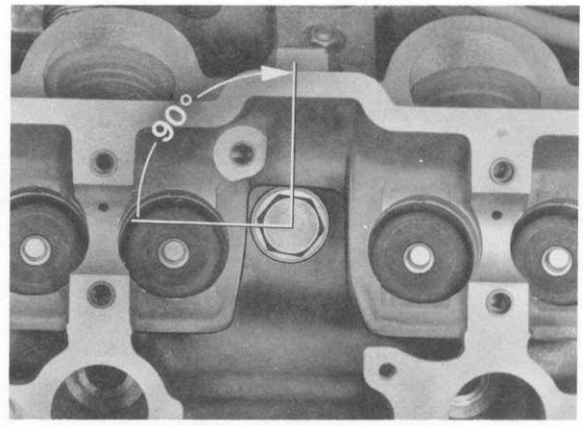
2. Install cylinder head
   Torquing sequence:
   (3 stages)
   Removal sequence:
   reverse order

1st stage	20 Nm (15 ftlb)
2nd stage	90° of turn
3rd stage	90° of turn





1st stage 20 Nm (15 ftlb)

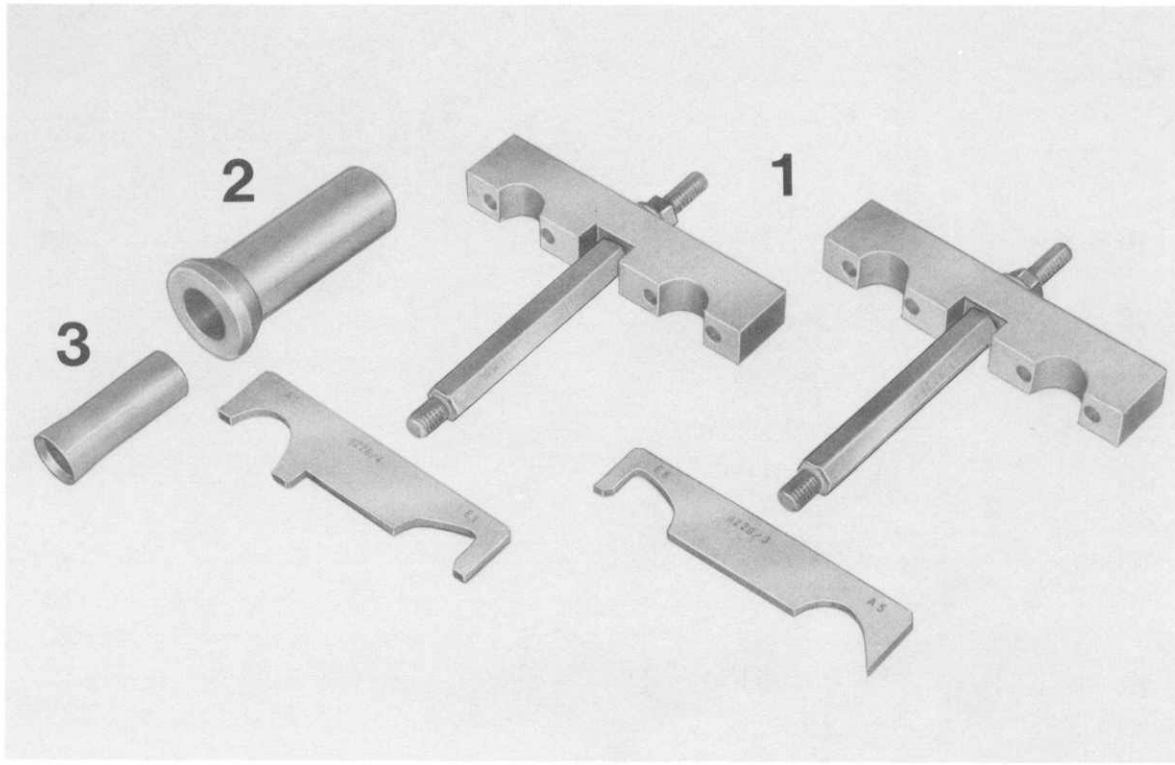


2nd stage	90° of turn
3rd stage	90° of turn

Note:

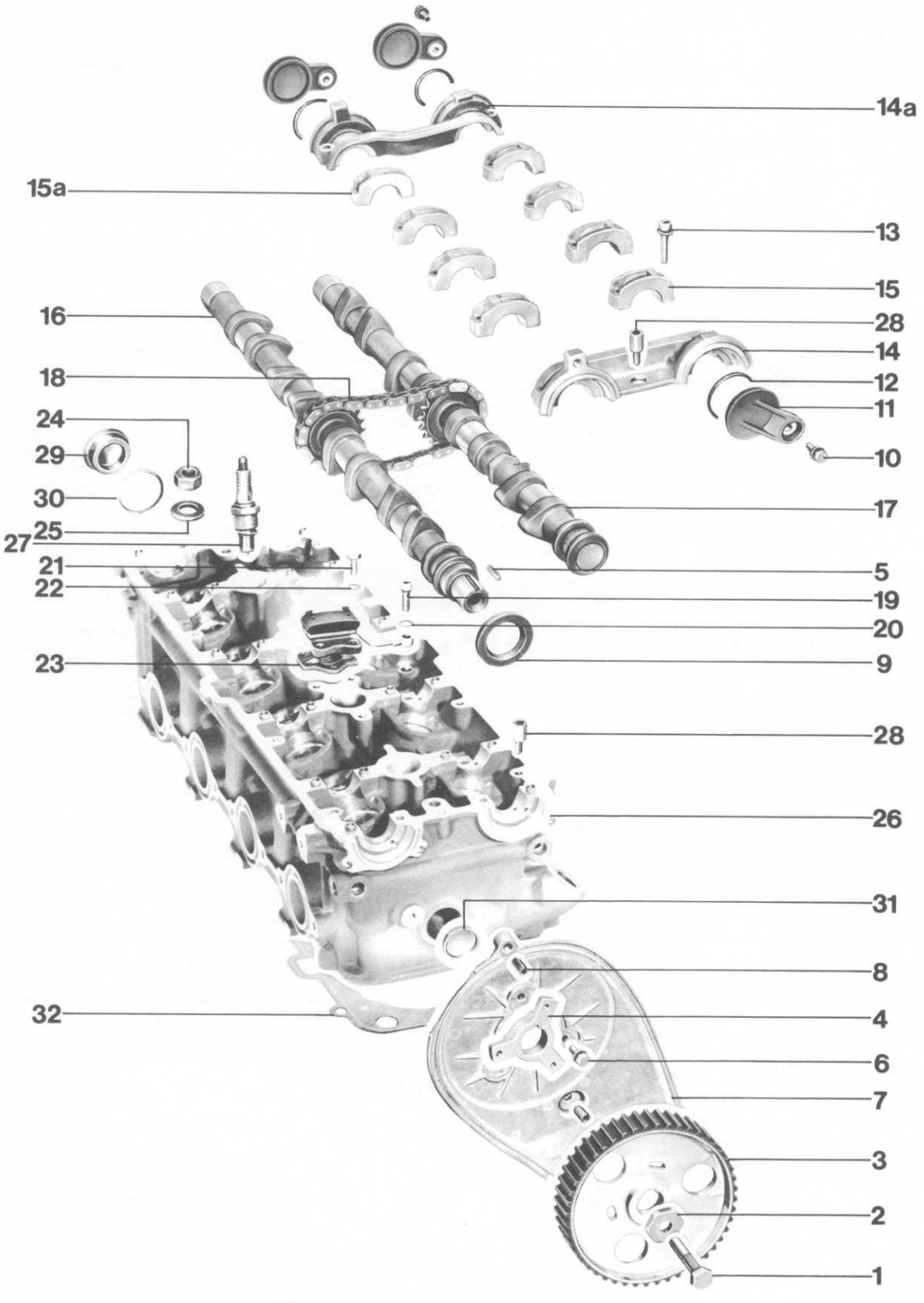
As a rule, do not use lubricant when installing the cylinder-head nuts or hex bolts and washers. It is only necessary to apply a light coat of engine oil to the stud bolts or hex bolts.

TOOLS - DISASSEMBLING AND ASSEMBLING VALVE DRIVE (32-VALVE ENGINE)



No.	Description	Special Tools	Remarks
1	Set of tools for installing camshaft	9226 or 9248	for 85/86 models for 87 models
2	Pressure piece for seal ring	9234	
3	Drift for seal ring	9233	

DISASSEMBLING AND ASSEMBLING VALVE DRIVE (32 VALVE ENGINE)



Printed in Germany

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	1		Torque: 65 Nm (47 ftlb); hold on washer with hexagon	
2	Washer	1			
3	Camshaft sprocket	1			
4	Hub	1			
5	Woodruff key	1			
6	Bolt M 6 x 18	3			
7	Rear toothed belt cover	1			
8	Dowel sleeve	2			
9	Shaft seal	1		Always replace. First oil sealing lip and then drive in seal with 9233 and 9234.	
10	Bolt with attached washer	3			
11	Plug	3			
12	Seal	3		Replace	
13	Bolt M 6 x 30 with attached washer	24		Torque: 10 Nm (7 ftlb)	
14	Front bearing bridge	1		Check code. Coat with Loctite 574.	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
14 a	Rear bearing bridge	1		Check code. Coat with Loctite 574	
15	Bearing cap for intake camshaft	4		Check code and pairing number.	
15 a	Bearing cap for exhaust camshaft	4		Check code and pairing number.	
16	Exhaust camshaft	1		Oil bearing surfaces. Check code.	
17	Intake camshaft	1		Oil bearing surfaces. Check code.	
18	Timing chain	1		Check relation to camshafts.	
19	Hollow bolt with check valve	2			
20	Aluminum washer	1		Replace	
21	Bolt	2			
22	Washer	2			
23	Chain tensioner	1			
24	Nut	10			
25	Washer	10			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
26	Cylinder head	1			
27	Spark plug	4		Torque: 25 to 30 Nm (18 to 22 ftlb). Coat threads with Molykote HTP Paste.	
28	Threaded insert	12			
29	Plug	1			
30	Round seal	1		Replace, if necessary.	
31	Plug	1		Install with Loctite 270.	
32	Cylinder head gasket	1		Always replace	

Camshaft Installation	USA, Canada and Japan	Australia, Switzerland, Austria and West Germany	Worldwide
Engine type 928 S 85/86/87 models (32-valve engines)	M 28.43 M 28.44	M 28.45 M 28.46	M 28.41 M 28.42
Right-hand camshaft Cylinder bank 1-4			
Intake shaft	928.105.291.04	928.105.291.04	928.105.291.09
Exhaust shaft	928.105.293.04	928.105.293.04	928.105.293.09
Identification code on rear end face	291.04 293.04	291.04 293.04	291.09 293.09
Left-hand camshaft Cylinder bank 5-8			
Intake shaft	928.105.292.04	928.105.292.04	928.105.292.09
Exhaust shaft	928.105.294.02	928.105.294.02	294.08
Identification code on rear end face	292.04 294.02	292.04 294.02	292.09 294.08
Valve timing, 1 mm lift, zero play			
Intake opens °CS	11° after TDC	11° after TDC	11° after TDC
Intake closes °CS	50° after BDC	50° after BDC	36° after BDC
Exhaust opens °CS	30° before BDC	30° before BDC	17° before BDC
Exhaust closes°CS	5° before TDC	5° before TDC	2° before TDC

Camshaft installation type 928 S4 - 928 GTS (5,4 l)

Camshaft Installation	World-wide model 88 onward	World-wide model 92 onward
	Engine type 928 S M 28.41/42	Enginetype 928 GTS (5,4 l) M. 28.49/50
Camshaft, right Cylinder bank 1 - 4		
Intake shaft	928.105.271.00	928.105.271.03
Exhaust shaft	928.105.273.00	928.105.273.03
Identification code on the rear End face	271.00 273.00	271.03 273.03
Camshaft, left Cylinder bank 5 - 8		
Intake shaft	928.105.272.00	928.105.272.03
Exhaust shaft	928.105.274.00	928.105.274.03
Identification code on the rear end face	272.00 274.00	272.03 274.03
Valve timing, 1 mm stroke, zero play		
Intake opens	11° CS after TDC	13° CS after TDC
Intake closes	36° CF after BDC	61° CS after BDC
Exhaust opens	17° CS before BDC	28° CS before BDC
Exhaust closes	2° CS before TDC	12° CS before TDC

Note

The camshafts of 87 and 88 models may be combined for installation.

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REMOVING AND INSTALLING CAMSHAFTS (32 VALVE ENGINE)

1. Unscrew and remove cross member.

Note

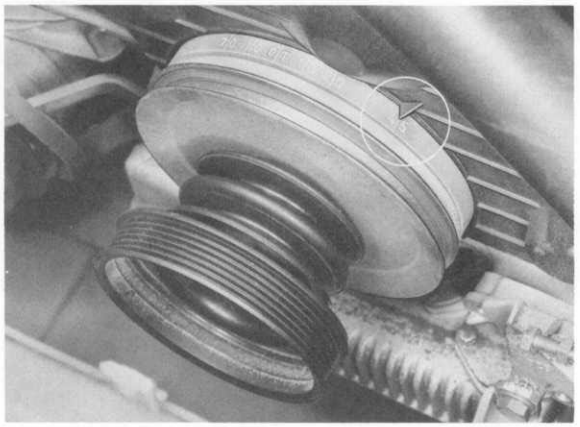
Car standing on its own wheels. Cross member has tension.

2. Remove air intake hoses and complete air cleaner.

3. Loosen hose clamps on intake air distributor and take off intake air distributor.

4. Remove distributor cover, distributor rotor, toothed belt upper section and cylinder head cover.

5. Turn crankshaft clockwise to align the 45° before TDC mark (cylinder no. 1) on vibration damper with cast boss of middle toothed belt cover.



Note

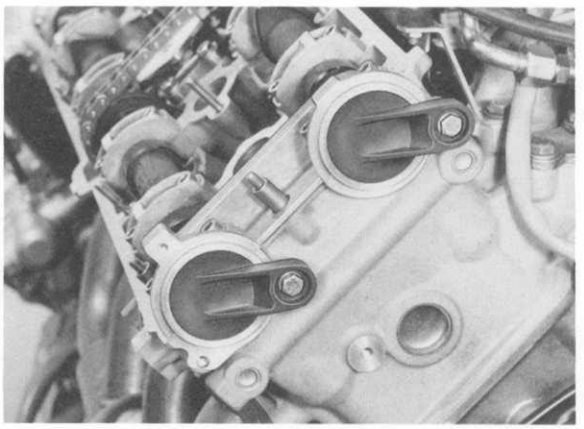
At the 45° mark camshafts can be turned without damaging the valves.

6. Loosen toothed belt with the toothed belt tensioner and take toothed belt off of camshaft sprocket.

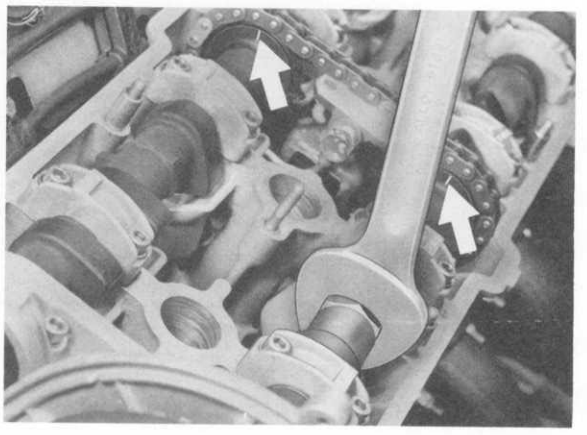
7. Unscrew camshaft bolt and take sprocket, drive hub and woodruff key off of exhaust camshaft.

8. Unscrew and take off rear toothed belt cover.

9. Loosen and remove camshaft seals.



10. Set marks on camshafts to face up by turning exhaust camshaft with a 27 mm open - end wrench.

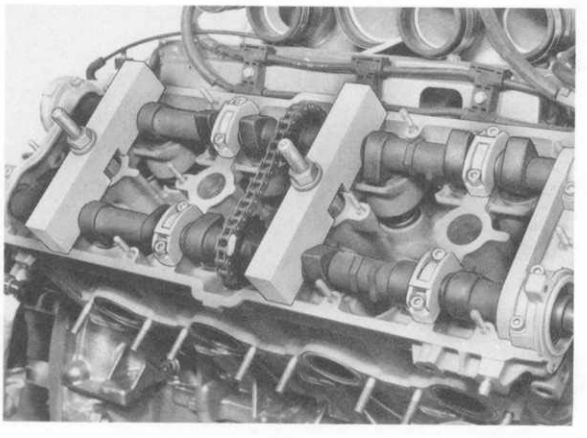


11. Unscrew and remove chain tensioner.

Note

Chain tensioner piston has spring force. Compress piston for removal and hold together with a suitable piece of wire after removing.

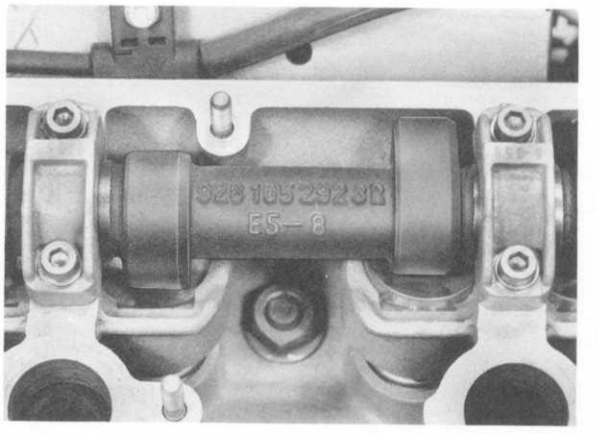
12. Hold both camshafts in bearings with Special Tool 9226. Unscrew and remove all other bearing bridges and bearing caps.

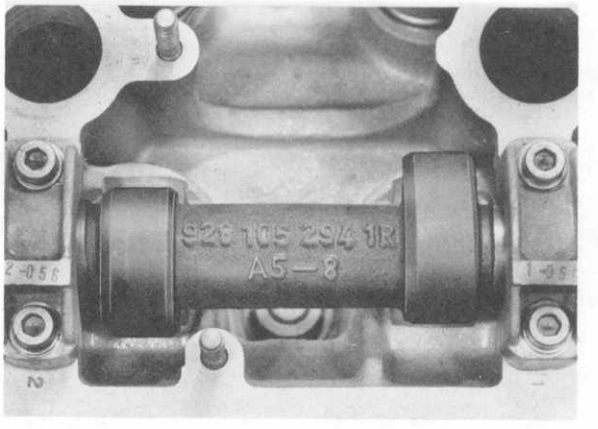


13. Release special tool uniformly and remove both camshafts with chain carefully.

Installing

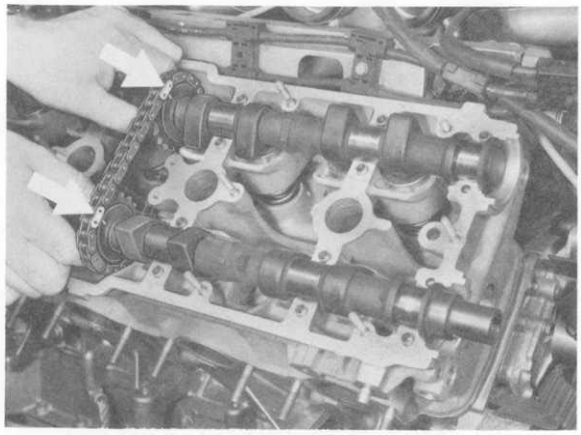
14. Place intake camshaft and exhaust camshaft in timing chain.



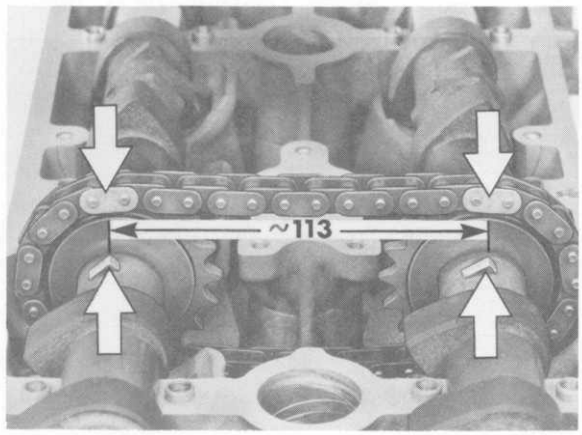


Adjusting

Place both camshafts in timing chain such that the marks of the camshafts or the cast noses are aligned with marked chain links. Lubricate bearing surfaces with oil and carefully place timing chain in bearings.



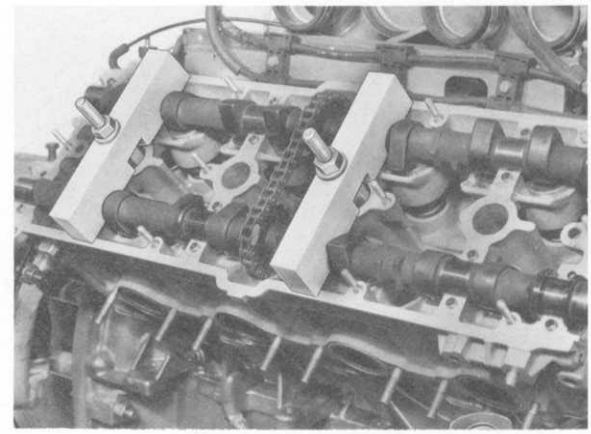
The distance between the markings on the inlet and outlet camshafts is 7 outer links of the chain, and/or aprox. 113 mm spacing between the cast lugs.



Note:

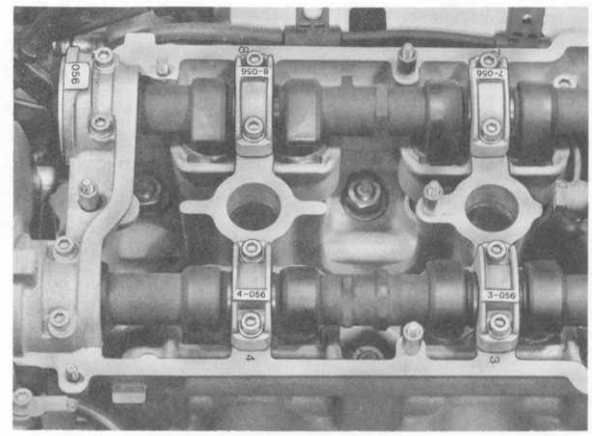
The crankshaft must be at the 45° before ignition TDC (cylinder 1) mark so that the valves do not contact the piston crown.

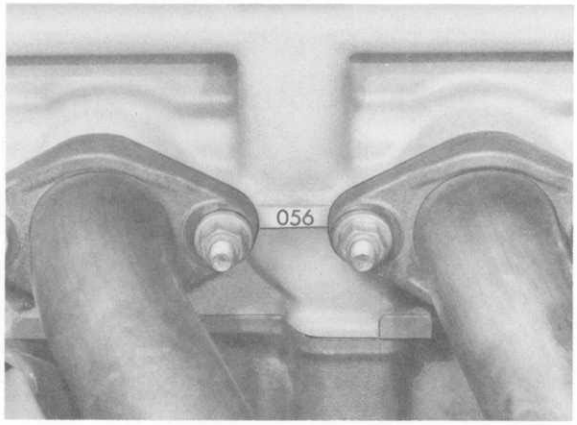
15. Secure camshafts in cylinder head with Special Tool 9226.



16. Install bearing bridges and bearing covers of camshafts. Bearing bridges and covers are machined with the cylinder head and must always be installed together. Note identifier and pairing code.

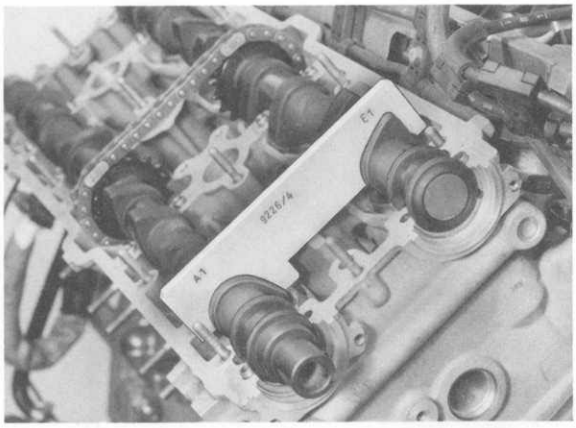
Tightening torque of bearing bridge and covers M 6 10 Nm (7 ftlb)
M 8 20 Nm (14 ftlb)

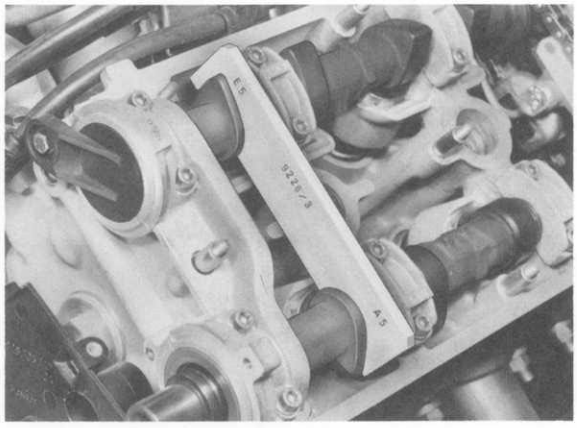




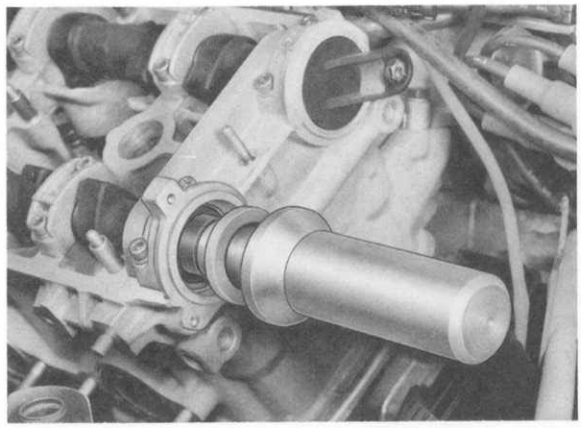
17. Apply Loctite 674 to mating surfaces of front and rear double-bearing bridges.

18. Recheck camshaft correlation with gage from Special Tool Set 9226.





19. Use Special Tool assembly sleeve 9233 and pressure piece 9234 to drive in sealing ring on the camshaft input side. Oil sealing lip before assembly.



N o t e

The camshaft adjustment gauges for cylinders 1 and 5 are discontinued as from model year 87, engine type M 28. 41/42

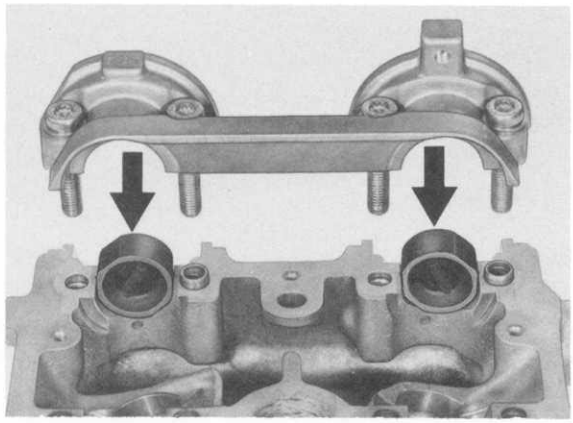
2. The timing chains must always be replaced after a toothed belt has failed, if the pistons have caused damage to the valves. Sprockets and chain tensioners must be subjected to a thorough visual inspection.

Installing camshaft seal

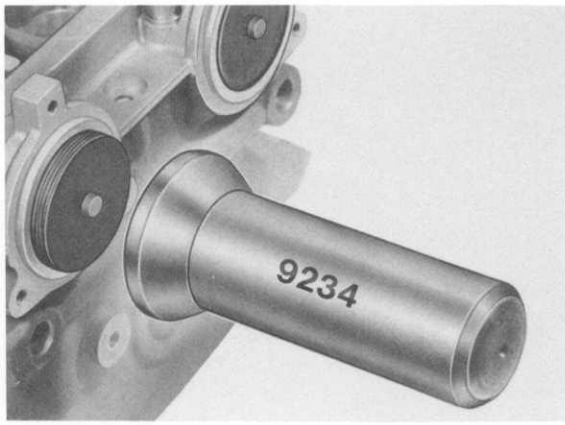
87 models onward

Engine type M 28.41/42/47/49/50

1. Place sealing washers (lock pins M 28.49/50 as of MY '92) into bearing seats and fit bearing saddle with Loctite 574. Tightening torque: 20 Nm (15 ftlb)



2. After torquing the bearing bridge, install sealing cover with the aid of Special Tool 9234.



85 models onward

Engine types
M 28.43/44/45/46/41/42/47/49/50

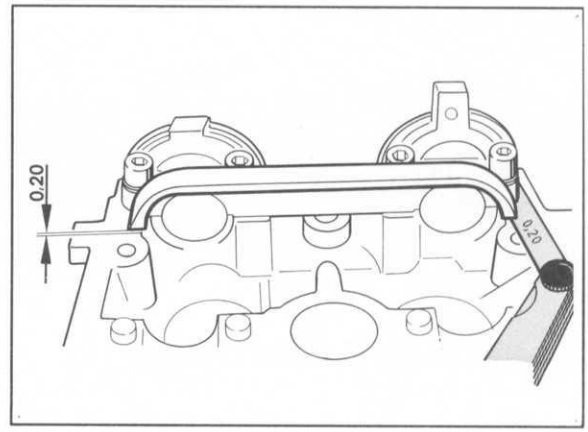
Engine installed

Note

If the sealing cover of an engine as of model year 85 (32 valve engines) leaks with the engine installed, the procedure for installing the cover is as follwos:

1. Place camshafts and sealing washers in bearing.

2. Apply Loctite 574 to bearing bridge and install. Place a 0.20 mm feeler gauge between bearing bridge and cylinder head and tighten bolts slightly by hand.



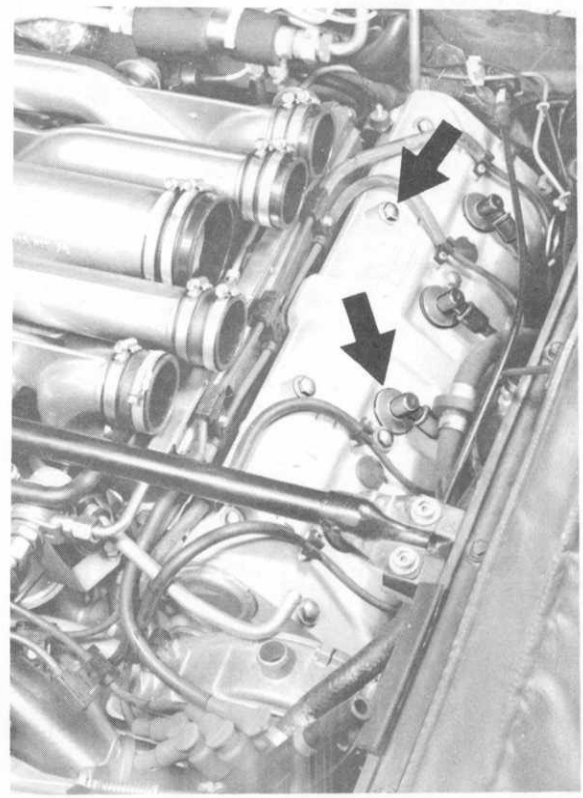
3. Apply a light film of oil to sealing cover and press on by hand. Tighten bearing bridge to specified torque.

M 6 bearing bridge	10 Nm (7.5 ftlb) Mod. 85/86
M 8 bearing bridge	20 Nm (15 ftlb) from Mod. 87

Printed in Germany – XXIX, 1992

REMOVING AND INSTALLING CHAIN TENSIONER FOR CAMSHAFTS

1. Unscrew and remove cross strut.

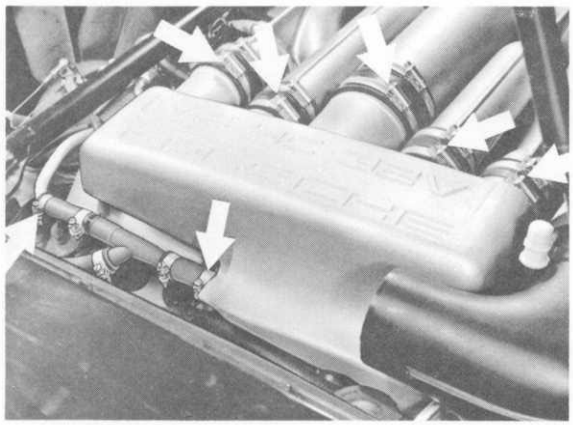


N o t e

Car must be on its wheels - cross strut has tension.

2. Remove air intake hoses and complete air cleaner.

3. Loosen hose clamps on intake air distributor and vacuum pipe. Pull off and lay suction pump aside. Loosen hose clamps on intake air distributor and intake pipe, and take off intake air distributor.



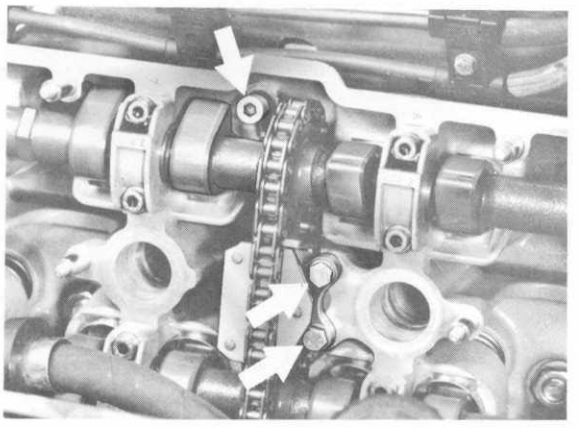
4. Unscrew suspension eye on engine only at rear left.

5. Pull off spark plug connectors and take ignition leads out of holder on cylinder head cover. Unscrew and remove cylinder head cover.

N o t e

Note that some bolts are with and some without a seal when unscrewing the cylinder head cover.

6. Unscrew and remove hollow union bolt with check valve on cylinder head. A seal is only used underneath the bolt head. Unscrew and remove chain tensioner on cylinder head.

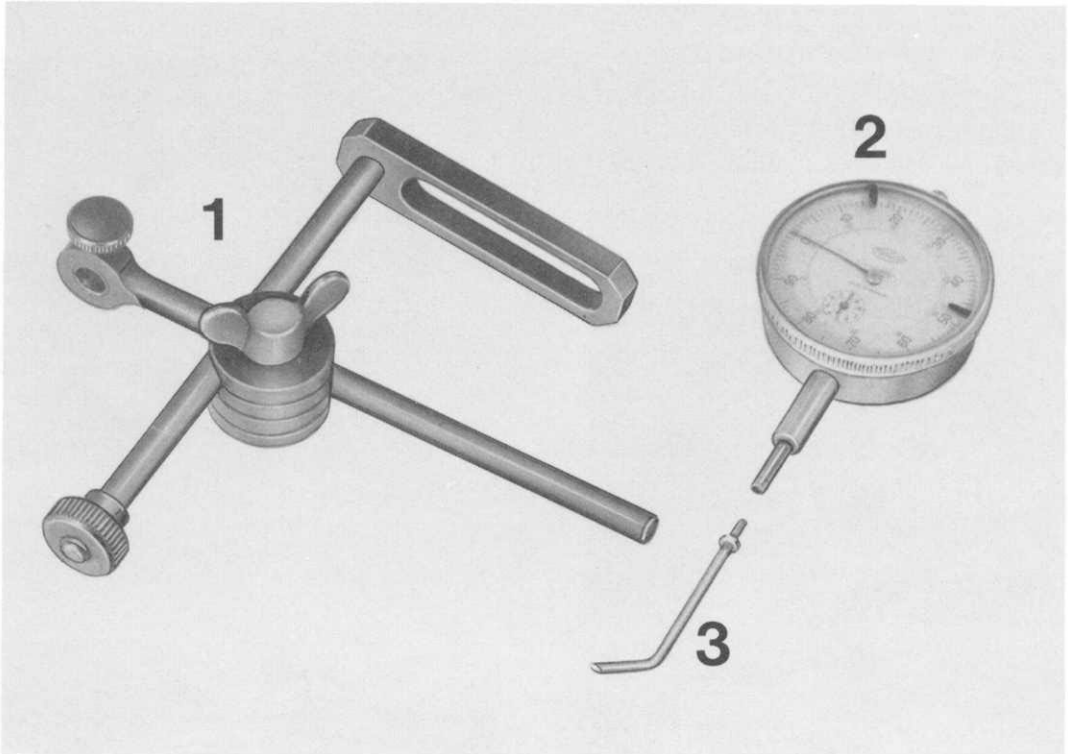


Note

Chain tensioner piston has spring force. Compress piston when removing and bind together with a suitable piece of wire after removing.
Chain tensioner piston on righthand side for cylinders 1 to 4 presses the chain up; on lefthand side for cylinders 5 to 8 down.
Tighten chain tensioner with specified torque after installation.

Printed in Germany

TOOLS FOR CAMSHAFT ADJUSTMENT (32-VALVE ENGINES)



No.	Designation	Special tool	Remarks
1	Gauge holder	VW 387	
2	Gauge		commercially available
3	Gauge inset	9232	

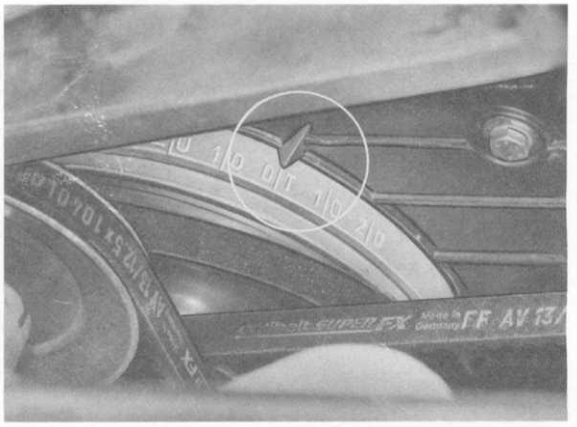
CHECKING AND ADJUSTING CAMSHAFT SETTING, 85/86 MODELS ONWARD

ENGINE TYPE M28. 43/44/45/46

P r e c o n d i t i o n :

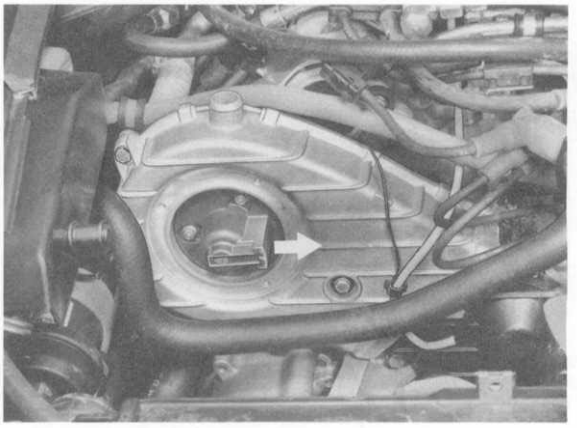
Timing belt tensioned as specified.
Specification: 5.0 + 0.3 scale gradations.

1.Turn engine in direction of rotation to TDC (cylinder No. 1).

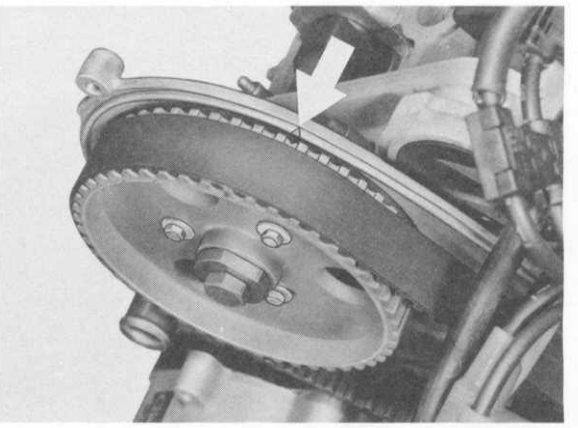


N o t e :

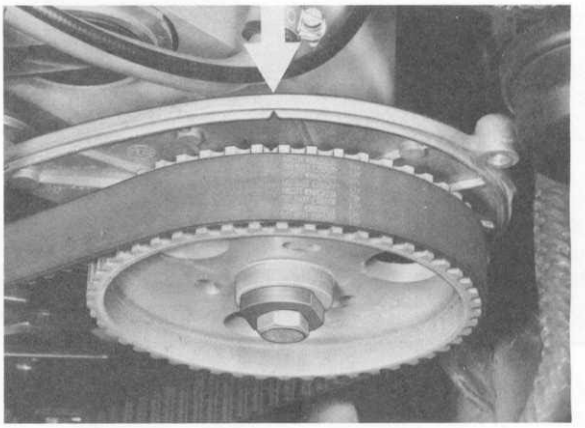
Both distributor fingers point left in forward direction of travel.



2.In this position, the marks on the camshaft gears and the flange bearings must also be aligned.

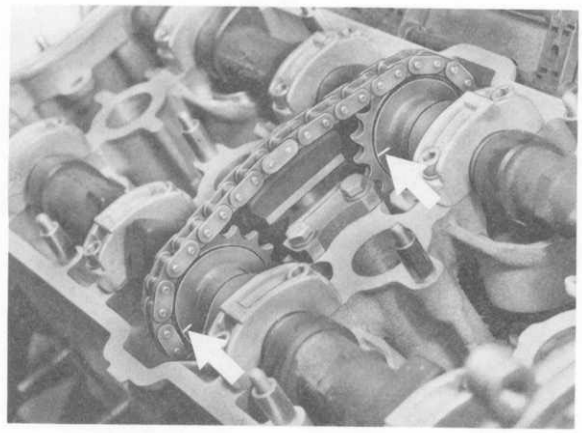


Cylinder bank 1-4

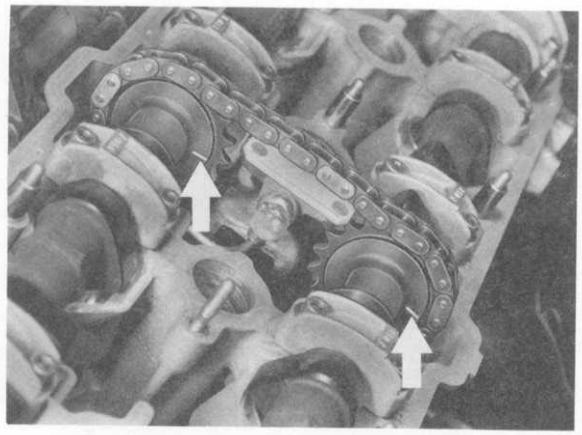


Cylinder bank 5-8

3.At the same time, check the marks (older engines) or noses (newer engines) on the camshafts.
Both marks point toward exhaust side.

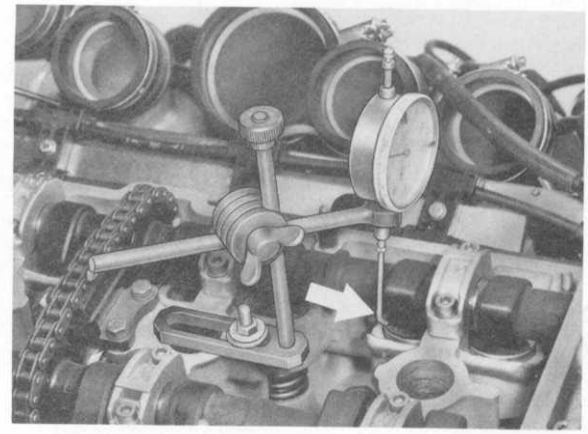


Cylinder bank 1 - 4



Cylinder bank 5 - 8

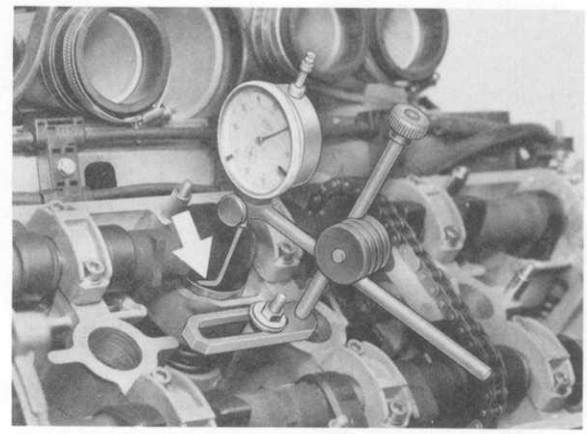
4. Mount gauge with holder VW 387 on cylinder head. Set gauge to 0 with 5 mm pretension on hydraulic tappet of cylinder 1 intake valve.



Cylinder bank 1 - 4

Correct setting 1.6 ± 0.1 mm

Place gauge on hydraulic tappet of cylinder 6 intake valve.

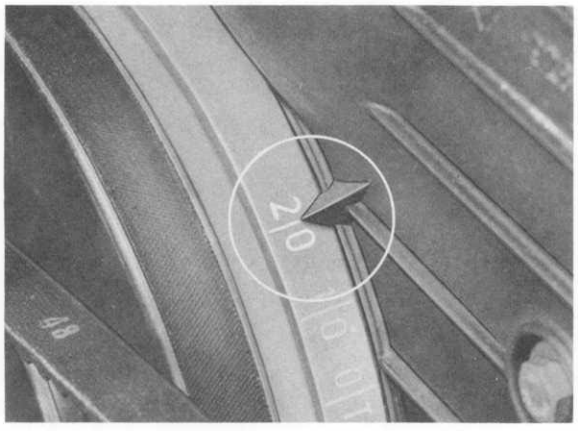


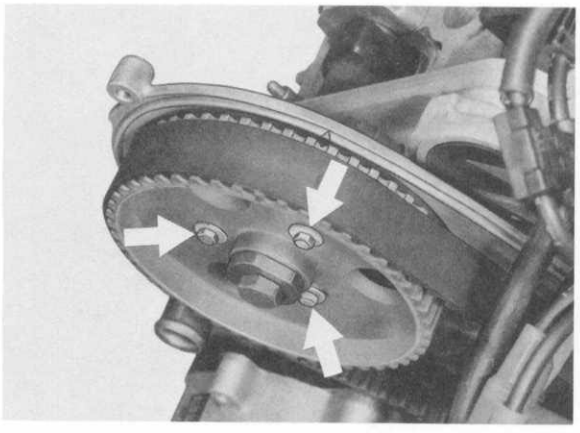
Cylinder bank 5 - 8
Specified value: 2.0 ± 0.1 mm

N o t e

The gauge must be aligned perpendicular to the intake valve.

5. Turn the crankshaft on past TDC (cylinder 1) while observing gauge. Continue turning engine until the lift is 1.6 ± 0.1 mm. The 20° (after TDC, cylinder 6) mark must now be aligned with the index mark on the camshaft drive belt cover.





2. Turn crankshaft in its usual direction of rotation until the gauge shows a lift of 1.6 ± 0.1 mm.

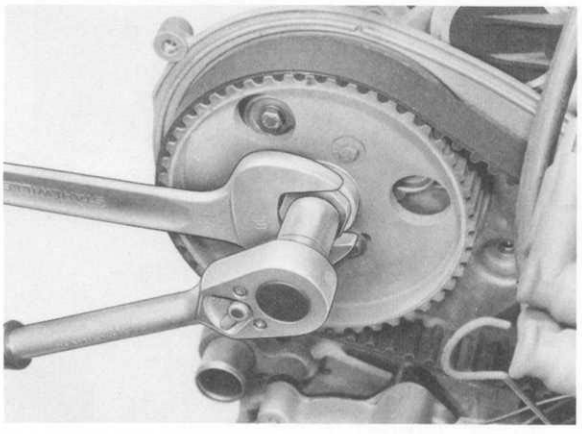
3. Slacken camshaft retaining bolts, bolts must be countered. Slacken provisional M 5 bolts.

6. If the components are not aligned, proceed as follows:

A d j u s t i n g

Cylinder bank 1 - 4

1. Install 3 extra M5 x 15 bolts to hold camshaft wheel, so as to prevent the camshaft wheel or camshaft turning when the retaining bolts are slackened.



4.Turn crankshaft until cylinder No. 6 is at 20° after TDC.

5.Block camshaft gears by installing 3 M 5 x 15 auxiliary bolts then tightening M 10 bolt to 65 Nm (47 ftlb).

6.Turn crankshaft through 2 more revolutions and recheck setting. Specified value: 1.6 + 0.1 mm, cylinder No. 6 20° after TDC. Readjust if necessary.

7.Once adjustment is completed, unscrew and remove temporary M 5 x 15 bolt.

Cylinder bank 5-8

8.Turn crankshaft until cylinder No. 6 is at TDC and check settings of cylinder bank 5-8 as described above (cylinder bank 1-4). Specified value 2.0 ± 0.1 mm, cylinder No. 1 20° after TDC.

CHECKING AND ADJUSTING CAMSHAFT SETTING

87 MODELS ONWARD

ENGINE TYPE M 28. 41/42

N o t e :

Installation of new camshafts in type M 28. 41/42 engines as of model year 87 has changed the valve timing. The new camshafts are recognizable because they have no rear journals.

A d j u s t i n g

Cylinder bank 1-4

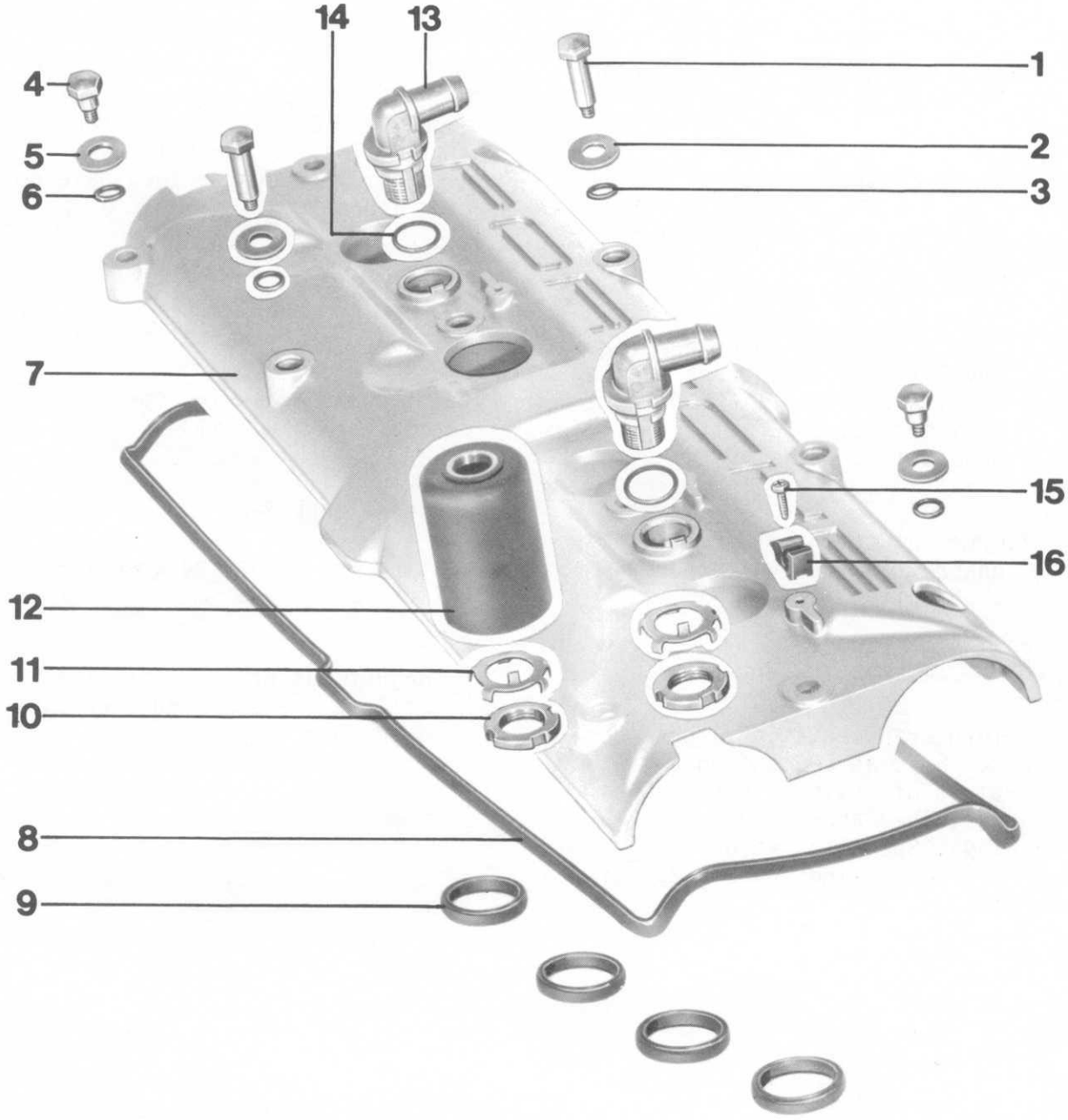
Testing and adjusting specification: 1.8 ± 0.1 mm

Cylinder bank 5-8

Testing and adjusting specification: 2.0 ± 0.1 mm

Adjustment of the camshafts follows the same sequence as described on p. 15 - 134.

CYLINDER HEAD COVER, DISASSEMBLING AND REASSEMBLING (32-VALVE ENGINES)



No.	Designation	Qty.	Note when: Removing	Installing
1	Screw	9		
2	Washer	9		
3	Gasket	9		
4	Screw	3		
5	Washer	3		
6	Gasket	3		
7	Cylinder head cover	1		
8	Seal	1		
9	Gasket	4		
10	Locknut	2		
11	Guard	2		
12	Oil separator	1		
13	Connection stub	2		Connection stub on oil separator with throttle 6.5 mm
14	O - ring	2		
15	Screw	4		
16	Ignition lead holder	4		

928 S_4 CLUB SPORT-Version

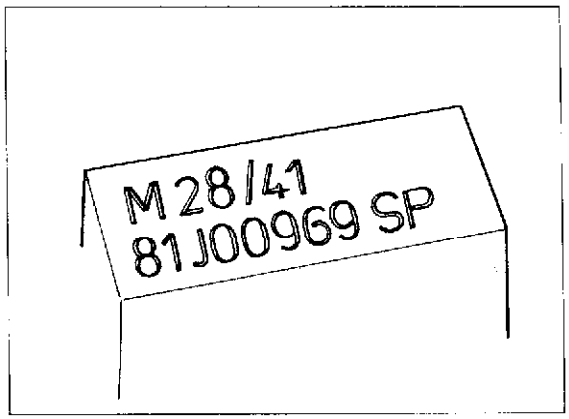
Identification, scope of modification, test and adjustment values

As from Model 88

Engine type M28.41 CLUB SPORT

Note

The identification code "SP" has been embossed as a suffix to the serial number.



62/15

Scope of modification, engine

- New camshafts with different valve-timing adjustment.
- EZK control unit (see Page 28 - 73).
- LH control unit (see Page 28 - 73).
- Idle speed: 775 rpm
- Modified middle and rear silencer with 2 end pipes.
- Lighter air-conditioning compressor.

Camshaft assignment for Club Sport and GT version

Camshaft assignment	Worldwide as from Mod. 88		Worldwide as from Mod. 89
Engine type	**928 S 4** **M 28.41 Club Sport**		**928 GT** **M 28.47**
Camshaft, right Cylinder bank 1...4			
Intake shaft	928.105.291.06	or	928.105.271.01
Exhaust shaft	928.105.293.06	or	928.105.273.01
Identification on the rear face surface	291.06 293.06		271.01 273.01
Camshaft, left Cylinder bank 5...8			
Intake shaft	928.105.292.06	or	928.105.272.01
Exhaust shaft	928.105.294.05	or	928.105.274.01
Identification on the rear face surface	292.06 294.05		272.01 274.01
Timings, 1 mm stroke, zero play			
Intake opens	3° crank angle after TDC		3° crank angle after TDC
Intake closes	42° crank angle after BDC		42° crank angle after BDC.
Exhaust opens	30° crank angle before BDC		30° crank angle before BDC
Exhaust closes	5° crank angle before TDC		5° crank angle before TDC

Note

The camshaft designs may be installed in mixed configuration.

The **camshaft adjustment gauges** for cylinders 1 and 5 can be used again for the camshafts for the engine types M 28.41 Club Sport or M 28.47, as described on Page 15-128.

Printed in Germany – XXIV, 1989

Checking and adjusting the camshaft setting, Club Sport and GT version

As from Model 88, Club Sport Version

Engine type M 28.41 CLUB SPORT

Note

The timings have changed as a result of installation of new camshafts as from Model 88 for the engine type M 28.41 Club Sport.

Adjustment

Cylinder bank 1 - 4
Testing and adjustment value: **2.8 ± 0.1 mm**

Cylinder bank 5 - 8
Testing and adjustment value: **3.1 ± 0.1 mm**

Camshaft adjustment is performed in the same order as described on Page 15 - 134.

As from Model 89, GT version

Engine type M 28.47

Note

The same camshafts as in engine type M 28.41 Club Sport are installed in the engine type M 28.47 as from Model 89. The setting has **not** changed.

Adjustment

Cylinder bank 1 - 4
Testing and adjustment value: **2.8 ± 0.1 mm**

Cylinder bank 5 - 8
Testing and adjustment value: **3.1 ± 0.1 mm**

Camshaft adjustment takes place in the same order as described on Page 15 - 134.

Printed in Germany – XXIV, 1989

Checking and adjusting camshaft setting, Type 928 GTS (5,4 l)

As of MY '92

Engine Type M 28.49/50

Note

Along with the introduction of new camshafts as of MY '92 for engine type M 28.49/50 928 GTS, the camshaft timing was changed.

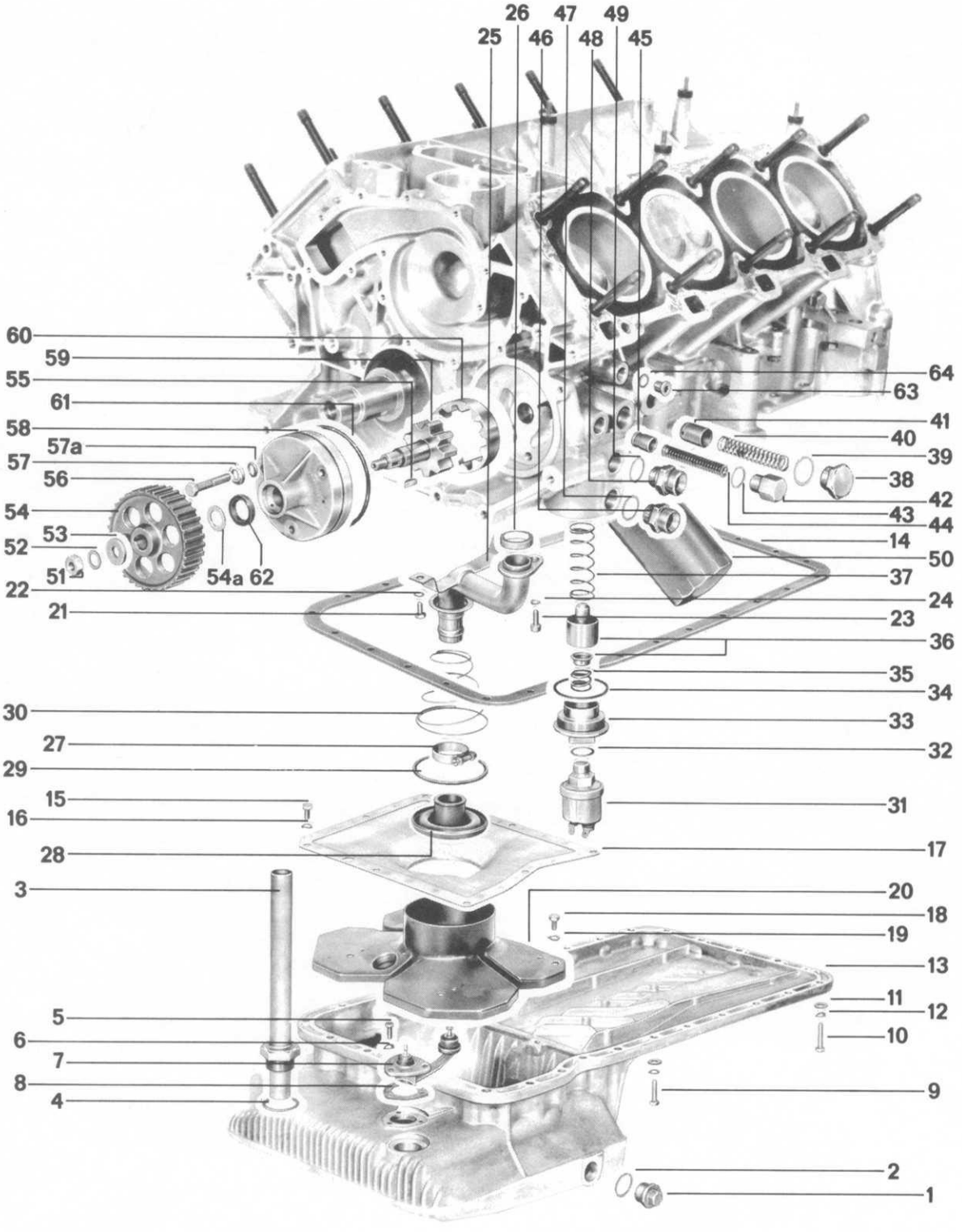
Adjusting

Cylinder bank 1...4
Checking and setting dimension:
1.83 ±0.1 mm

Cylinder bank 5...8
Checking and setting dimension:
2.08 ±0.1 mm

To adjust the camshafts, proceed in the order described on page 15 - 134.

Printed in Germany – XXVII, 1991


26
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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Magnetic plug	1		Tighten to specified torque	
2	Seal	1		Replace	
3	Pipe	1			
4	Seal	1		Replace	
5	Bolt	3			
6	Washer	3			
7	Oil level supply switch	1			
8	Gasket	1		Replace	
9	Bolt	5		Install at depressions of oil pan	
10	Bolt	25			
11	Washer	30			
12	Washer	30			
13	Oil pan	1		Check	
14	Oil pan gasket	1		Replace	
15	Bolt	8			
16	Washer	8			
17	Oil filter screen	1		Check	
18	Bolt	4		Use Loctite 270 or 271	
19	Washer	4			
20	Oil pan insert	1		Check	
21	Bolt	2			
22	Washer	2			
23	Socket head bolt	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
24	Washer	1			
25	Oil intake tube	1		Check	
26	Gasket	1		Replace	
27	Hose clamp	1			
28	Rubber sleeve	1		Check for damage, replace if necessary	
29	Spring support disc	1		Position correctly	
30	Spring	1			
31	Oil pressure sender	1			
32	Seal	1		Replace	
33	Plug	1		Tighten to specified torque	
34	Seal	1		Replace	
35	Thermostat spring	1			
36	Thermostat insert	1			
37	Thermostat spring	1			
38	Plug	1			
39	Seal	1		Replace	
40	Spring	1			
41	Bypass valve piston	1	Check for wear		
42	Plug	1			
43	Seal	1		Replace	
44	Spring	1			
45	Pressure relief valve piston	1	Check for wear		
46	Adaptor	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
47	Seal	1		Replace	
48	Adapter	1			
49	Seal	1		Replace	
50	Oil filter	1	Loosen with standard strap, e. g. Hazet 2171-2		
51	Nut	1			
52	Washer	1			
53	Washer	1			
54	Oil pump gear	1			
54a	Shim 22 x 16 x 1	1		Only use together with light alloy gear	
55	Woodruff key	1			
56	Bolt	3			
57	Washer	3			
57 a	Round cord seal	3			
58	Oil pump housing	1			
59	Inner rotor	1		Lubricate	
60	Outer rotor	1		Lubricate, chamfered side must be inside of oil pump body (facing forward)	
61	O-ring	1		Replace	
62	Shaft seal	1		Replace, drive into oil pump body flush. Install with 9195, see page 17 - 6 a	
63	Plug for oil bores	1			
64	Seal	1		Replace	

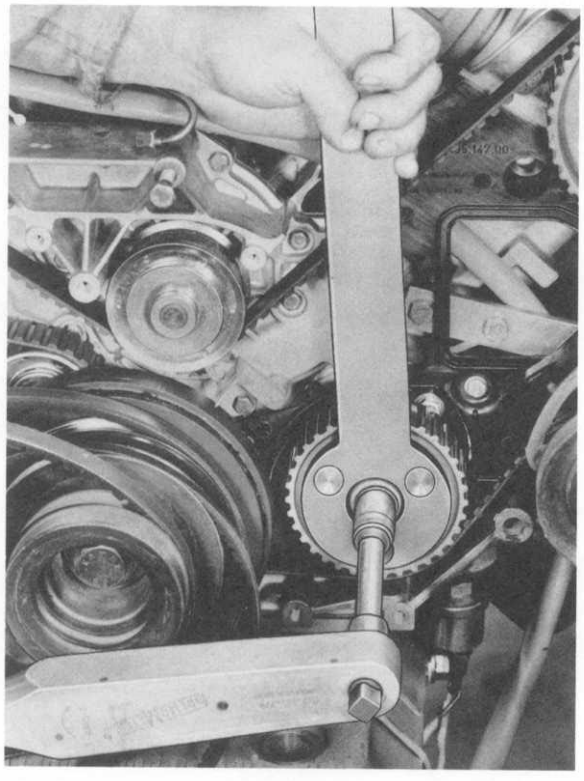
ASSEMBLY INSTRUCTIONS
OIL PUMP, REMOVING AND INSTALLING

R e m o v i n g

1.Lock oil pump drive wheel with special tool 9157, unscrew retaining nuts and pull off drive wheel.

N o t e

Use special tool 9157/1 to lock oil pump drive wheels with HTD tooth shape (83 models onward).



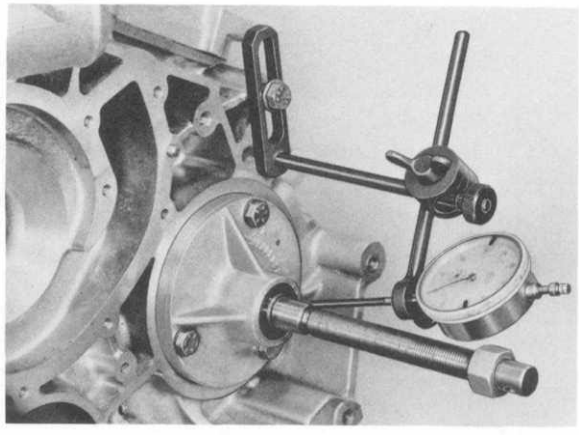
2.Unscrew the oil pump mounting bolts and remove oil pump.

I n s t a l l i n g
N o t e

Measure axial play before installation. The measurement must be carried out with the pump dry, in other words without oil.

1.Use gauge holder VW 387 and threaded section to measure axial play.

Axial play 0.08 to 0.12 mm



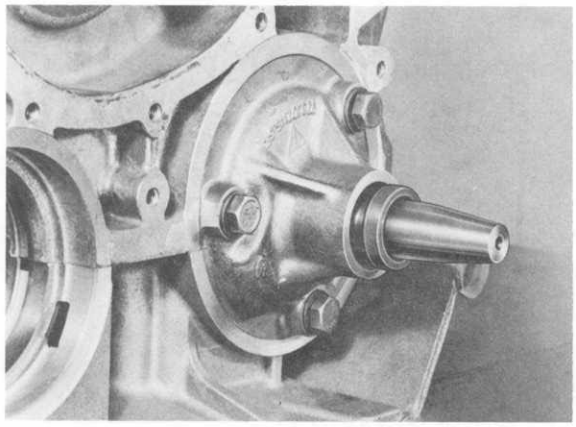
2.If necessary, remove inner rotor.

Size 21 $^{-0.080}_{-0.095}$ mm

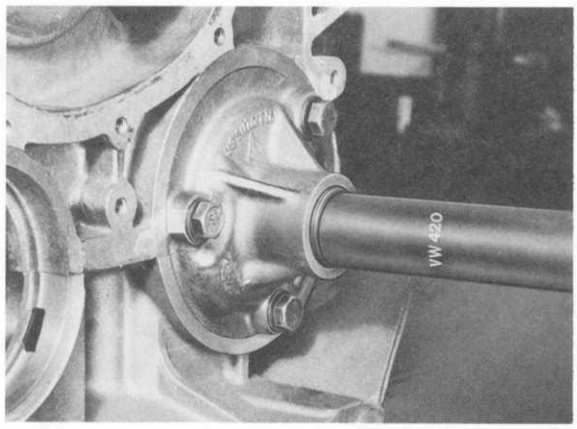
3.When installing a replacement oil pump, do not remove transport fixture until mounting bolts have been tightened.

REPLACING SHAFT SEAL FOR OIL PUMP

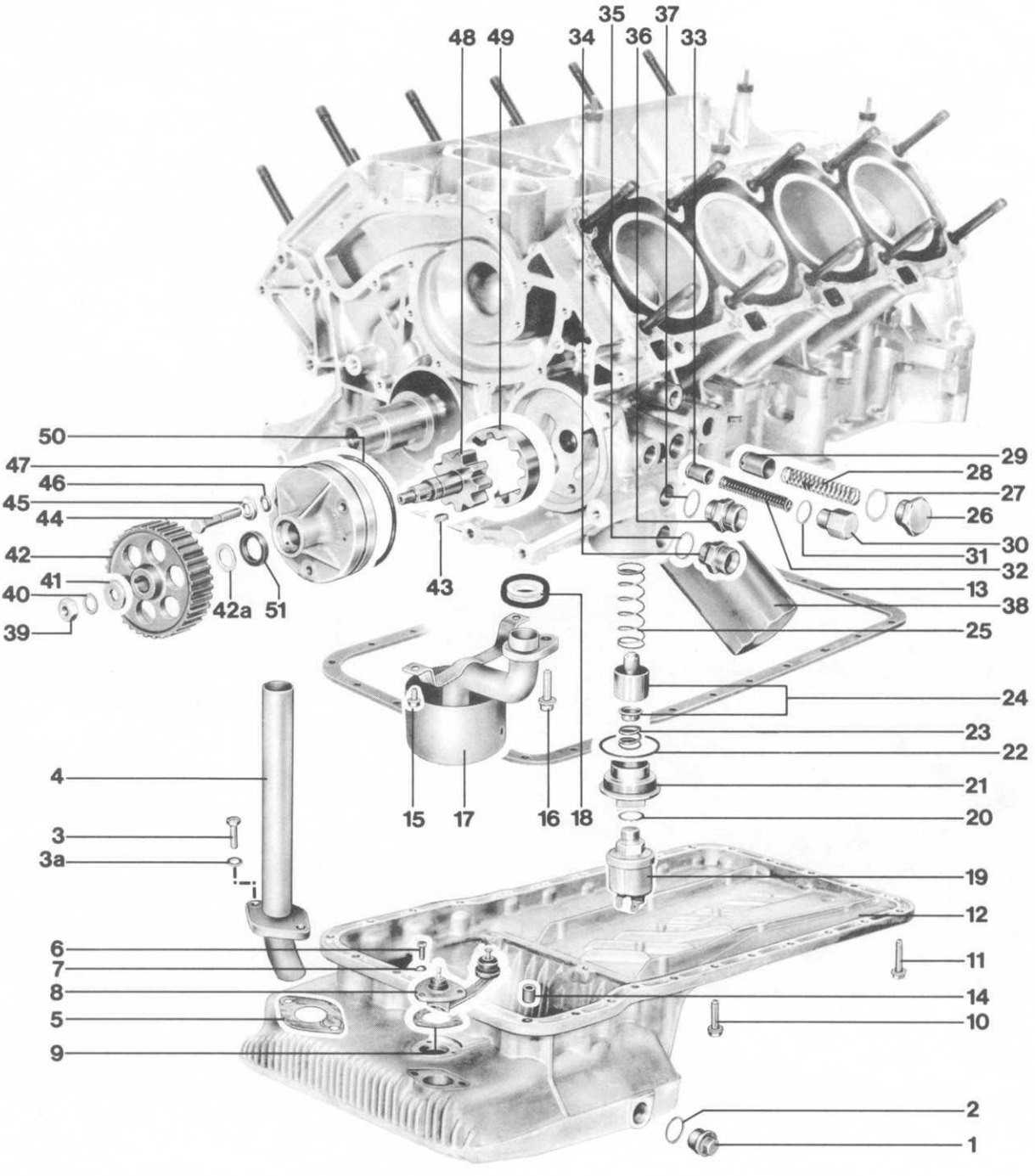
1. Lubricate sealing lip with oil and slide seal over Special Tool 9195 on to the drive shaft inner race.



2. Knock in seal flush with a suitable pressure pad, e. g. VW 420.



LUBRICATION SYSTEM COMPONENTS, REMOVING AND INSTALLING,
83 MODELS ONWARD



No.	Designation	Qty.	Note when: Removing	Installing
1	Magnetic plug	1		tighten plug to correct torque setting.
2	Gasket	1		fit replacement
3	Hex bolt M 6 x 20	2		
3a	Washer	2		
4	Tube	1		
5	Seal	1		fit replacement
6	Hex bolt M 5 x 12	3		
7	Spring washer	3		
8	Oil level switch	1		
9	Seal	1		fit replacement
10	Hex bolt M 6 x 25 with washer	5		install in oil pan recesses
11	Hex bolt M 6 x 28 with washer	25		
12	Oil pan	1		check
13	Oil pan seal	1		fit replacement
14	Centering sleeve (rubber)	2		

No.	Designation	Qty.	Note when: Removing	Installing
15	Hex bolt M 6 x 12 with washer	2		
16	Allen bolt M 8 x 30 with washer	1		
17	Oil intake tube	1		check
18	Gasket	1		fit replacement
19	Oil pressure sensor	1		
20	Gasket	1		fit replacement
21	Threaded plug	1		tighten to correct torque setting
22	Gasket	1		fit replacement
23	Spring for thermostat	1		
24	Regulator insert	1		
25	Spring for thermostat	1		
26	Threaded plug	1		
27	Gasket	1		fit replacement
28	Pressure spring	1		
29	Plunger for bypass valve	1	check for wear	
30	Threaded plug	1		

No.	Designation	Qty.	Note when: Removing	Installing
31	Gasket	1		fit replacement
32	Pressure spring	1		
33	Piston for pressure release valve	1	check for wear	
34	Screw connector	1		
35	Gasket	1		fit replacement
36	Screw connector	1		
37	Gasket	1		fit replacement
38	Oil filter	1	use commercially available oil filter remover, e.g. Hazet 2171-2	
39	Hex nut	1		
40	Spring washer	1		
41	Washer	1		
42	Toothed wheel for oil pump	1		
42a	Shim ring 22 x 16 x 1	1		only install with light alloy toothed wheel
43	Woodruff key	1		
44	Hex bolt M 8 x 45	3		
45	Washer	3		

No.	Designation	Qty.	Note when: Removing	Installing
46	Sealing ring	3		fit replacement
47	Oil pump body	1		
48	Inner rotor	1		oil
49	Outer rotor	1		oil, install with chamfered side in oil pump body (in forward direction of travel)
50	O-Ring	1		fit replacement
51	Shaft seal	1		fit replacement, use drift 9195 to fit seal flush with oil pump body, see p. 17 - 6a

Note

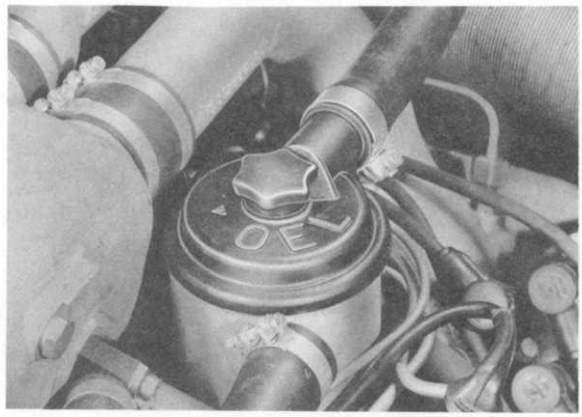
The **short-circuiting valve**, Nos. 26 to 29, is **deleted** on the engines for the 1991 MY. The crankcase is no longer machined at the respective valve location. Exchange engines with **new** crankcases are also supplied **without** short circuiting valve.

Printed in Germany – XXIX, 1992

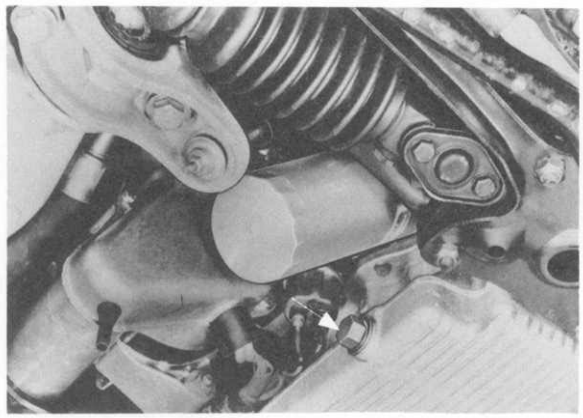
CHANGING ENGINE OIL AND ENGINE OIL FILTER

Requirement:
Engine at operating temperature.

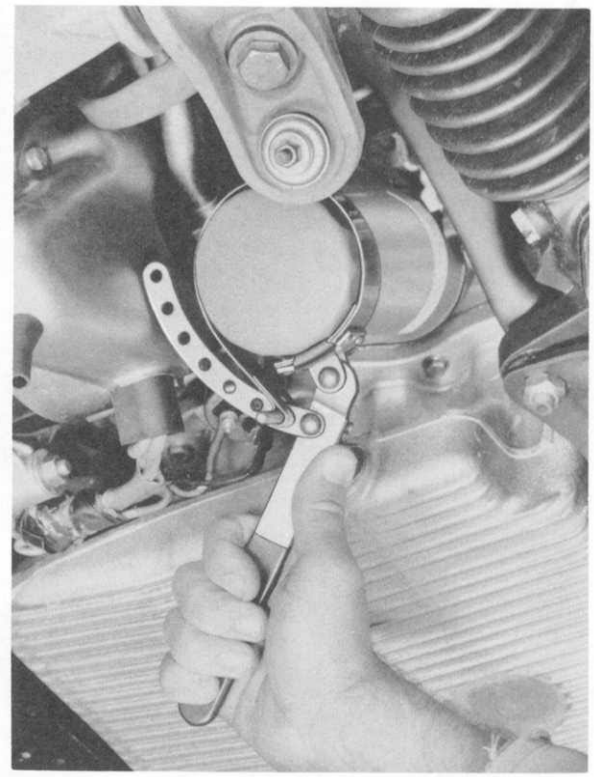
1. Loosen and remove oil filler cap.



2. Remove oil drain plug from oil pan and drain engine oil.



3. Loosen oil filter with a standard strap wrench, or US 4462.



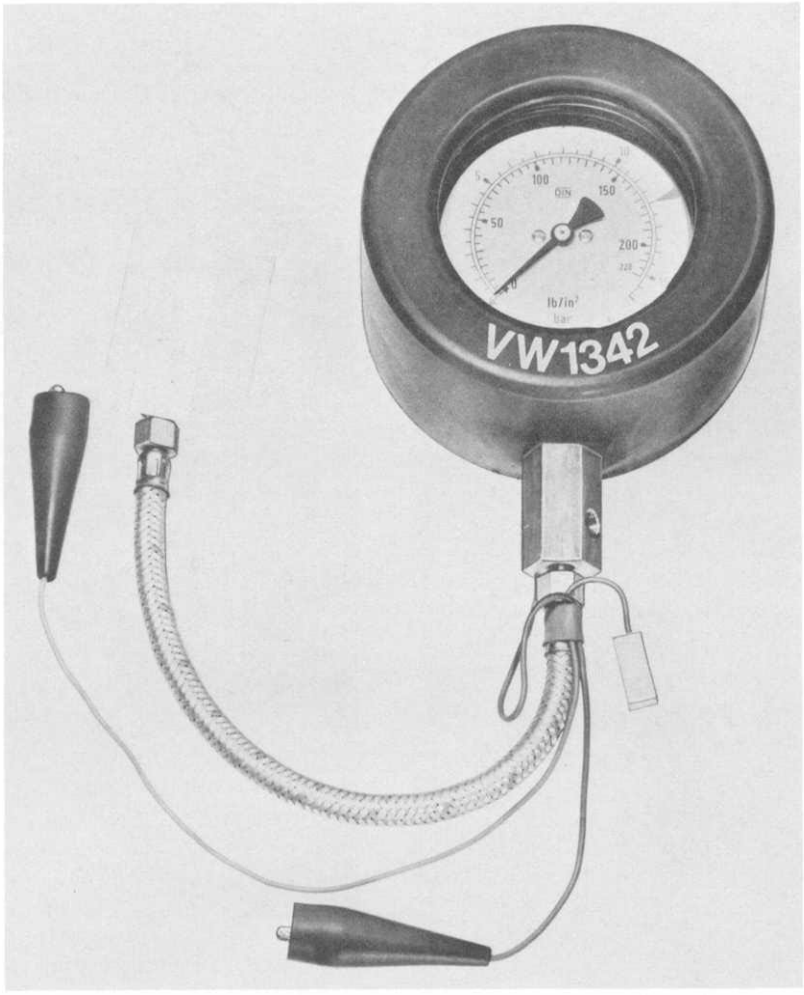
4. Clean drain plug. Replace seal. Tighten drain plug to 4.0 + 0.3 (29 + 2 ft lb).

5. Lubricate gasket on oil filter slightly, install by hand until gasket contacts surface and then tighten one more turn.

6. Add engine oil, run engine to operating temperature and check for leaks.

7. Check oil level on stopped engine.

TOOLS



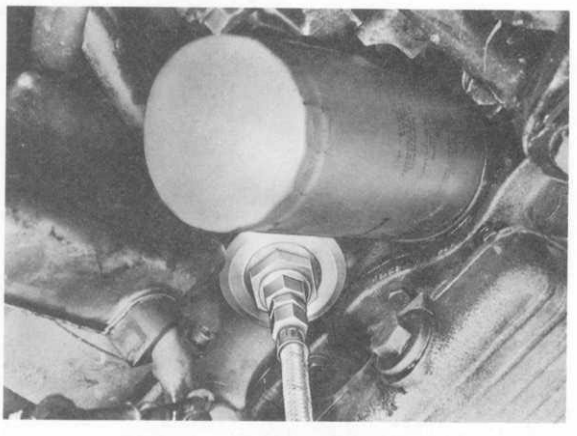
No.	Description	Special Tool	Remarks
1	Oil pressure tester	VW 1342	

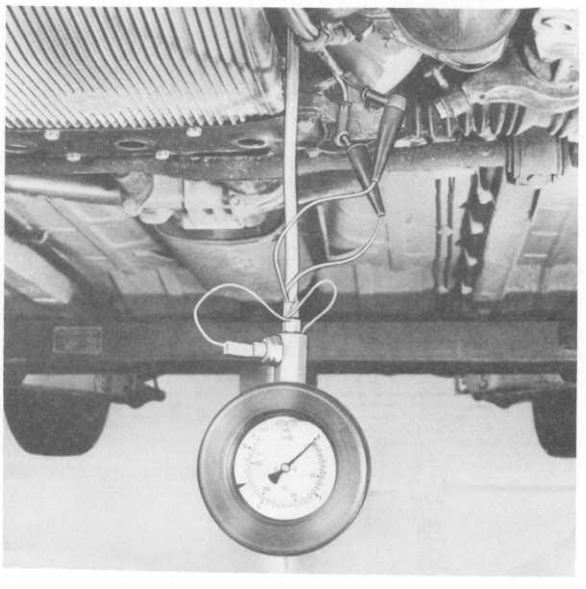
CHECKING OIL PRESSURE

1. Drain engine oil.

2. Remove oil filter and oil pressure sensor.

3. Screw oil pressure tester VW 1342 in conjunction with M 10 x 1 adapter, Part No. 999.105.013.02, and M 10 x 1 / M 18 x 1.5 adapter, Part No. 901.101.175.01, in plug opening for oil thermostat housing in place of the oil pressure sensor. Mount oil filter and add oil.





4. Run engine to operating temperature (about 80°C/176°F).

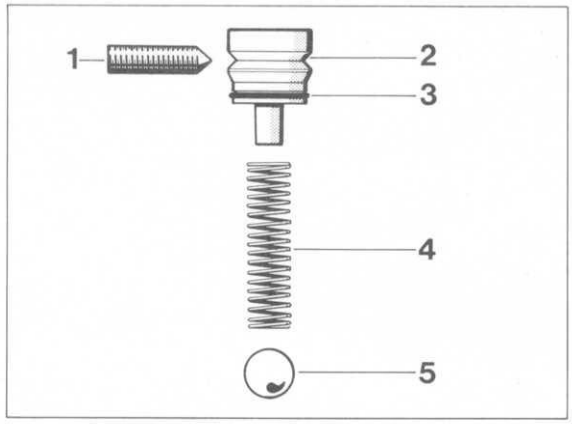
5. Have a second person raise the engine speed to 4000 rpm.

6. Read oil pressure on tester. Value must be higher than 5 bar (73 psi).

CLEANING OIL CHECK VALVE FOR HYDRAULIC VALVE TAPPETS

Note:

The oil check valve prevents the oil from flowing back out of the cylinder head, thus assuring operation of the hydraulic valve tappets. If the valve tappets chatter as the engine turns over just after starting, it is essential to clean the check valve.



1 - Threaded rod

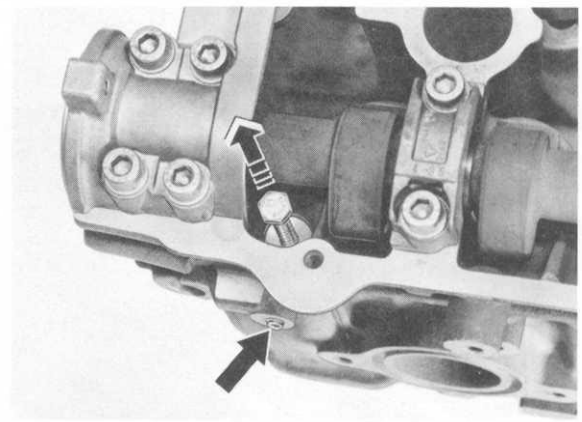
2 - Spring guide

3 - O-ring

4 - Compression spring

5 - Ball

1. Remove cylinder-head cover. Screw a hex bolt, e.g. M 6 x 40 down into spring guide. Slacken threaded rod 2 turns and lift out valve guide.



2. Use a magnet to withdraw compression spring and ball. Thoroughly clean ball seat, ball, compression spring and oil duct. The ball seat remains in the cylinder head and great care must be taken to ensure that it is not damaged.

3. Replace O-ring before installation. Tightening torque for threaded rod 3.5 Nm (2.8 ftlb).

Cleaning the complete engine-oil system following engine failure (bearing failure)

Note

This cleaning sequence is only intended to given pointers as to where chips may be found. The actual scope of work involved must be determined individually for each engine failure.

Replace the following parts:

- Hydraulic valve tappets
- Chain tensioner
- Oil filter

The following parts must be dismantled, checked and cleaned thoroughly:

- Oil pump
- Thermostat housing
- Bypass valve
- Release valve
- Oil retension valve in the cylinder head

See Page 17 - 10

The following parts must be cleaned thoroughly and/or rinsed several times:

Note:

All oil feeder holes may be flushed thoroughly with a commercially available oil - gasoline syringe and benzine.

- Oil sump
- Oil inlet pipe
- Crankcase
- Crankshaft
- Cylinder heads
- Camshaft housing
- Oil lines
- Oil filler pipe
- Oil cooler in the radiator

Change oil filter and engine oil after approx. 500 km running time.

Note:

Following an engine failure, the complete intake system must be checked for foreign bodies and/or oil and cleaned before assembly.

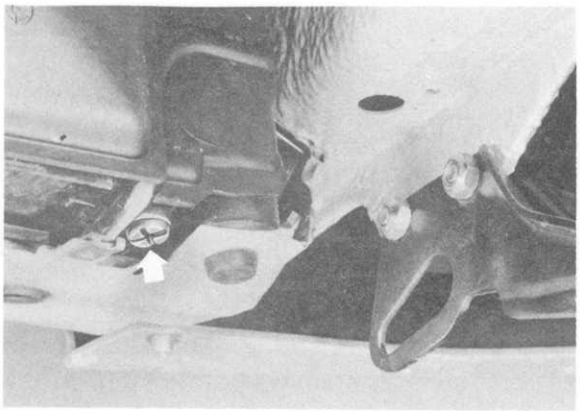
CHANGING COOLANT AND BLEEDING COOLING SYSTEM

Requirement:
Engine cool for draining coolant.

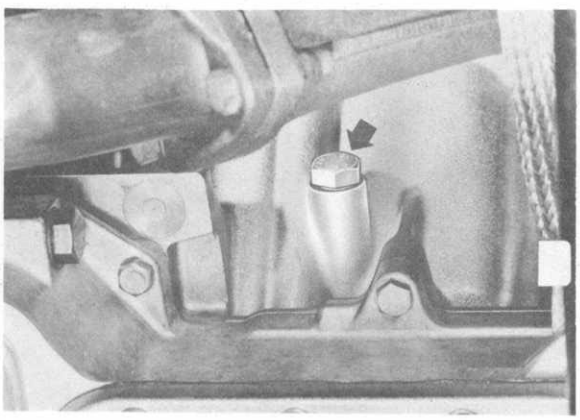
1. Set heater lever at "warm" and run engine briefly.

2. Take off cap on expansion tank.

3. Unscrew drain plug on radiator and catch coolant.



4. Unscrew coolant drain plugs on left and right-hand sides of crankcase and catch coolant.



5. Replace seals for drain plugs on crankcase and O-ring for drain plug on radiator.

Torques:
Radiator plug - 1.5 to 2.0 Nm (13 to 17 in.lb)
Crankcase plug - 45 to 50 Nm (33 to 36 ft lb)

6. Add coolant until level reaches edge of filler opening (heater lever must be at "warm").

7. Run engine to operating temperature and check coolant level, adding more if necessary.

Coolant level must reach center of expansion tank.

COOLANT MIXING TABLE

Protection to	Antifreeze	Water	Antifreeze	Water
- 25° C/- 13° F	40 %	60 %	6.4 ltr./6.8 US qt	9.6 ltr./10.1 US qt
- 30° C/- 22° F	45 %	55 %	7.2 ltr./7.6 US qt	8.8 ltr./9.3 US qt
- 35° C/- 31° F	50 %	50 %	8.0 ltr./8.5 US qt	8.0 ltr./8.5 US qt

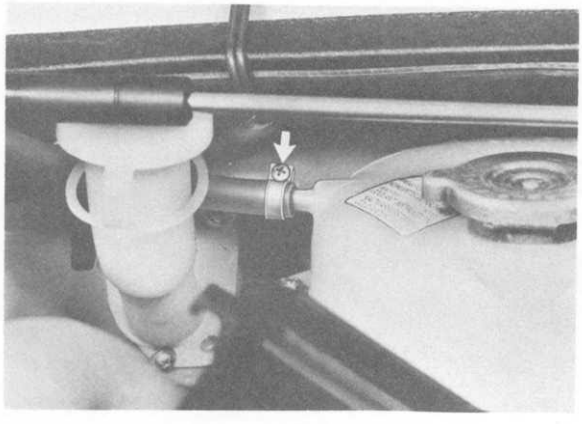
CHECKING COOLING SYSTEM FOR LEAKS

Note

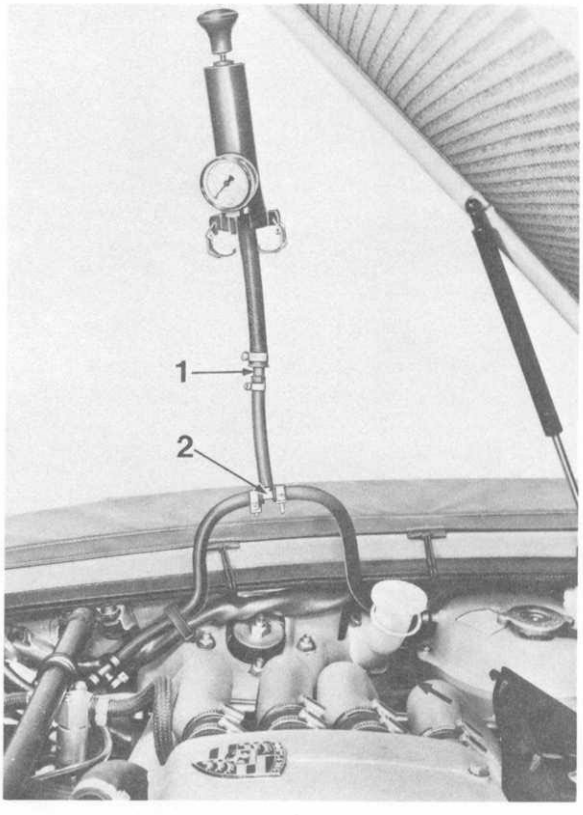
Engine must be cold for leak test.

Check coolant and warm water hoses for proper routing, porosity, swelling, tears and cafe. Replace damaged hoses.

1. Detach hose from radiator to expansion tank at expansion tank.



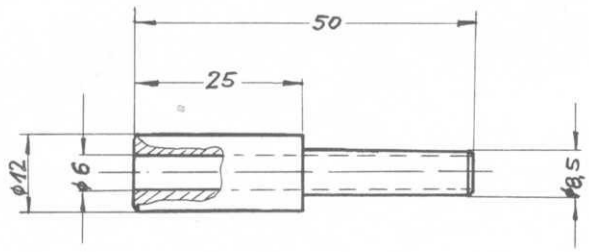
2. Connect tester VW 1274 with separate T-adapter and pertinent hoses ahead of the expansion tank.



1 - Adapter
2 - T-adapter

CHECKING COOLANT SYSTEM CAP

3. An adapter (made locally) will be required to connect the tester on the T-adapter.



Material: steel pipe St 35. 12 x 3

4. Build up about 1 bar pressure in cooling system by pumping. Pressure valve in cap must open between 0,9 and 1,15 bar.

5. Visually inspect the following parts for leaks.

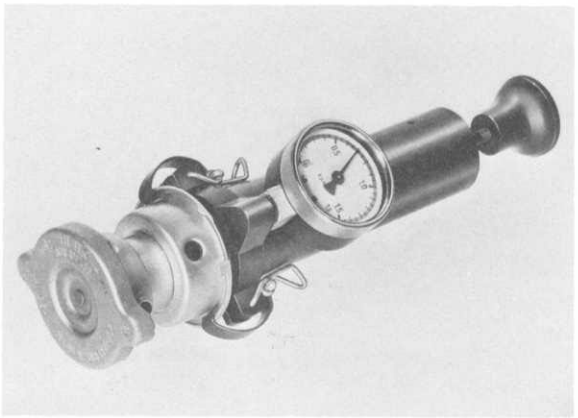
Engine block: Water pump
Cylinder head gasket
Thermostat housing
Hose connections
Cylinder head mounting studs

Radiator: Bleeder neck
Water drain plug
Hose connections
Oil cooler cap
Temperature switch or
Plug

Heater: Hose connections

1. Mount cap on tester.

2. Produce pressure with hand pump. Pressure valve should open between 0,9 and 1,15 bar.

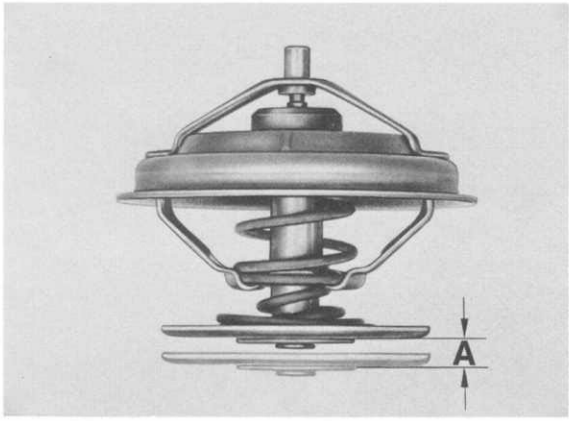


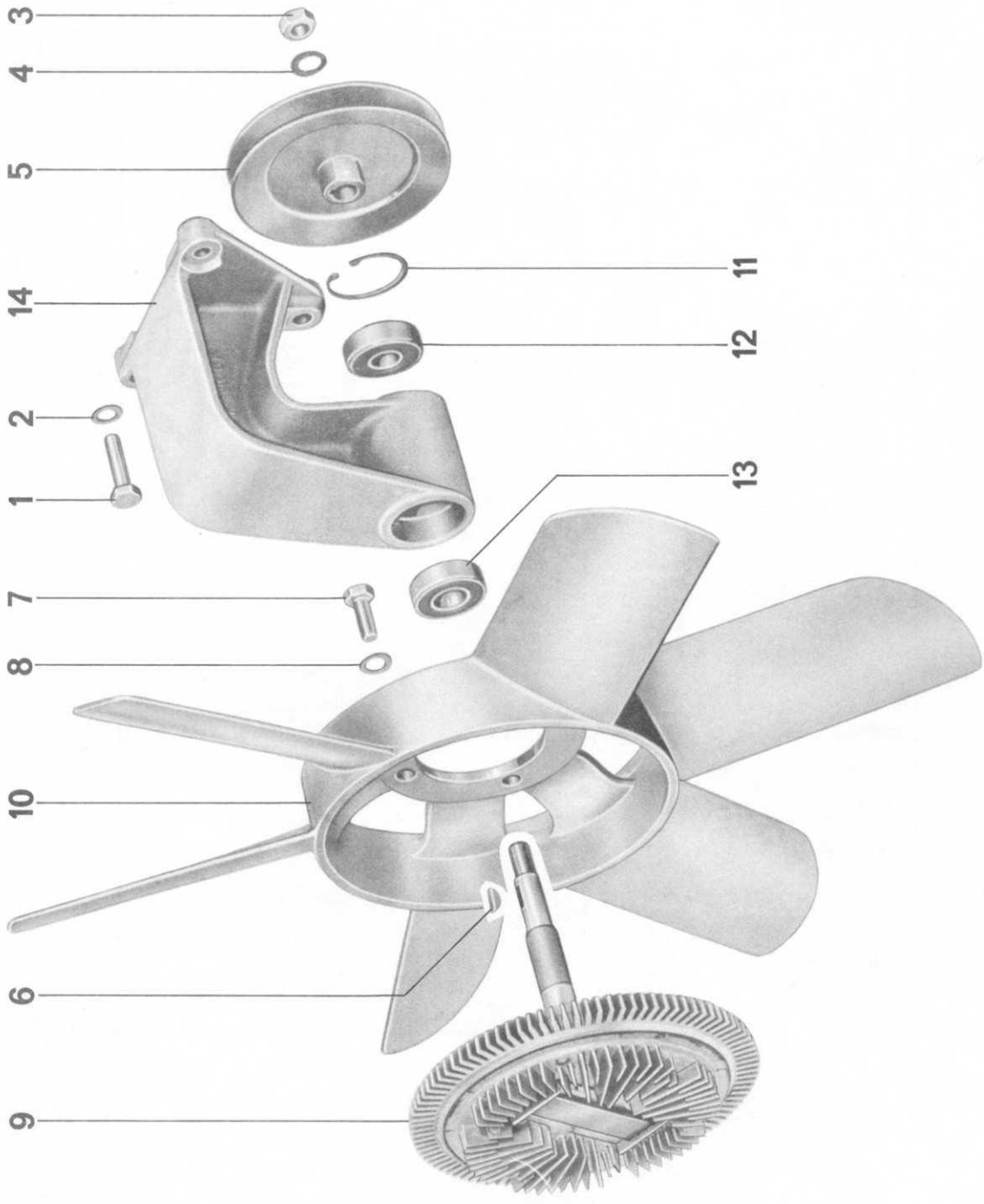
CHECKING COOLANT THERMOSTAT

Heat coolant thermostat in a water bath.

Begins to open: approx. 83 ± 2°
Ends: approx. 98°

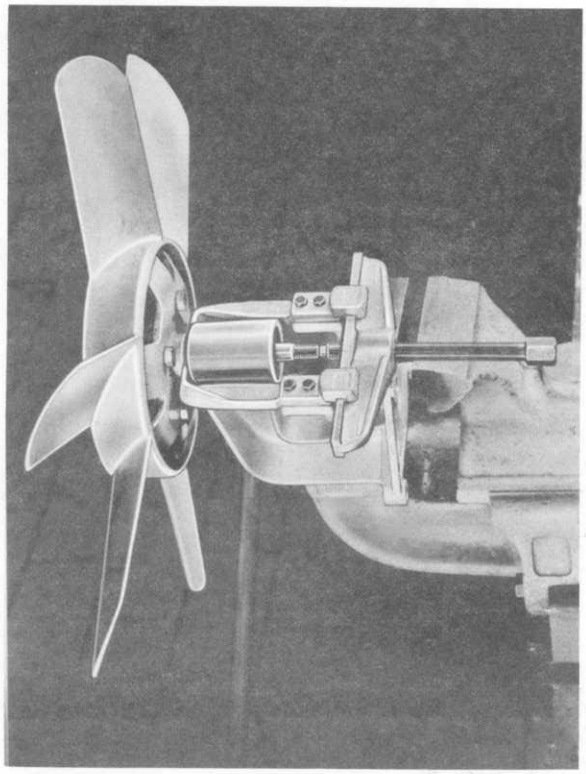
Opening travel (distance A): at least 8 mm.



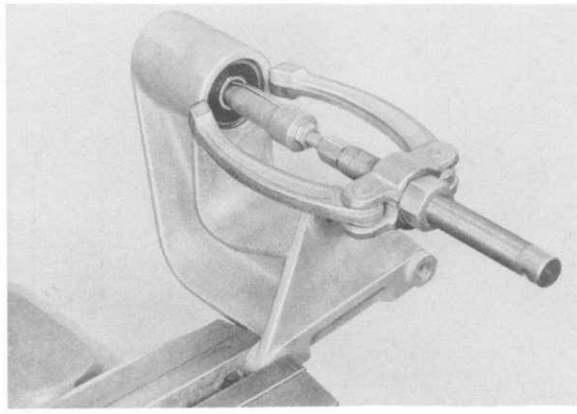

3
4
5
14
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11
12
13

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	3			
2	Washer	3			
3	Nut	1			
4	Washer	1			
5	Pulley	1	Pull off	Check runout	
6	Woodruff key	1			
7	Bolt	4			
8	Washer	4			
9	Viscuous coupling	1	Press off, store so that shaft is horizontal or inclined no more than 45°	Coat seats for ball bearings on shaft with Loctite 270 or 271	
10	Fan	1			
11	Circlip	1		Position correctly	
12	Ball bearing (small diameter inner race)	1	Pull out with, e.g., Kukko internal extractor No. 21/1 (12 - 14.5 mm)	Check, replace if necessary. Drive in with suitable mandrel	
13	Ball bearing (large diameter inner race)	1	Pull out with, e.g., Kukko internal extractor No. 21/2 (14.5 - 18.5 mm)	Check, replace if necessary Drive in with suitable mandrel	
14	Fan carrier	1		Check	

DISASSEMBLING AND ASSEMBLING VISCUOUS FAN

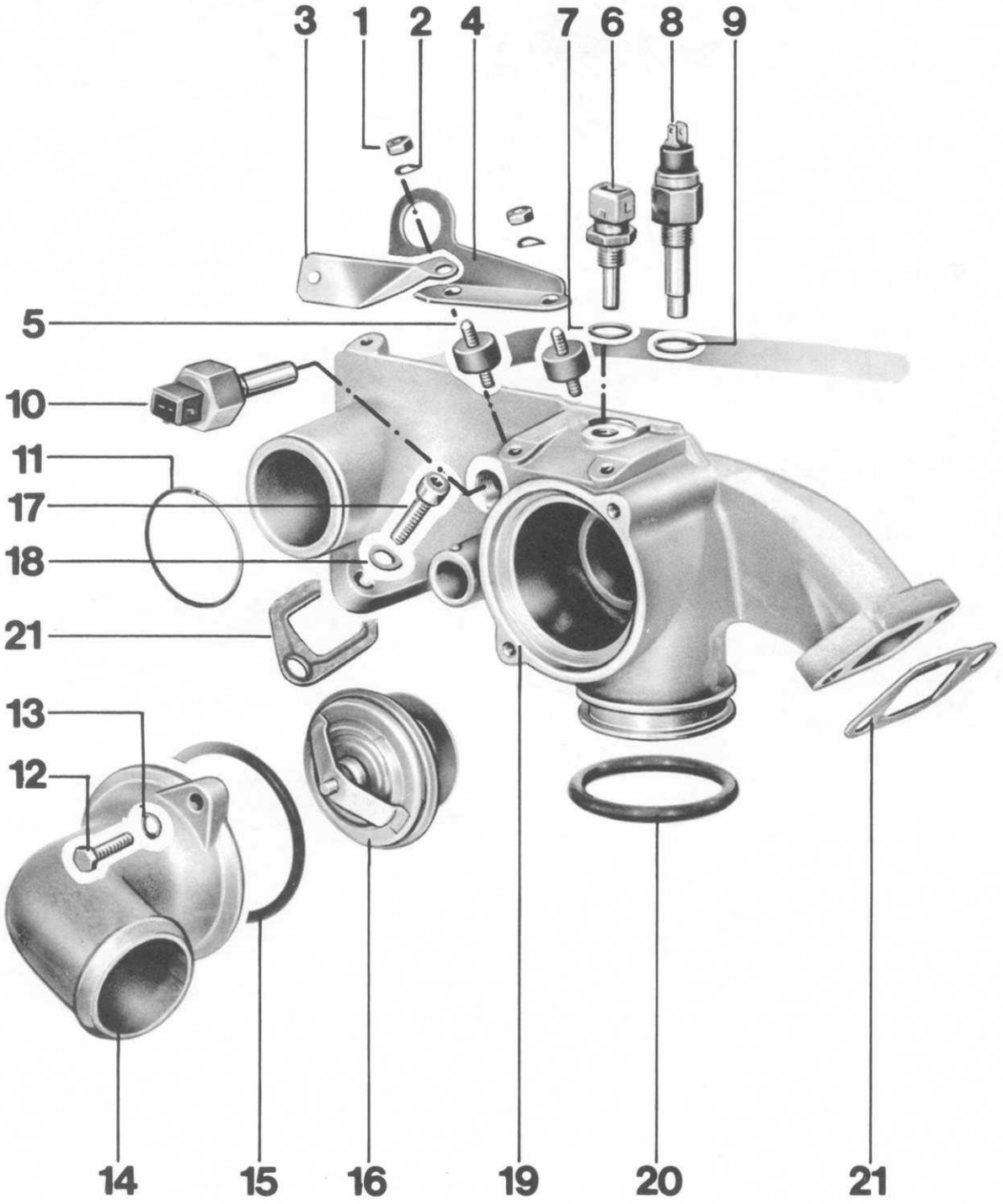


Pull off viscuous coupling with a double-arm extractor, e.g. Kukko 20/10 (width: 120 mm, depth: 100 mm).



Pull out grooved ball bearings with an internal extractor, e.g. Kukko.

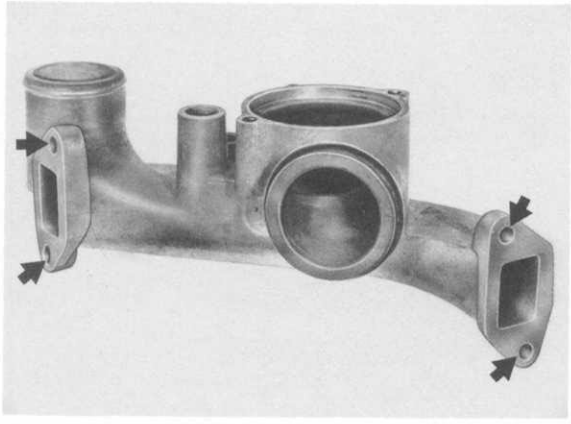
DISASSEMBLING AND ASSEMBLING THERMOSTAT HOUSING
FOR COOLING SYSTEM (AFC)



No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Nut M 6	2			
2	Washer	2			
3	Ignition cable holder	1			
4	Pressure damper holder	1			
5	Rubber/metal mount	2		Check, replacing if necessary	
6	Temperature switch II	1			
7	Seal	1		Replace	
8	Temperature sensor	1			
9	Seal A 14 x 18	1		Replace	
10	Temperature time switch (for cold start valve)	1			
11	Retaining	1			
12	Bolt M 6 x 25	2			
13	Washer B 6	2			
14	Cover for thermostat housing	1			
15	Round seal	1		Replace	
16	Thermostat insert	1			
17	Bolt M 8 x 30	4			
18	Washer A 8.4	4			
19	Thermostat housing	1			
20	O-ring 53 x 7	1		Replace	
21	Gasket	2		Replace	

Note:

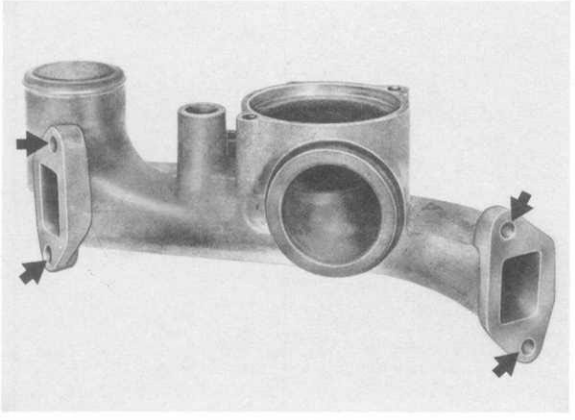
If cylinder heads had been machined or ground, check that thermostat housing fits correctly afterwards. It must not be installed with tension. If necessary, correct by machining mounting bores.



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Electric air valve	1			
2	Hose clamp	1			
3	Hose	1			
4	Bolt	2			
5	Washer	2			
6	Throttle bypass valve	1			
7	Bolt	2			
8	Washer	2			
9	Holder	1			
10	Warm-up control	1			
11	Temperature sensor (coolant)	1			
12	Seal	1		Replace	
13	Temp. time switch for cold start valve	1			
14	Retainer	1			
15	Bolt	2			
16	Washer B 6	2			
17	Cover for governor housing	1			
18	Round seal	1		Replace	
19	Thermostat insert	1			see page 19 - 2 b
20	Bolt	2			
21	Washer A 8,4	2			
22	Governor housing	1			
23	0-ring 53 x 7	1		Replace	
24	Gasket	2		Replace	

NOTE

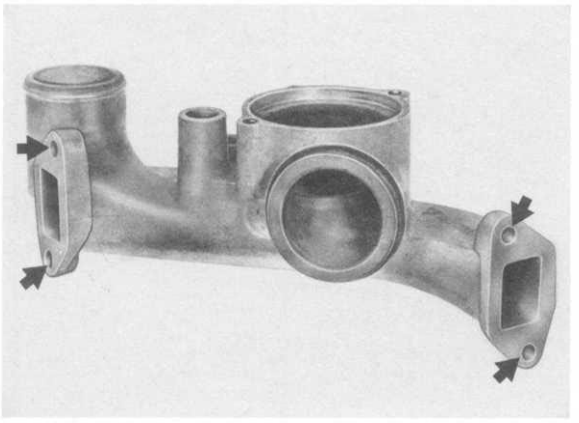
If cylinder heads had been machined or ground, check that thermostat housing fits correctly afterwards. It must not be installed with tension. If necessary, correct by machining mounting bores.



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Electric air valve	1			
2	Hose clamp	1			
3	Hose	1			
4	Bolt	2			
5	Washer	2			
6	Throttle bypass valve	1			
7	Bolt	2			
8	Washer	2			
9	Holder	1			
10	Warm-up control	1			
11	Temperature sensor (coolant)	1			
12	Seal	1		Replace	
13	Temp. time switch for cold start valve	1			
14	Retainer	1			
15	Bolt	2			
16	Washer B 6	2			
17	Cover for governor housing	1			
18	Round seal	1		Replace	
19	Thermostat insert	1			see page 19 - 2 b
20	Bolt	2			
21	Washer A 8,4	2			
22	Governor housing	1			
23	O-ring 53 x 7	1		Replace	
24	Gasket	2		Replace	

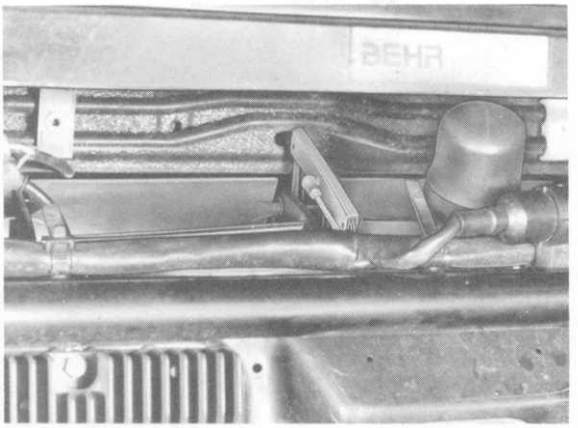
NOTE

If cylinder heads had been machined or ground, check that thermostat housing fits correctly afterwards. It must not be installed with tension. If necessary, correct by machining mounting bores.



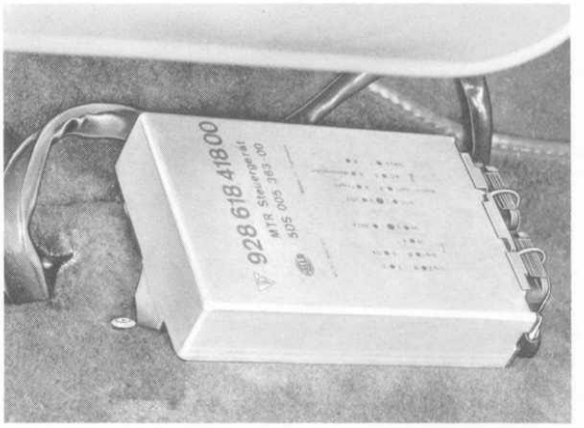
COOLING-AIR FLAP CONTROL,'87 MODELS ONWARD

The cooling air which enters through the new front air dam is regulated from the radiator intake by cooling air control flaps actuated by an electric positioning motor.

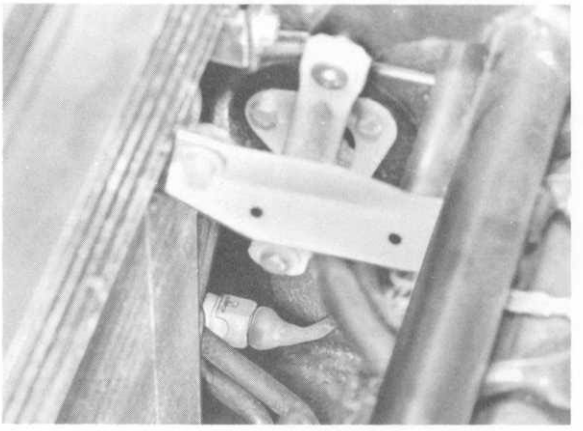


The flaps are positioned by a linkage connected to the positioning motor crank. The crank position which corresponds to the flap position is stored mechanically on a control disk integrated in the positioning motor. (0%, 30%, 100%).

The control unit for the flaps and cooling-air control is positioned beside the passenger seat.

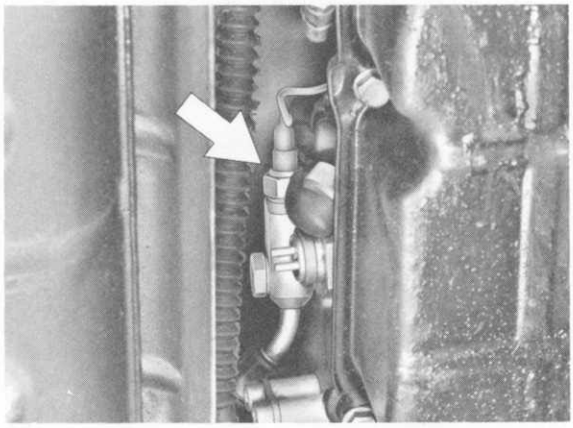


Cooling-water temperature sender



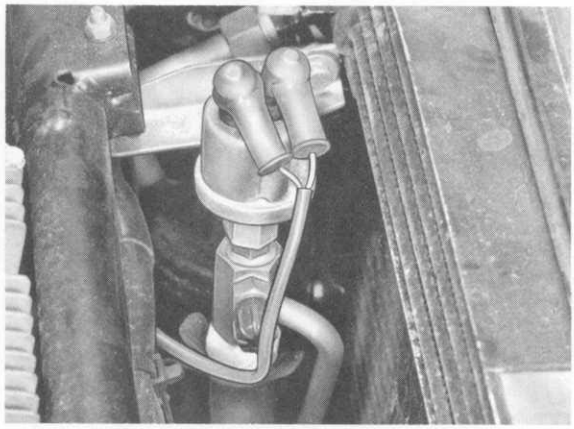
Tightening torque: 30 Nm (22 ftlb)

Temperature switch, automatic transmission



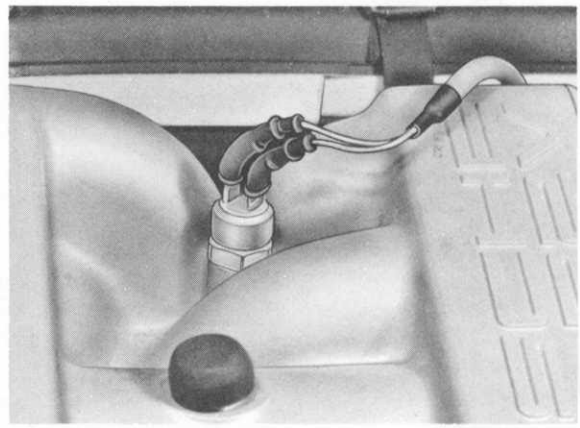
Tightening torque: 30 Nm (22 ftlb)

Pressure sender, Frigen



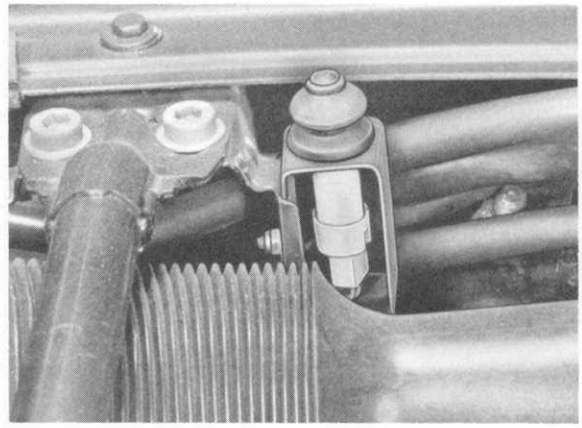
Tightening torque: 30 Nm (22 ftlb)
M 4 nut : 1 Nm (0.7 ftlb)

Temperature switch, intake

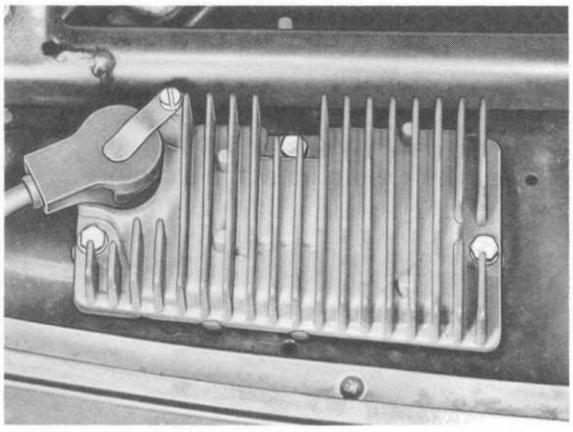


Tightening torque: 40 Nm (30 ftlb)

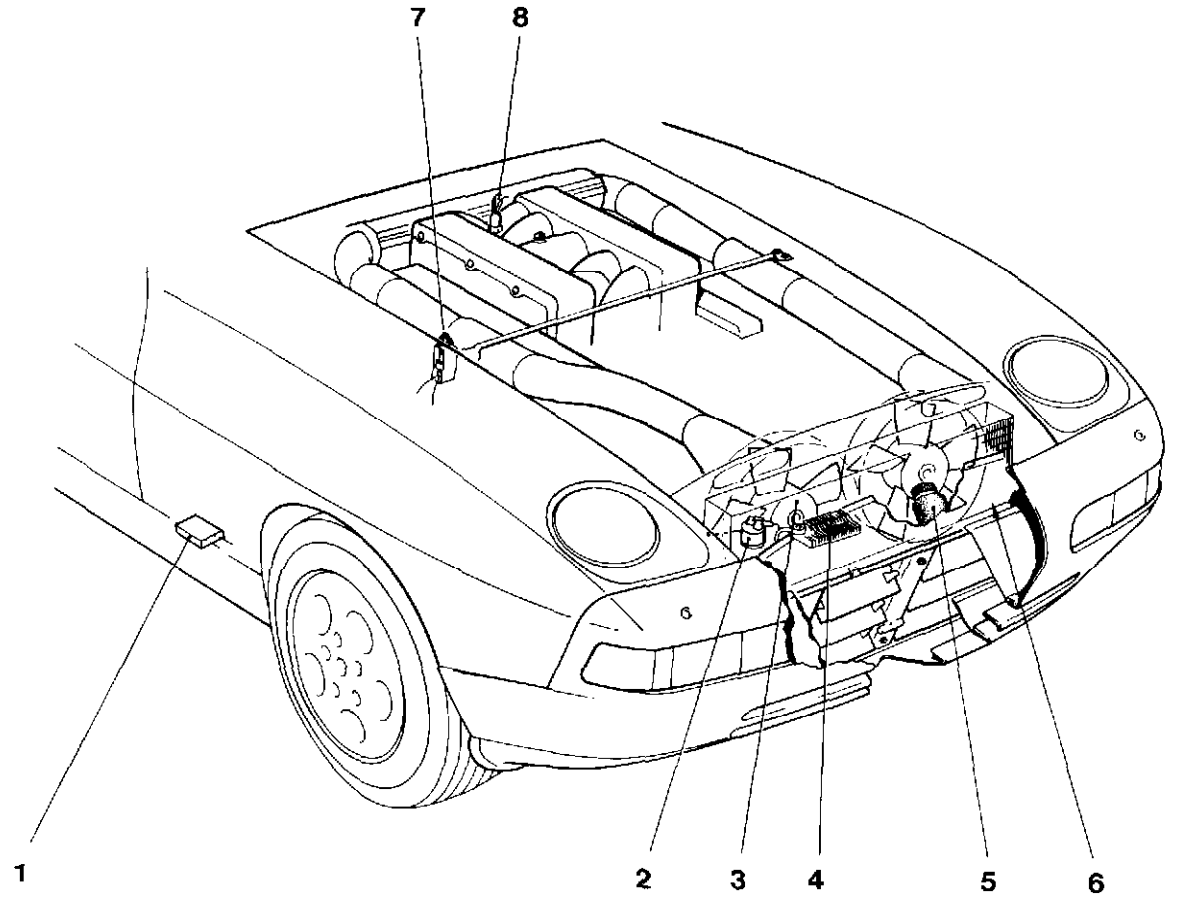
Engine-compartment lid switch



The output stage receives a square signal from the control unit. The output stage contains two mutually independent output-stage modules with separate protective circuits: each module controls a separate cooler fan.



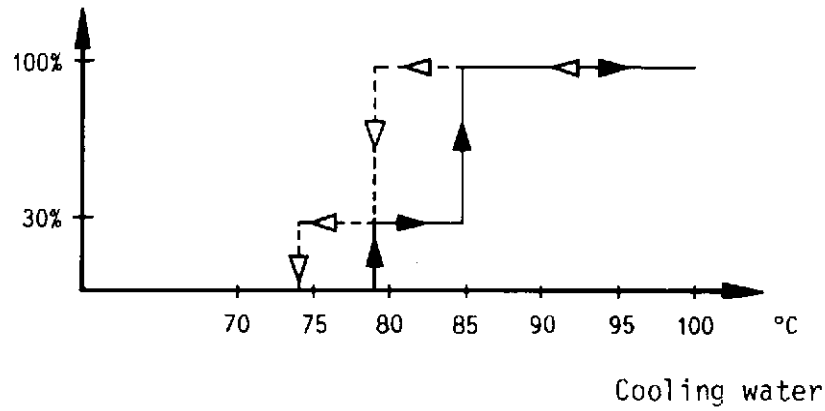
If a fault occurs, the cooling-air flaps are opened to the 100% setting and the intact fan operates at full speed, while the faulty fan is switched off. A check is made approx.every 20 seconds to ascertain whether the fault persists.



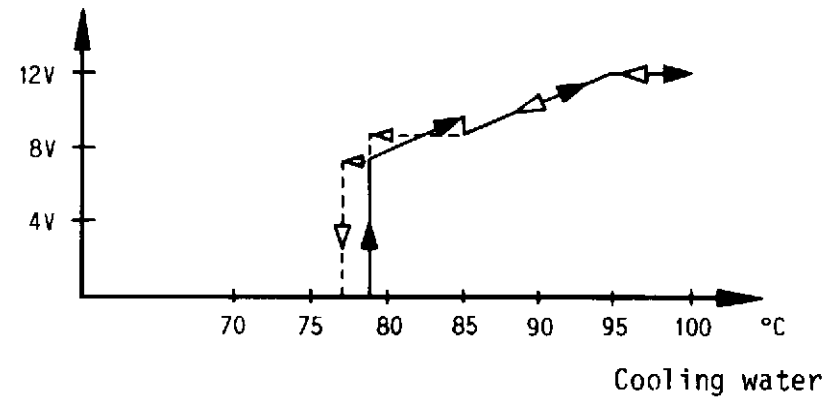
1. Control unit
2. Pressure sender, Frigen
3. Engine fan
4. Output stage
5. Flap positioning motor
6. Temperature sender, cooling water
7. Engine-compartment lid switch
8. Temperature switch, intake

Temperature sender, cooling water

Flap position

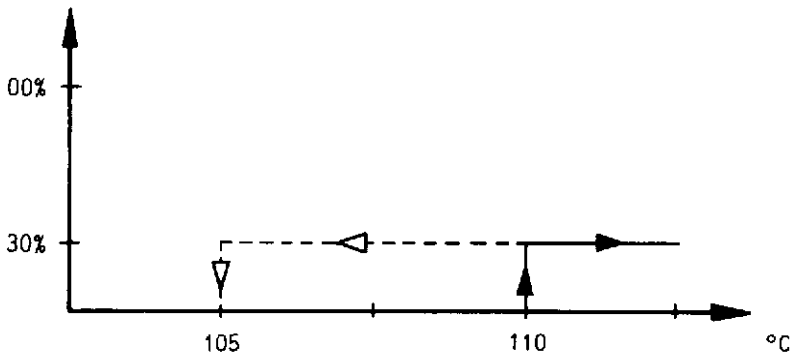


Fan voltage



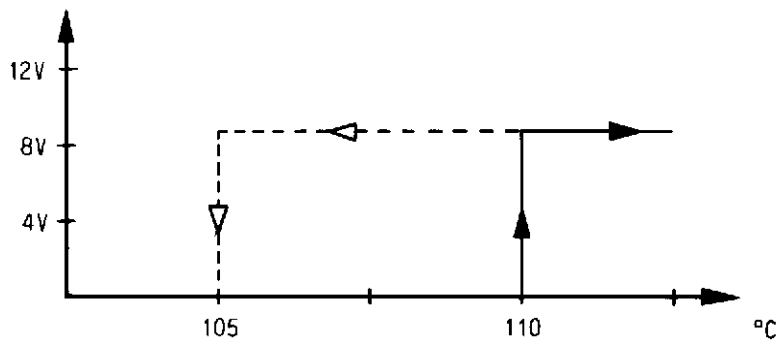
Temperature switch, automatic transmission

Flap position



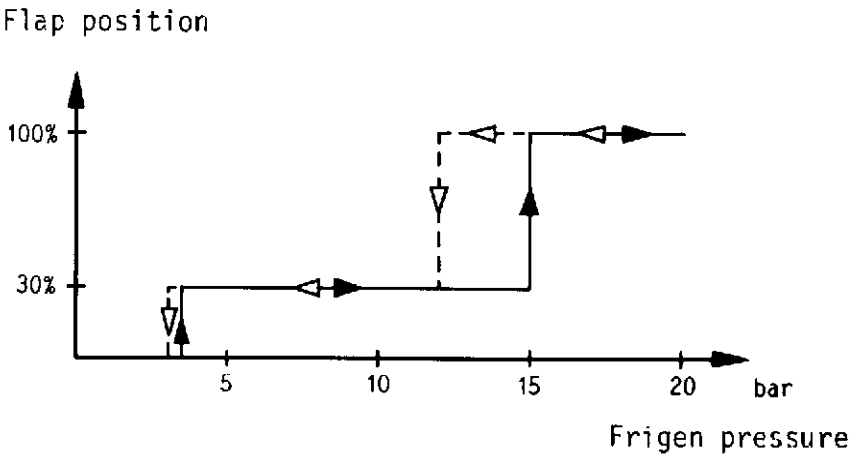
Temperature switch, automatic transmission

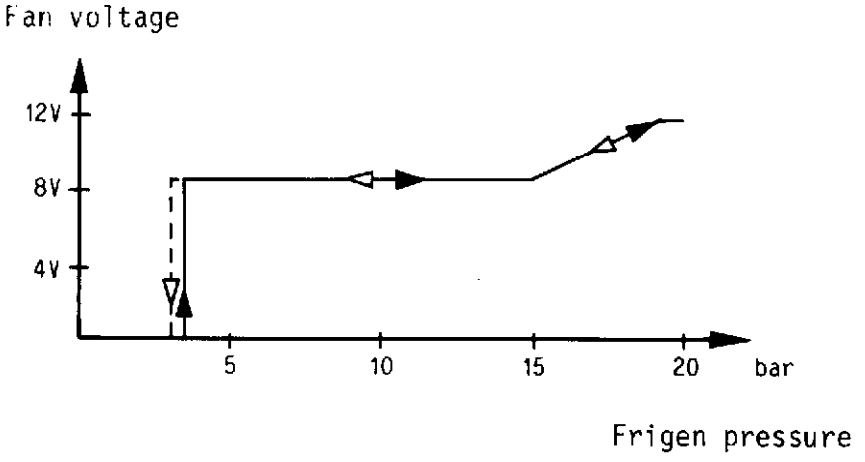
Fan voltage



Temperature switch, automatic transmission

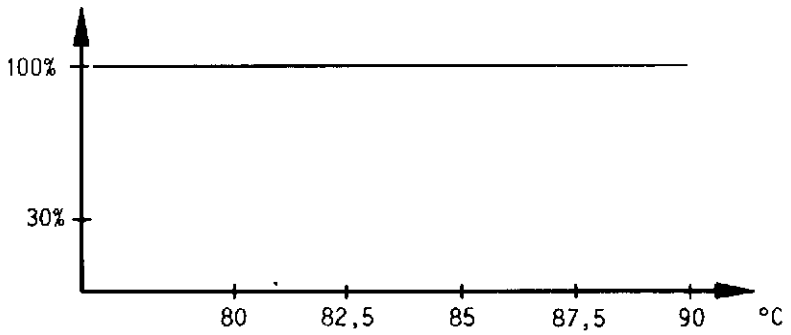
Pressure sender, Frigen





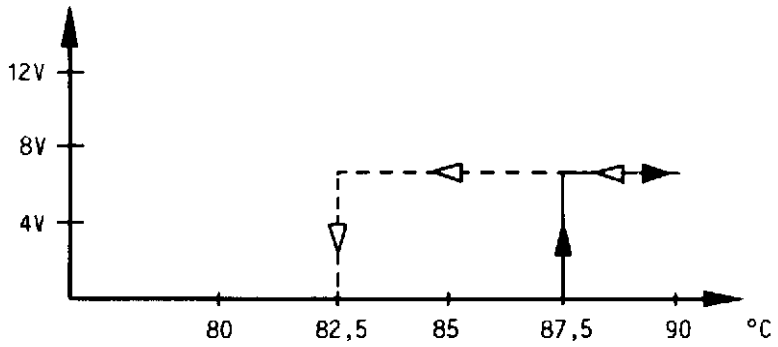
Run-on

Flap position



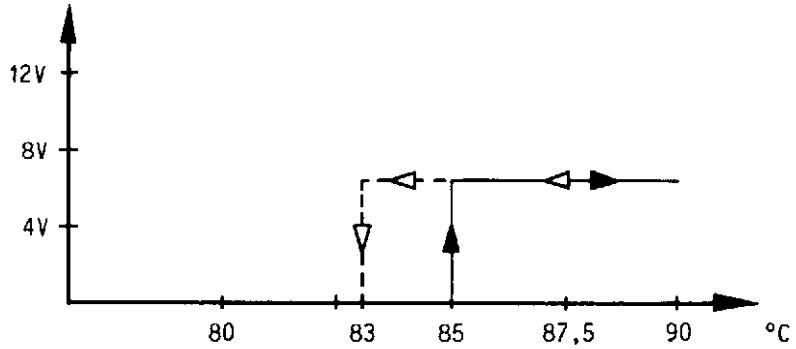
Intake temperature/
cooling water temperature

Fan voltage



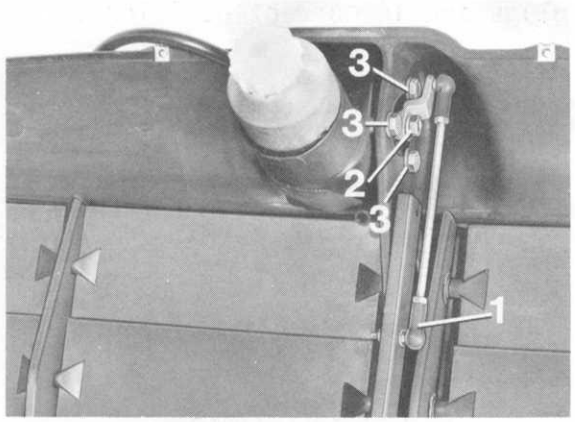
Intake temperature

Fan voltage



Cooling water

REMOVING COOLING-AIR FLAP MOTOR



1.) Detach actuating linkage at ball joint (1).

2.) Remove nut from drive axle (2).

3.) Remove three nuts holding flap-positioning motor (3).

4.) Disconnect connector at joint.

INSTALLING

When installing, ensure that engine temperature is less than 74°C.

1.) Re-connect connector

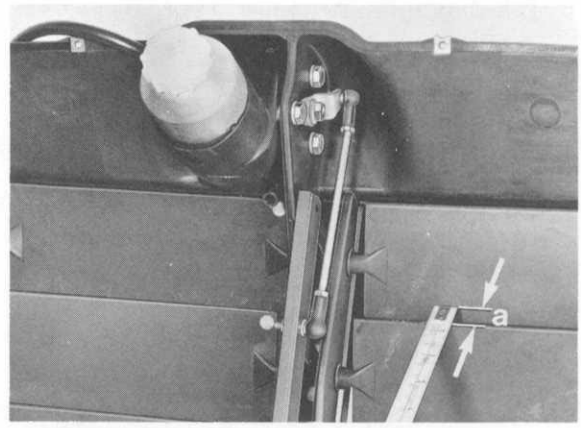
2.) Switch ignition on.
Flap positioning motor moves to 0% position.

3.) Tighten securing nuts (3 nuts).

4.) Set adjusting arm so that the air flaps are in the 0% position when the actuating rod is installed.

5.) Press AC button
The positioning motor moves to the 30% position.

6.) Check distance a
a = 16.5 ± 2 mm.



The 100% position is set off the 0% or 30% position.

REMOVING AND INSTALLING FANS

1.) Disconnect battery.

2.) Remove both mounting bolts.



3.) Cut cable holders.

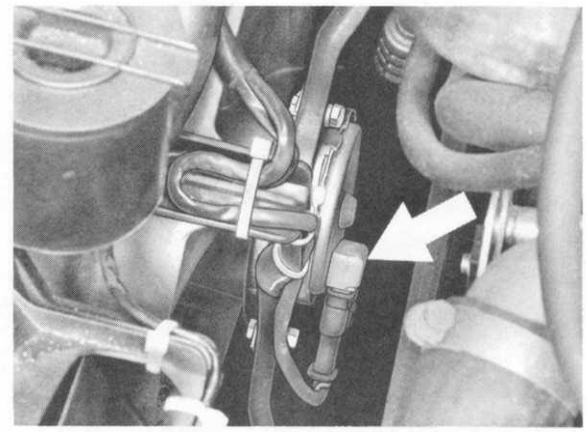
4.) Remove plugs from fans.

5.) Remove hose clamp from air filter (auxiliary air pump).

6.) Remove hose clamp from oil reservoir (servo oil).



When installing fans, ensure that plugs are in correct positions.

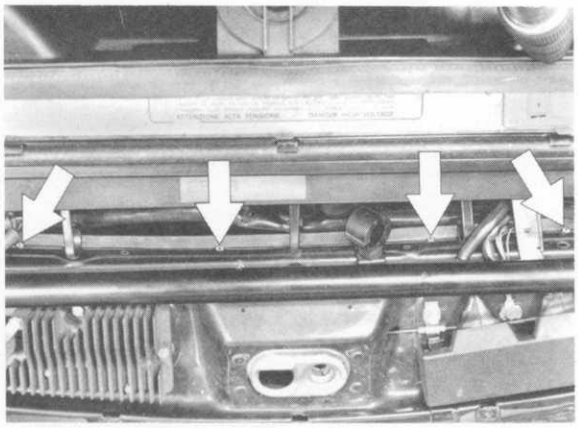


REMOVING AND INSTALLING COOLING-AIR FLAPS

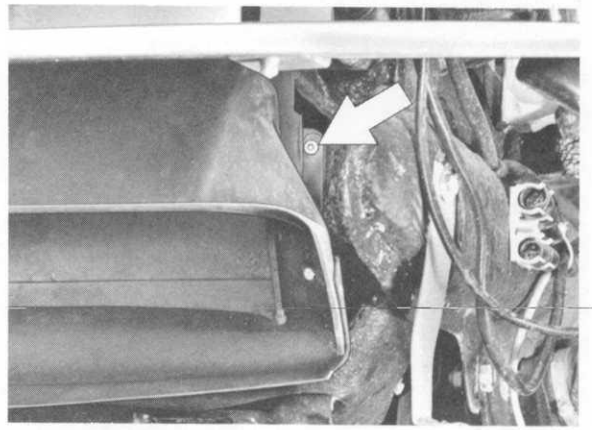
Removing and installing front air dam: see Repair Group 66.

Removing and installing PU part: see Repair Group 63.

Remove securing bolts.



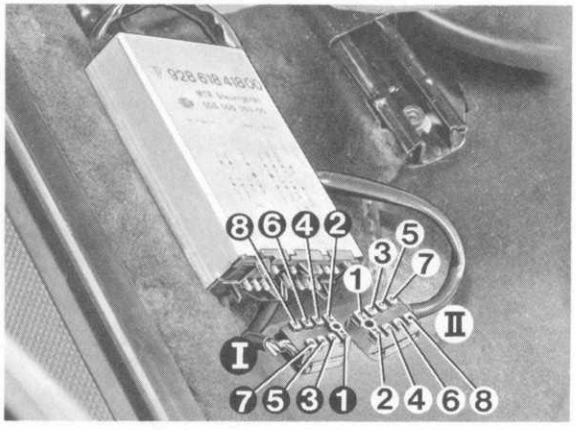




Disconnect plug of flap positioning motor at coupling.

TROUBLESHOOTING

Disconnect plug I and plug II from control unit.



1.) Test voltage supply

Connect voltmeter to pin 2 (plus) and pin 7 (minus) of plug I

Reading: battery voltage

2.) Connect voltmeter to pin 4 (plus) and pin 7 (ground) of plug I

Ignition on

Reading: battery voltage

Ignition off

Reading: 0 V

Function test of AC button

Connect voltmeter to pin 7 (ground) of plug I and pin 5 (plus) of plug II

Ignition on

Press AC button

Set the air-distribution slide switch to up/down.

Reading: battery voltage

Function-testing the individual senders with an ohmmeter.

1.) Temperature sender, cooling water

A resistance of between 1000 ohm and 4000 ohm, depending on engine temperature, should be measurable between pin 1 of plug II and pin 7 of plug I.

Reading:

60°C = 3862 ohm ± 150 ohm
85°C = 1582 ohm ± 54 ohm
100°C = 967 ohm ± 36 ohm

2.) Pressure sender, Frigen

Pin 4, plug II and pin 7, plug I.
Resistance is between 20 ohm and 150 ohm, depending on Frigen pressure.

Reading.

1.5 bar = 22 ohm ± 4 ohm
5 bar = 53 ohm ± 4 ohm
10 bar = 92 ohm ± 5 ohm
15 bar =125 ohm ± 5 ohm

3.) Engine-compartment lid switch

Pin 6, plug II and pin 7, plug I

Engine-compartment lid closed

Reading: ∞ ohm

Engine-compartment lid open

Reading: 0 ohm - 20 ohm

4.) Temperature switch intake/ automatic transmission

Pin 3, plug II and pin 7, plug I

Intake temperature > 87.5°C

Reading: 0 ohm

Intake temperature < 82.5°C

Reading: ∞ ohm

Temperature switch, automatic transmission

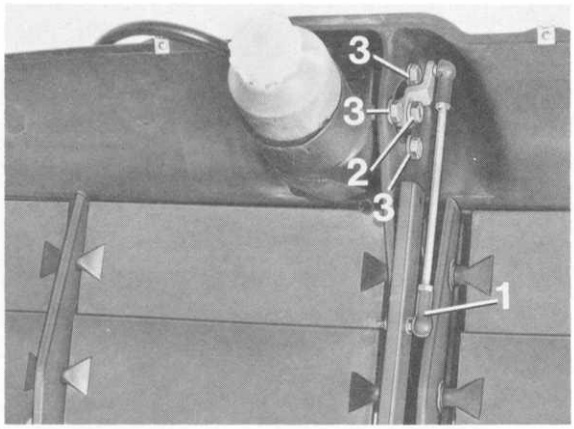
> 110°C reading: 0 ohm
< 105°C reading: ∞ ohm

If the values stated are not reached, the sender in question is defective.

Function-testing the flap positioning motor

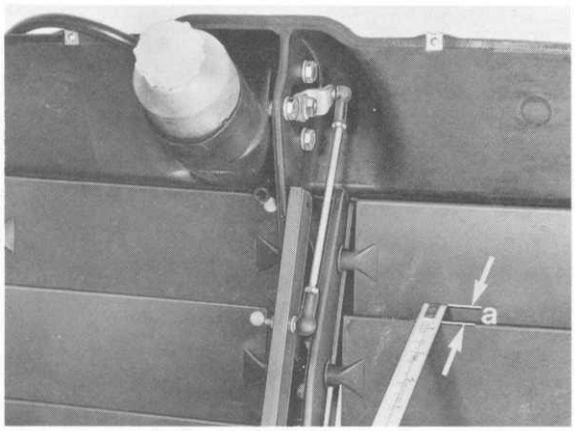
With a length of cable, connect pin 7 (ground) of plug I to pin 5 (0%) of plug I (approx. 2 - 4 seconds).

The flap positioning motor moves to the 0% position.



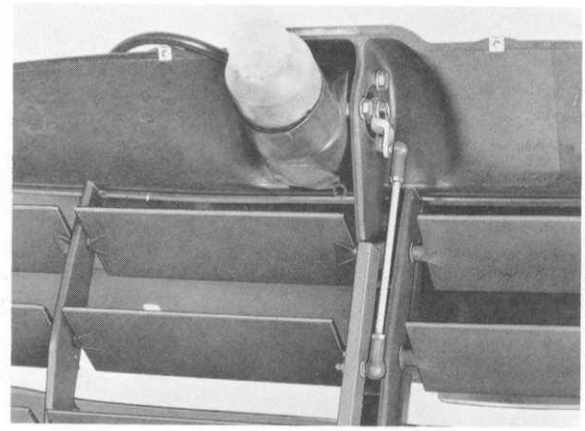
Connect pin 7, plug I and pin 2, plug II (approx. 2 - 4 seconds).

The flap positioning motor moves to the 30% position.



Connect pin 7, plug I and pin 1 (100%) (approx. 2 - 4 seconds).

The flap positioning motor moves to the 100% position.



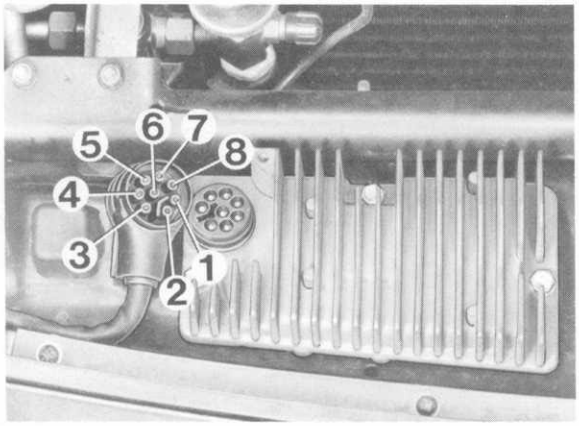
If the flap positioning motor fails to assume one of the positions stated, use an ohmmeter to check the conductivity of the control unit - flap positioning motor wire harness.

If the wire harness is OK the flap positioning motor is defective.

Function-testing the output stage

1.) Plugs I and II must be connected to the control unit.

2.) Checking voltage supply.



Connect voltmeter to pin 3 (ground) and pin 4 (plus) of the fan output-stage plug connector.

Reading: battery voltage

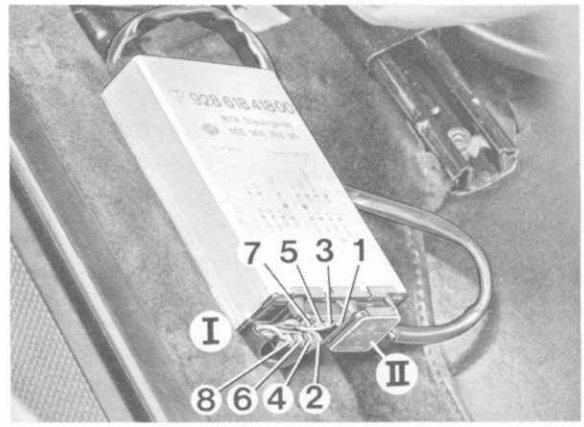
3.) Connect voltmeter to pin 3 (ground) and pin 2 (plus).

Ignition on

Reading: battery voltage

4.) Function-testing the control signal of the output stage.

Reconnect output-stage plug connector. Remove cover from plug I of control unit.



Engine temperature < 79°C (175°F)

Measure the voltage with an analog voltmeter with an external resistance (Ri) 100 kOhm.

Pin 7, plug I (ground) and pin 6 (plus).

Ignition on

Press AC button

Set the air-distribution slide switch to up/down.

Reading: approx. 7 V

Pin 7, plug I (ground) and pin 8 (plus).

Ignition on

Press AC button

Set the air-distribution slide switch to up/down.

Reading: approx. 7 V

If both fans refuse to operate when the AC button is pressed while the ignition is on, the output stage is defective.

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Ignition System

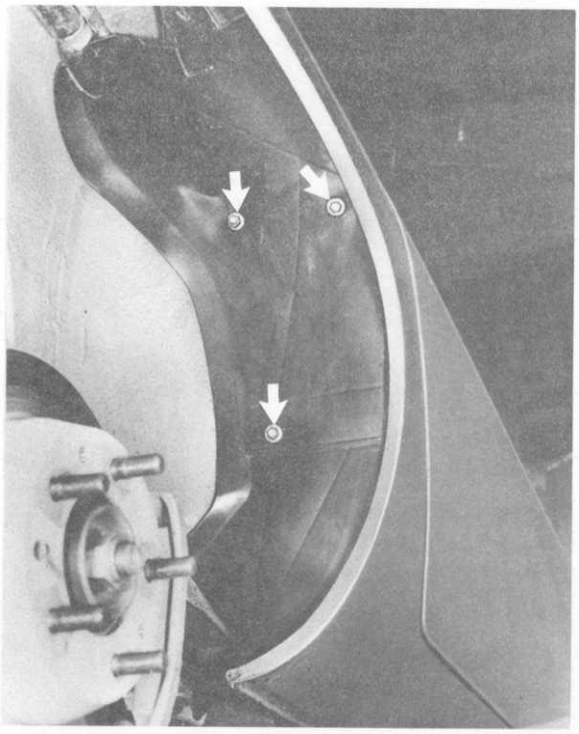
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REPLACING FUEL FILTER - up to 1980 Models

Remarks

Fuel filter is located in right rear wheel house behind lock pillar.



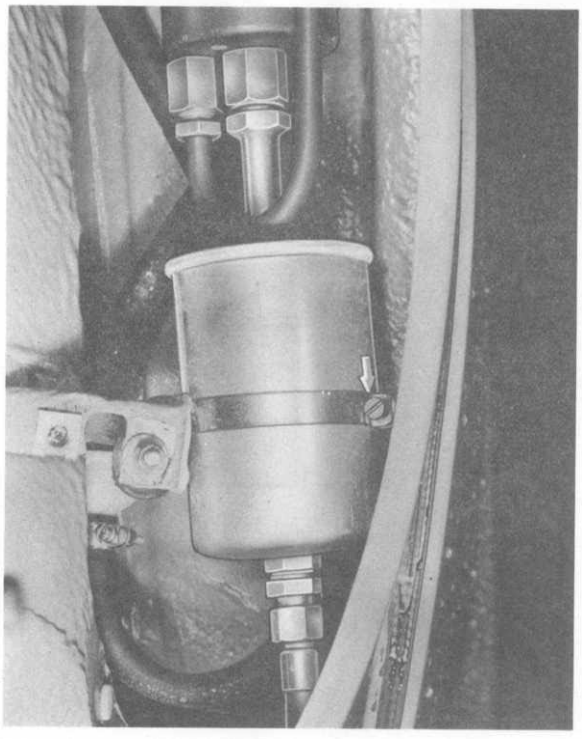
1. Take off cover.

2. Detach fuel lines, while counterholding. Catch escaping fuel.

3. Loosen clamp and take off fuel filter.

4. Install new filter, noting direction of flow (arrow).

5. Check for leaks.



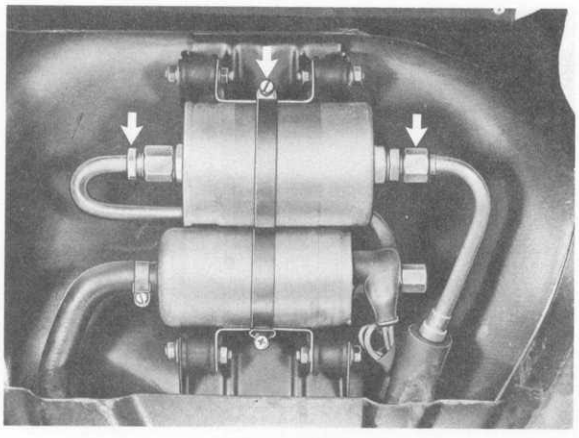
REPLACING FUEL FILTER - from 1980 Models

1. Disconnect ground wire at battery.

2. Take cover off of fuel tank at bottom.

3. Disconnect fuel lines, not forgetting to counter-hold. Catch escaping fuel.

4. Loosen clamp and take off fuel filter.



5. Install new filter. Watch direction of flow (arrow faces fuel distributor).

6. Check for leaks.

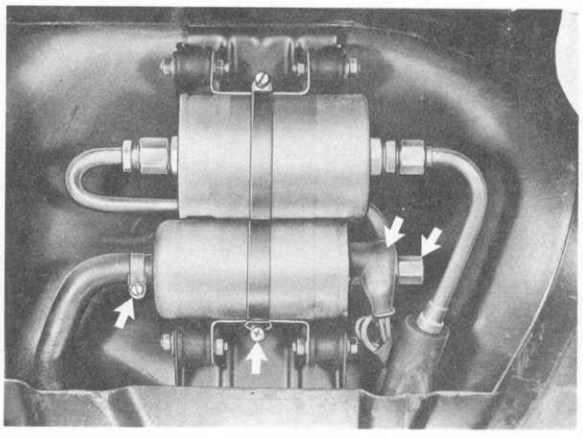
REMOVING AND INSTALLING FUEL PUMP

Removing

1. Disconnect ground wire at battery.

2. Take cover off of fuel tank at bottom.

3. Pinch intake line with VW 647 clamp and detach hose. Disconnect electric wires, unscrew hollow bolt, loosen fuel pump clamp and take off fuel pump. Catch escaping fuel.



Installing

Use a new seal on the hollow bolt.

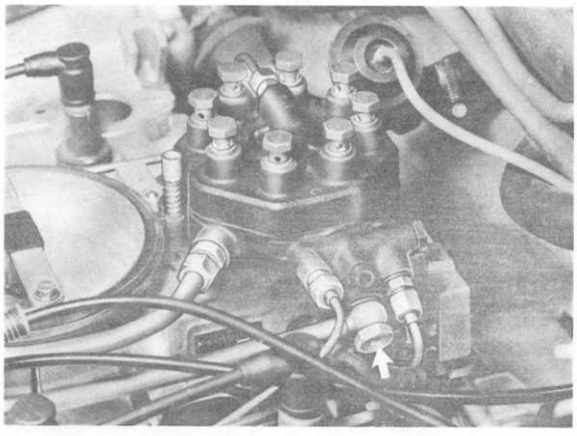
Printed in Germany

CHECKING DELIVERY RATE OF FUEL PUMP - CONTINUOUS INJECTION SYSTEM

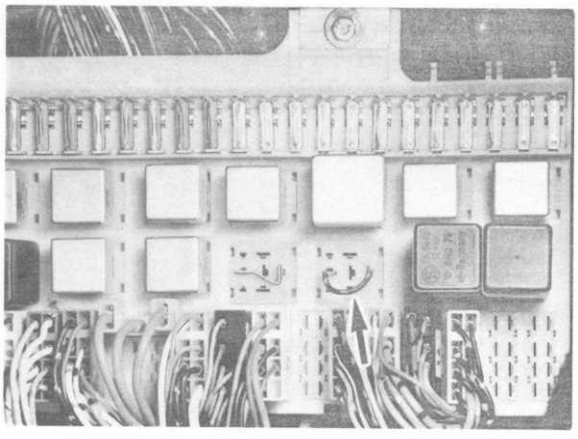
Requirements:
Fuel filter and power supply okay.

1. Take off air cleaner assembly.

2. Remove fuel return line from fuel distributor and connect a suitable test hose in its place (test hose with 12 mm dia. ring connector).



3. Bridge fuel pump relay socket terminals 30 and 87.



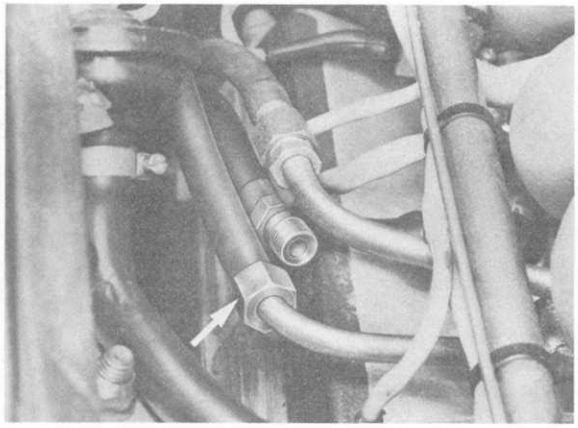
4. Hold end of test hose in a measuring glass.

5. Bridge fuel pump circuit for duration of specified measuring time and measure delivery rate.

CHECKING FUEL PUMP DELIVERY - AFC

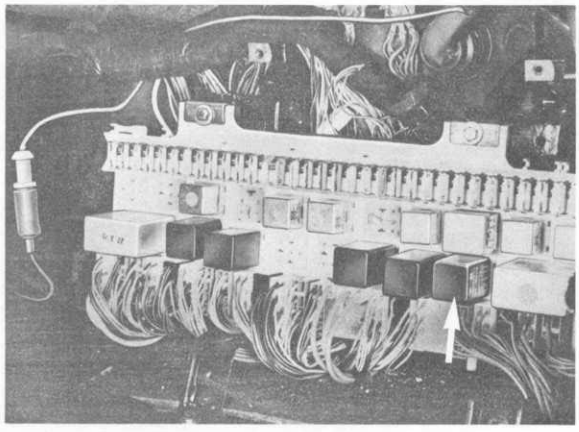
Requirements:
Fuel filter and power supply okay.

1. Disconnect fuel return line in engine compartment.

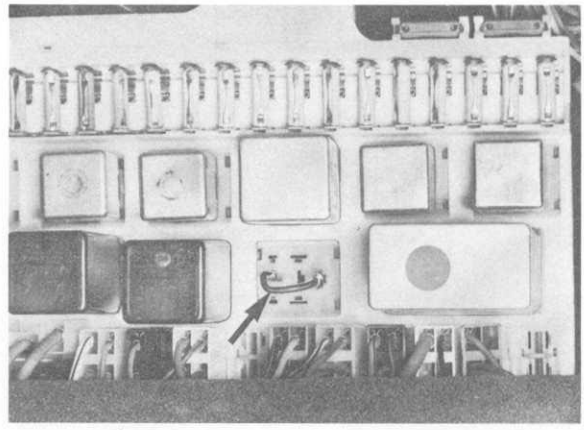


2. Hold end of fuel return hose from pressure regulator in a measuring glass (approx. 1500 cc).

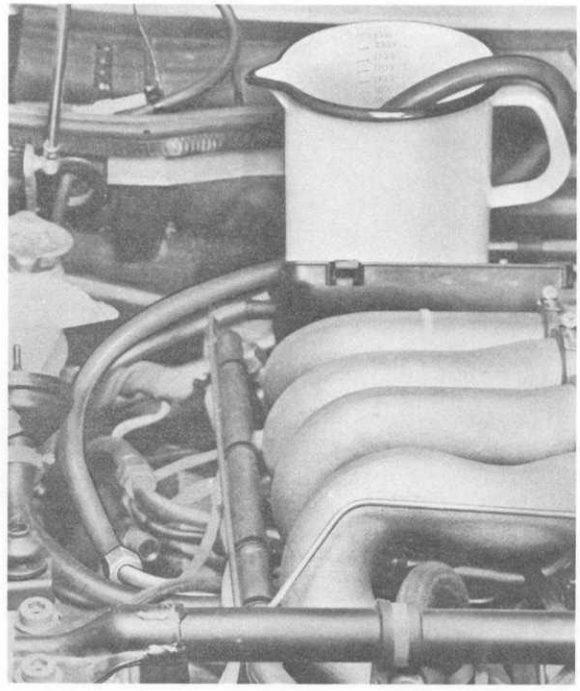
3. Unplug fuel pump relay from central electric board.



4. Bridge terminals 30 and 87 with an extra wire.



5. Let fuel run into measuring glass for 30 seconds. See page 24 - 1 for test values.

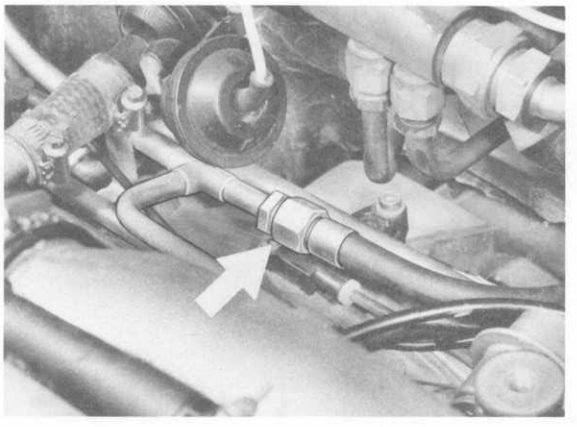


CHECK FUEL PUMP DELIVERY – LH-JETRONIC

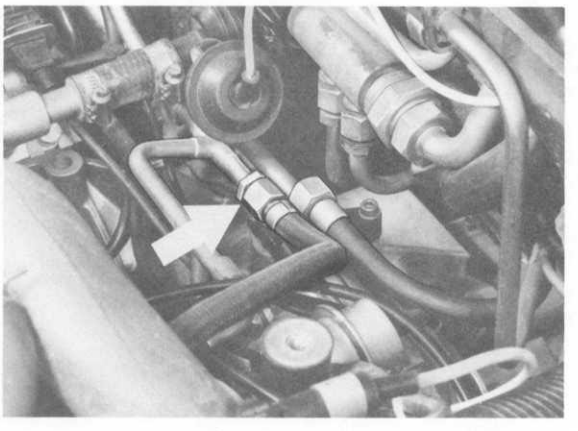
Beginning with 1984 Models

Requirements:
Fuel filter and power supply okay.

1. Disconnect fuel return line in rear of engine compartment while counterholding (essential).

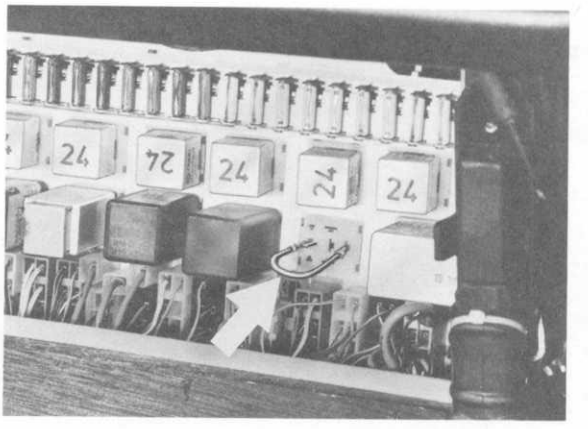


2. Connect a commercially available fuel hose.

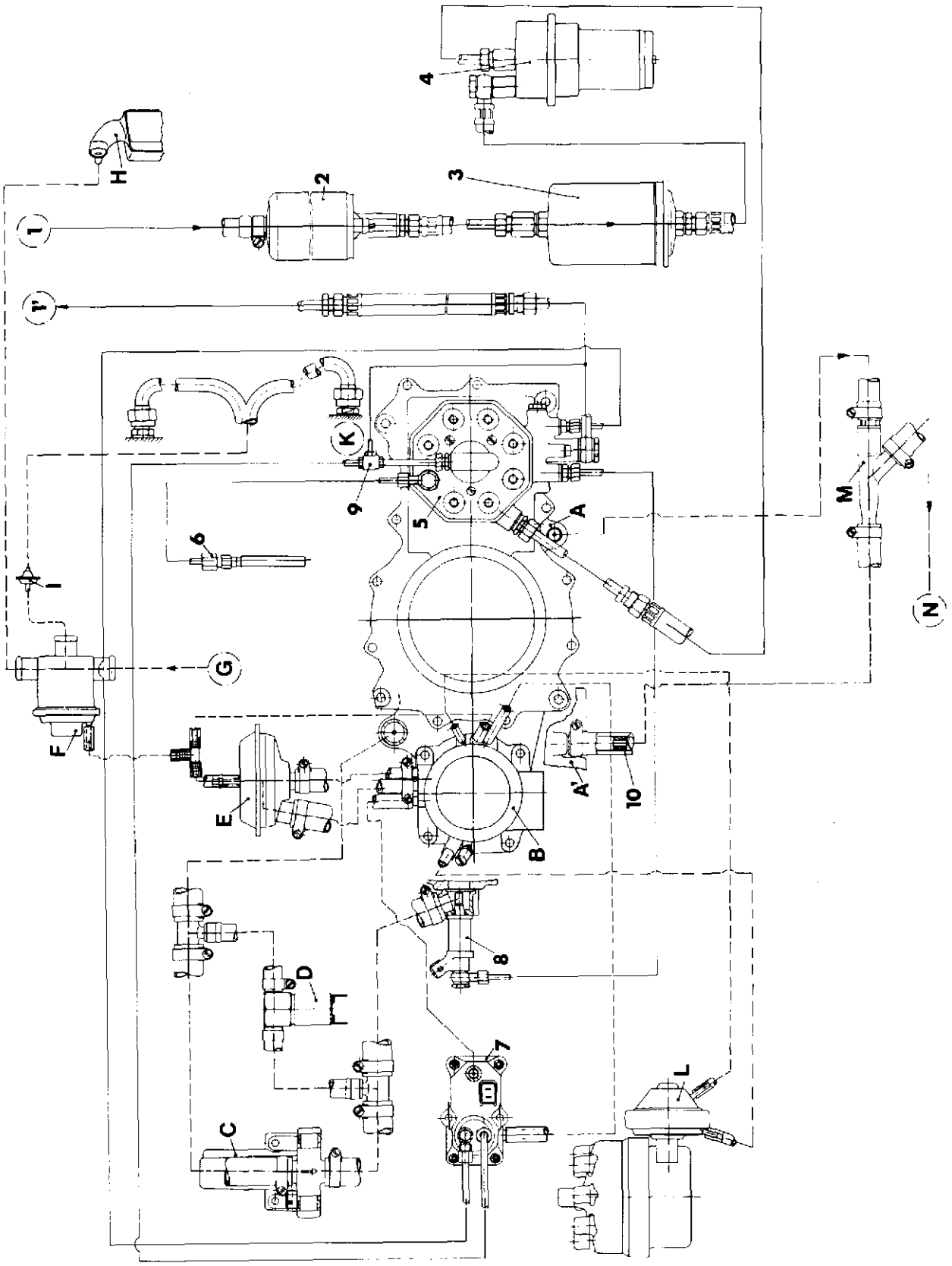


3. Hold end of test hose in a measuring glass (approx. 2000 cc).

4. Pull off fuel pump relay on central electric board and bridge terminals 30 and 87 with an extra wire for 30 seconds.



5. See page 24 - 121 for test values.


4
H
2
3
1
1'
K
9
5
A
6
M
I
N
G
F
E
A'
10
B
8
D
7
L
C

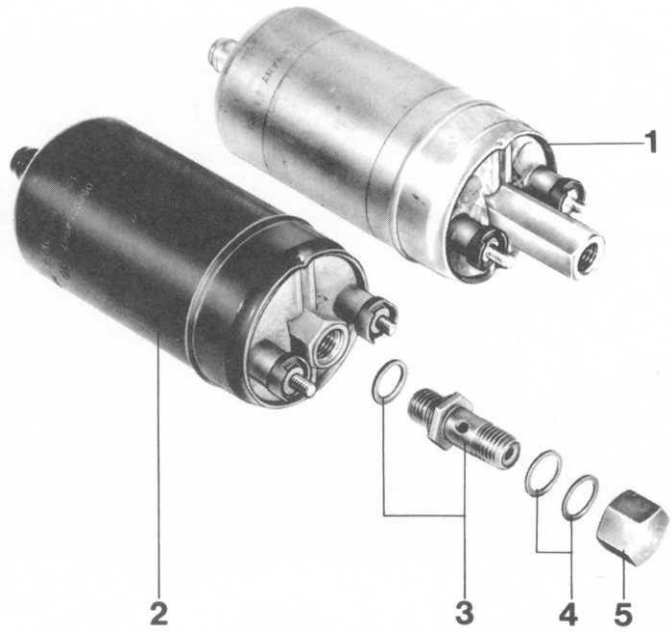
HOSE PLAN FOR K-JETRONIC SYSTEM 928

1 - From fuel tank
1' - To fuel tank
2 - Fuel pump
3 - Fuel filter
4 - Fuel pressure reservoir
5 - Fuel distributor
6 - Fuel injector(s)
7 - Warm-up control
8 - Cold start valve
9 - Solenoid valve
10 - Hose orifice

A - Air guide housing
A' - Intake distribution housing
B - Throttle housing
C - Throttle bypass valve
D - Solenoid valve (only for A/C)
E - Booster valve (vacuum control)
F - Blowoff switching valve
G - From auxiliary air pump
H - To air cleaner
I - Check valve
K - To exhaust ports
L - Ignition control
M - Suction ejection pump
N - To brake booster

—— Fuel
--- Air/vacuum

ARRANGEMENT OF CHECK VALVES ON FUEL PUMPS



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Fuel pump (long neck version with integrated check valve)	1			
2	Fuel pump (new version since 1981 models)	1			
3	Check valve with seal	1		Always replace seal. Torque: 20 Nm (14 ftlb)	
4	Seal	2		Always replace	
5	Cap nut	1		Torque: 20 Nm (14 ftlb)	

REPLACING CHECK VALVE

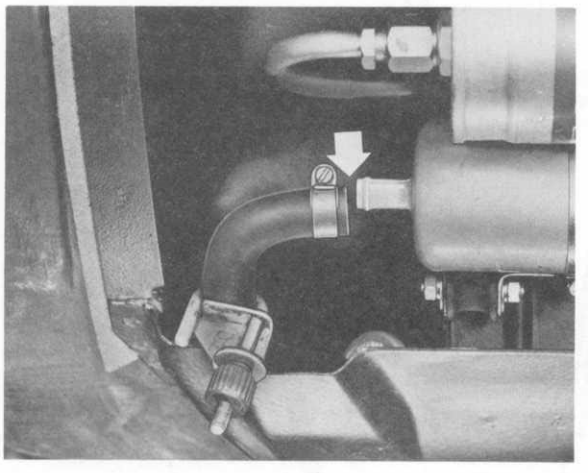
Caution!

Conform with safety regulations for working on fuel systems!

Removing

1. Remove fuel tank cover at bottom.

2. Pinch fuel intake hose with a standard hose clamp and detach hose.



3. Disconnect electric wires.

4. Disconnect hose on pressure side of fuel pump by unscrewing cap nut. Catch escaping fuel.

5. Unscrew check valve, while holding on hexagon of fuel pump with a narrow (machined) open-end wrench.

Installing

1. Screw in new check valve with a new seal.
   For long neck version fuel pumps the new check valve is installed in addition to the check valve integrated in the pump.

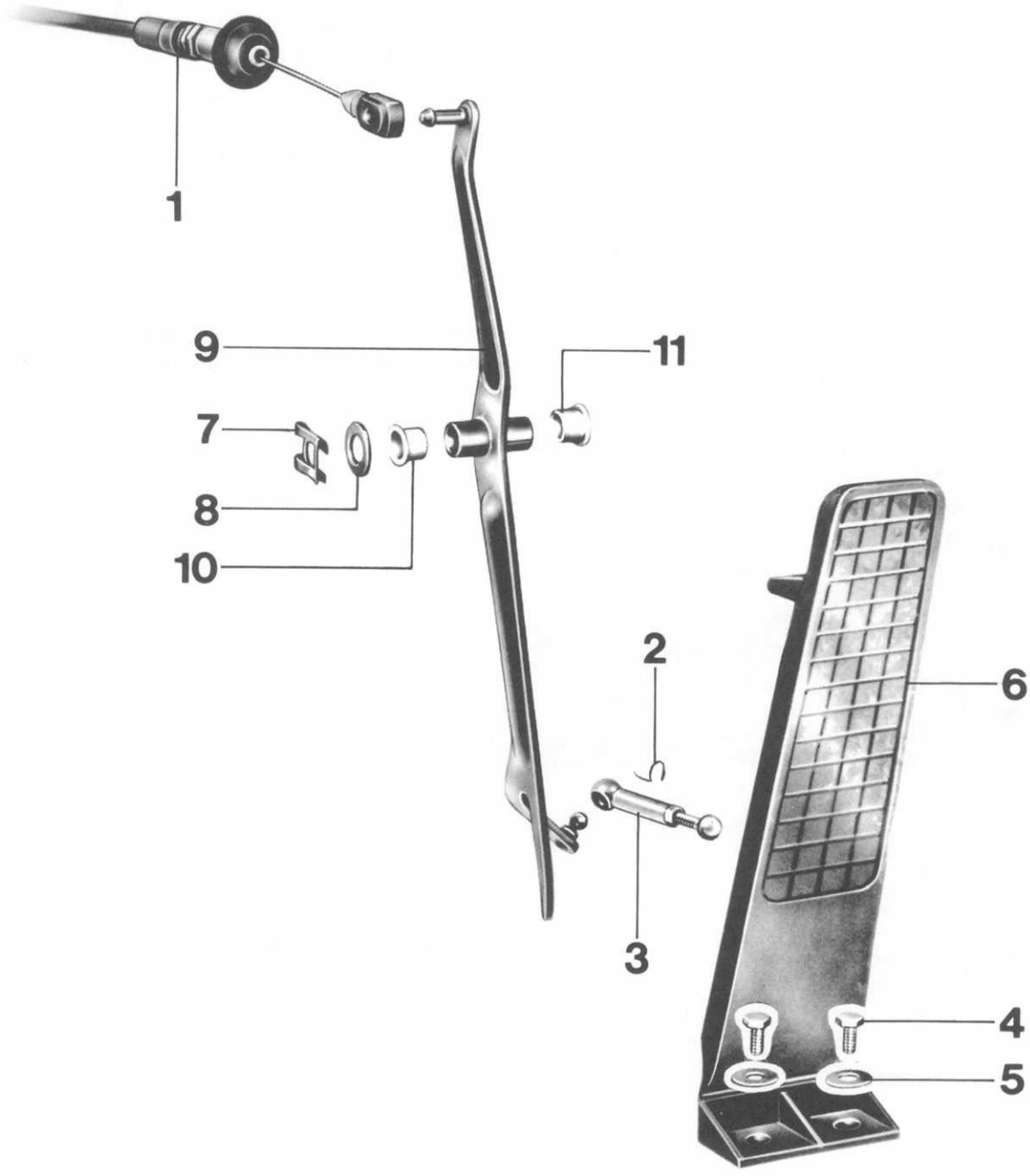
2. Install fuel line with ring adapter and new seals, and secure with cap nut.

Important!

Make sure fuel hose is routed correctly and cannot rub before tightening the cap nut.

3. Remove hose clamp and check for leaks. Install cover again.

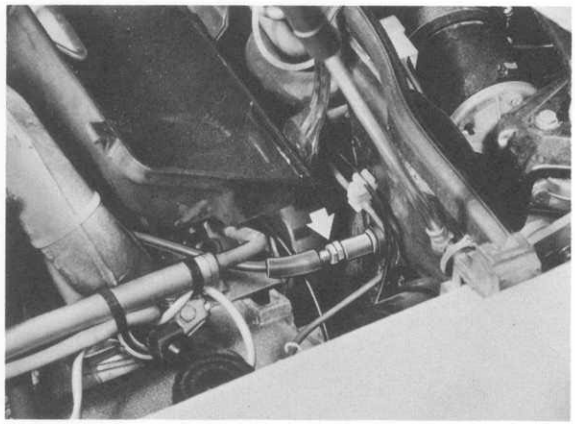
DISASSEMBLING AND ASSEMBLING ACCELERATOR PEDAL



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Throttle cable	1			
2	Lock	1			
3	Push rod	1		Adjust push rod to 48 ± 1 mm for LHD (between ball head centers) and connect	
4	Bolt	2			
5	Washer	2			
6	Accelerator pedal	1			
7	Lock	1			
8	Washer A 10.5	1			
9	Operating lever	1			
10	Bearing	1		Check, replace if necessary and lubricate with multipurpose grease	
11	Bearing	1			

ADJUSTING FULL LOAD POSITION OF THROTTLE

The throttle linkage has to be adjusted so that there is at least 1 mm play on the throttle lever when the accelerator pedal is floored.



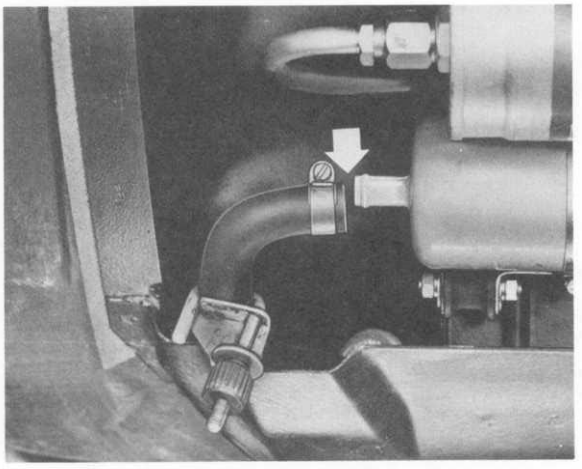
REMOVING AND INSTALLING FUEL TANK

Removing

1. Disconnect ground wire at battery.

2. Draw off fuel.
   Caution!
   Conform with safety regulations for working on fuel systems.

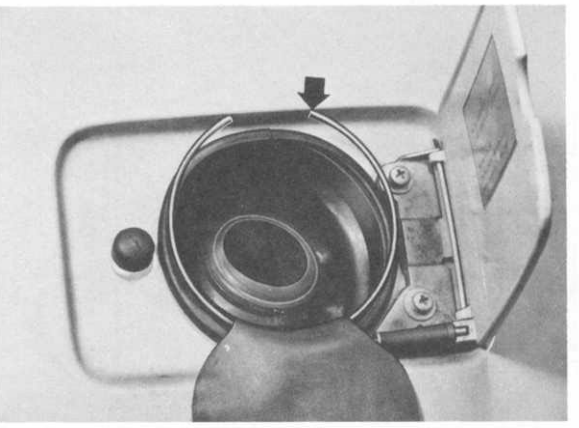
3. Take off bottom tank cover. Pinch fuel intake hose with a standard hose clamp and detach hose on fuel pump.



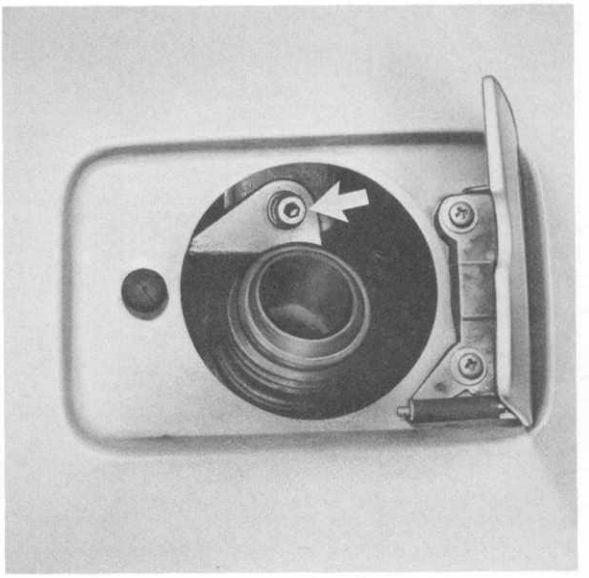
4. Fold back floor mat. Remove cover on fuel lever transmitter. Disconnect hose and electric wire plug on fuel level transmitter.

5. Unscrew hose clamp and pull off breather hose on fuel expansion tank.

6. Remove retainer with guards and grommet.

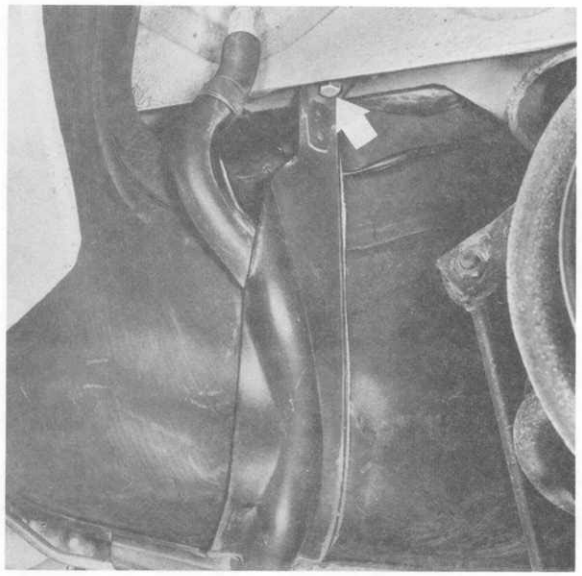


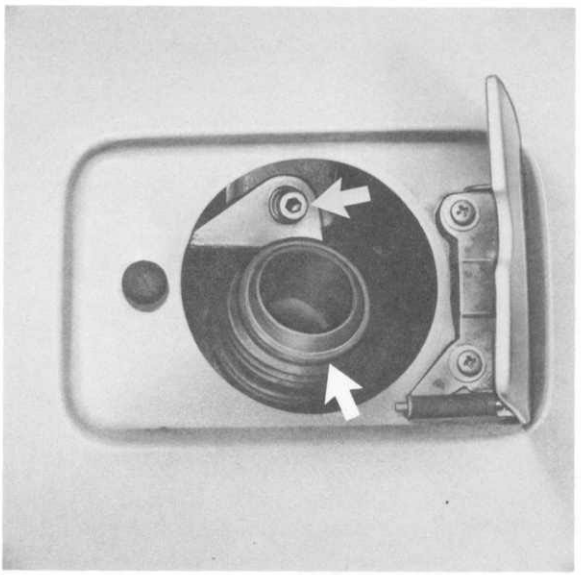
7. Unscrew bolt at upper fuel tank mounting point.



8. Unscrew four mounting points for retaining straps and let complete suspension with fuel pump and fuel filter hang down on one side.

2. Make sure seal fits correctly in tank filler neck.

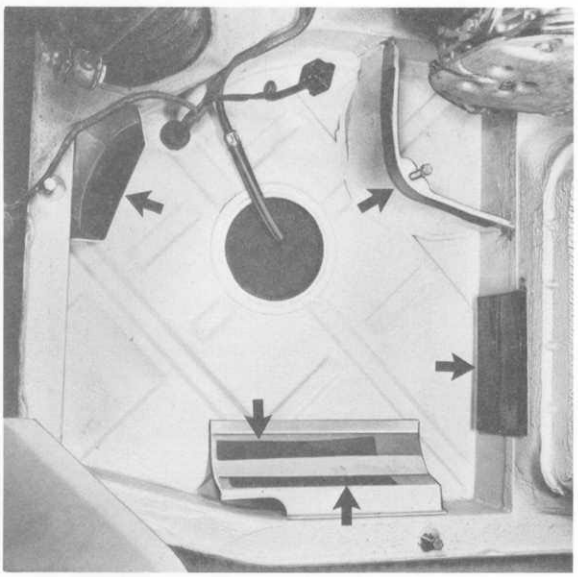




9. Remove fuel tank from below.

Installing

1. Check suspension points for correct fit before installing fuel tank.



REMOVING AND INSTALLING INITIAL FUEL PUMP IN TANK (JAPAN)

Note

Conform with safety regulations for working on fuel systems!

Removing

1. Disconnect ground wire at battery.

2. Draw off fuel.

3. Remove bottom tank cover. Pinch fuel intake hose with a standard hose clamp.

4. Disconnect 4 mounting points of suspension straps and let complete suspension with fuel pump and fuel filter hang down to one side.



5. Disconnect electric wire plugs, hose clamp and pump in tank, and remove. Catch escaping fuel.

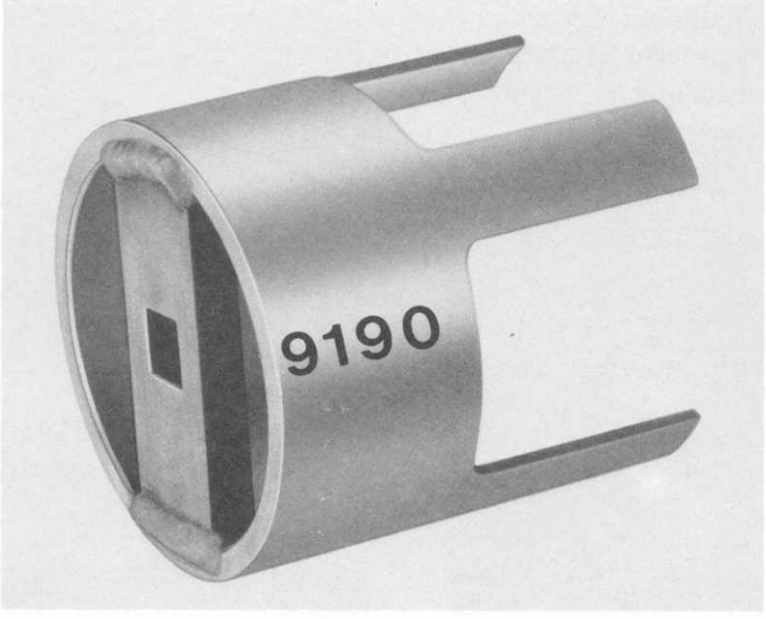
Installing

1. Always use a new gasket.

2. Tightening torque for pump in tank: 25 Nm.

REMOVING AND INSTALLING
FUEL TANK SENSOR

TOOL



No.	Designation	Special tool	Remarks
	Pin wrench	9190	

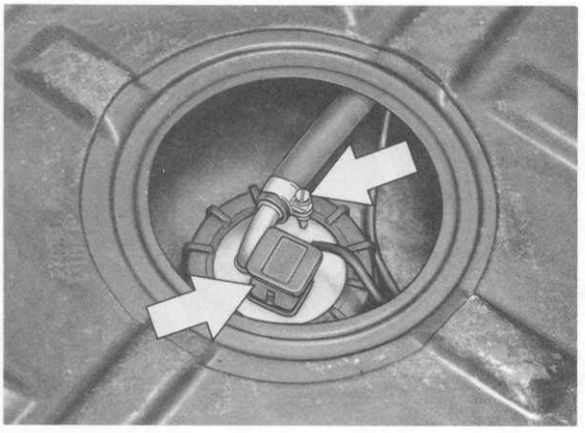
Removing and installing the fuel tank gauge unit

Note

When working on the fuel system, observe relevant safety requirements. Do not remove the gauge unit while the tank is full.

Removal

1. Remove luggage compartment floor covering. Remove cover of fuel tank gauge unit. Undo hose clamp, disconnect fuel return hose and electrical connector.



2. Undo union nut using Special Tool 9190. Take gauge unit complete with gasket.

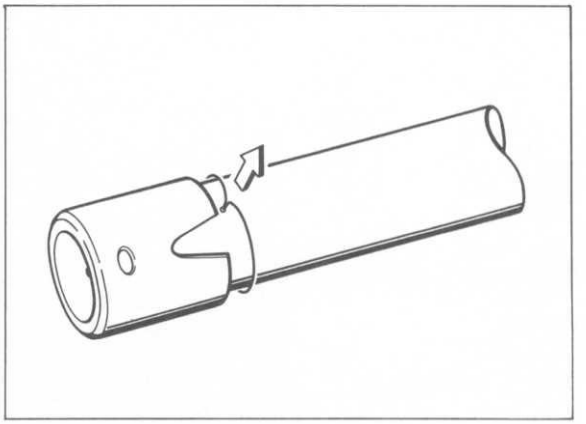
Installation

1. Always use a new gasket. Coat threads and seating area of union nut with Optimoly TA.

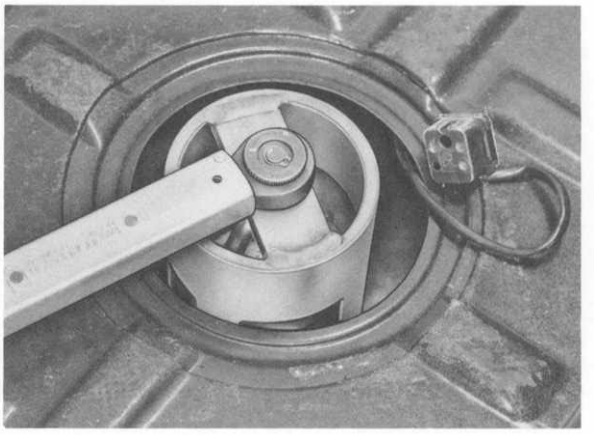
Note

TO facilitate assembly, immerse the union nut into hot water (heated to approx. 60 to 70 deg. C) for approx. 8 minutes.

2. Before fitting a new tank gauge unit, remove the transport protector.



3. Tighten union nut to a torque of 35 ± 5 Nm (26 ± 4 ftlb) using Special Tool 9190.



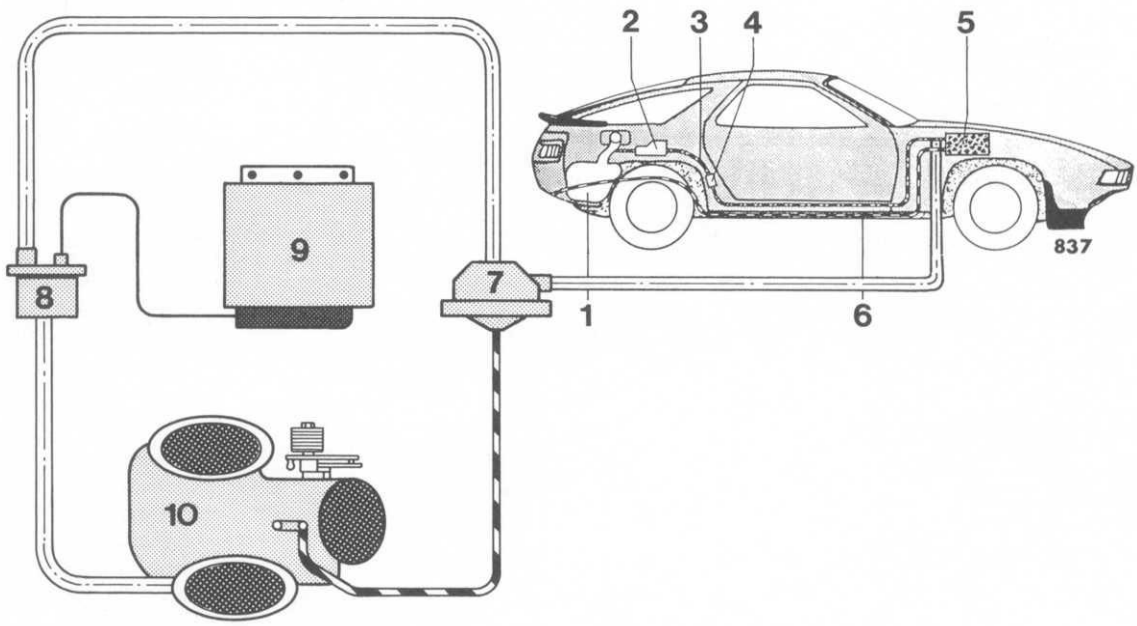
4. When fitting the fuel return hose, make sure the screw of the hose clamp does not contact the union nut or the fuel tank gauge unit.

Printed in Germany – XXVII, 1991

ACTIVATED CHARCOAL CANNISTER FOR REMOVAL OF TOXIC SUBSTANCES FROM FUEL TANK BREATHER (DIAGRAM)

87 MODELS ONWARD

ENGINE TYPE M28. 41/42



1 - Fuel tank
2 - Expansion tank
3 - Hose
4 - Rollover valve
5 - Activated charcoal cannister
6 - Breather line
7 - Diaphragm valve
8 - Solenoid valve
9 - LH Jetronic control unit
10 - Throttle housing

Calibrating the tank sensor system for Model 89 onwards

Note

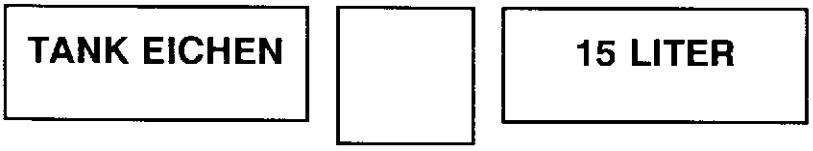
The system must be calibrated if the fuel tanks, tank sensor or backlit instrument cluster have been replaced.

1. Empty the fuel tank.

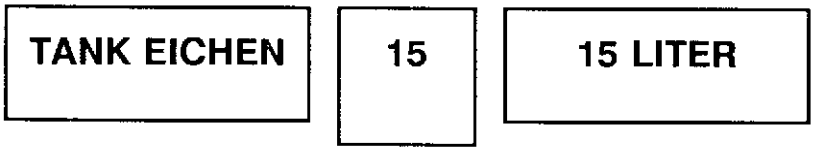
2. Fill with exactly 15 l (3.96 gallons) fuel.

3. Wait for at least 1 minute. Vehicle must remain stationary.

4. Pull the operating lever for the backlit instrument cluster, turning the ignition on at the same time. The following response appears in the left and right display boxes*



5. Press the reset button in the center console until 15 appears in the center display box.



The tank sensor system is now calibrated.

***TANK EICHEN = CALIBRATE TANK**

Note

Terminate calibration mode by switching off the ignition or starting the engine.

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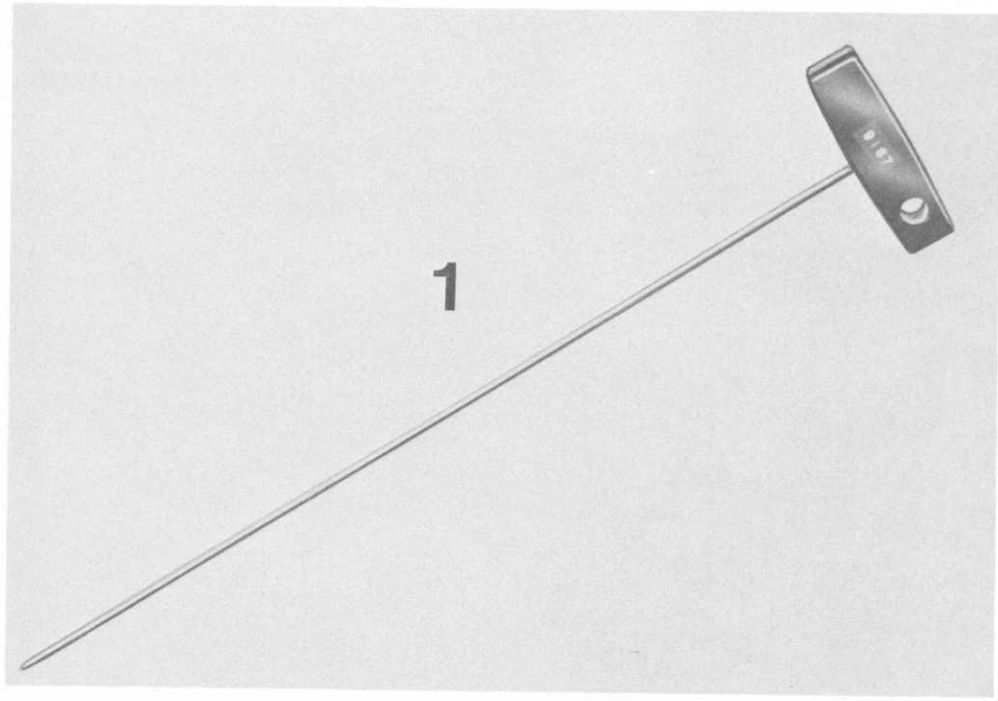
928 with AFC	Control Unit	Air Flow Sensor	Fuel Injector	Temp. Sensor	Oxygen Sensor	Electric Fuel Pump
1980 model	928.618.106.01 Bosch No. 0280.002.101	928.606.121.01 Bosch No. 0280.203.009	928.606.110.01 Bosch No. 0280.150.154	928.606.125.01 Bosch No. 0280.130.023	928.606.123.01 Bosch No. 0258.001.017	928.608.104.01 Bosch No. 0580.464.017
1981 / 1982 models	928.618.106.04 Bosch No. 0280.002.104	928.606.121.02 Bosch No. 0280.203.015	as above	as above	as above	as above
1983 model	as above	as above	as above	as above	928.606.124.01 Bosch No. 0258.003.003	as above
	Press. Damper or Diaphragm Damper	Pressure Regulator	Auxiliary Air Regulator	Cold Start Valve	Temperature Time Switch in Thermostat Housing	Vacuum Control
1980, 1981, 1982 models	928.110.202.00 Bosch No. 0280.161.008	928.110.198.10 Bosch No. 0280.160.215	928.606.102.01 Bosch No. 0280.140.219	911.606.107.01 Bosch No. 0280.170.409	928.605.101.00 Bosch No. 0280.130.214	928.110.173.00 Bosch No. 0280.162.200
1983 model	as above	as above	928.606.102.02 Bosch No. 0280.140.227	as above	as above	928.110.173.01 Bosch No. 0280.160.322

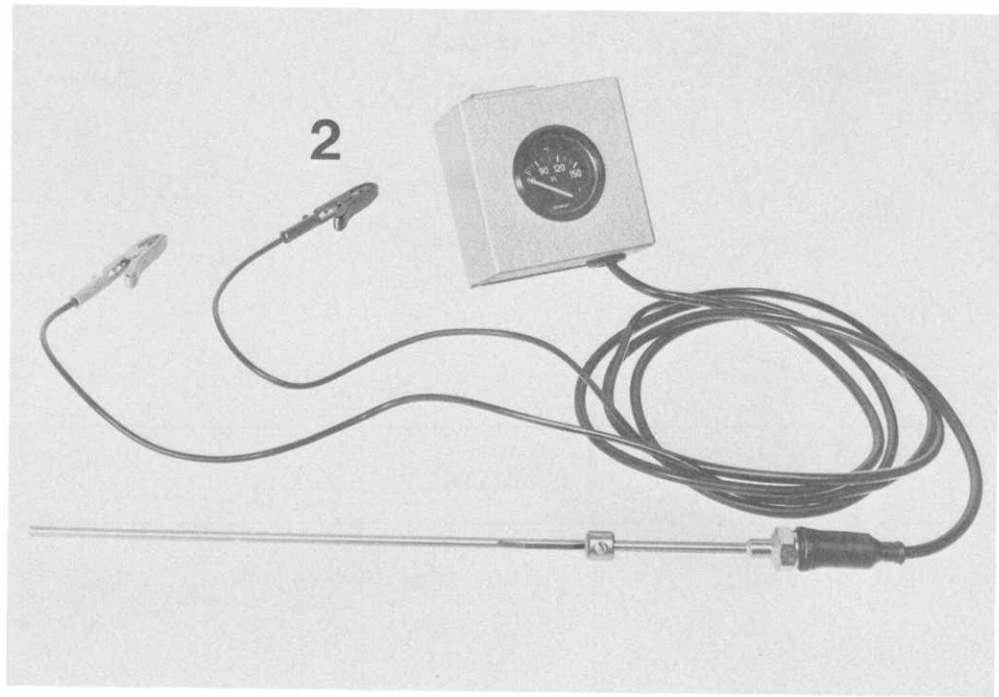
TESTING AND ADJUSTING SPECIFICATIONS FOR AFC
(1980/1981/1982/1983 Models)

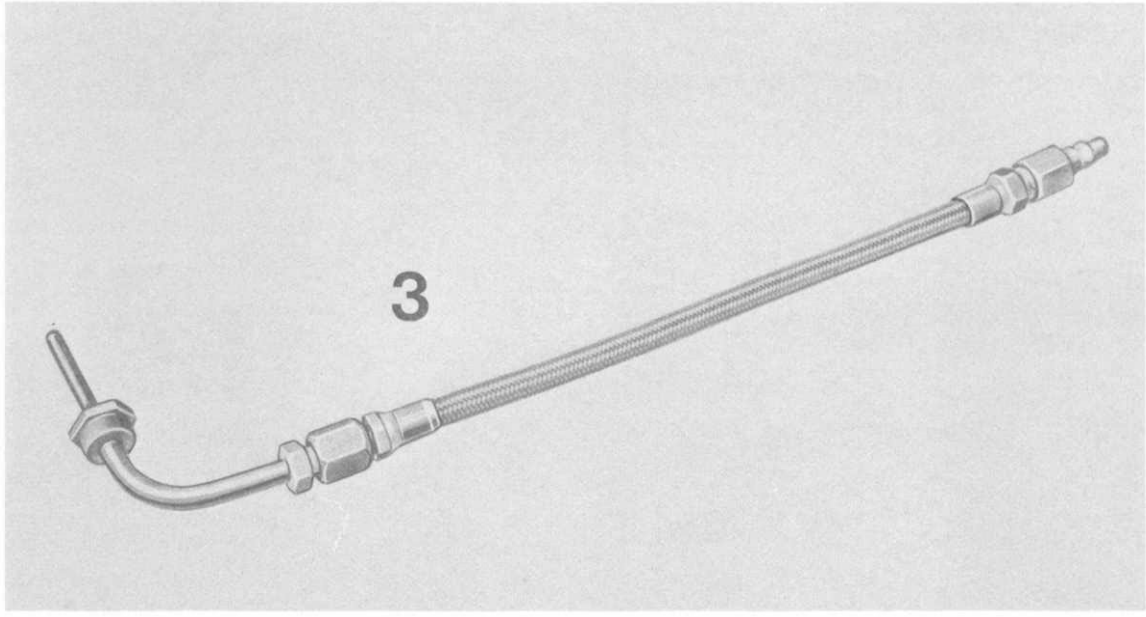
Test Point	Specifications	Remarks
Electric fuel pump Delivery rate	at least 1150 cc/30 sec.	
Fuel pressure (engine stopped) Fuel pump bridged Check value for idle	 2.5 ± 0.2 bar approx. 2 bar	
Leak test Min. pressure after 20 minutes	 1 bar	
Idle adjustments Idle speed CO level	 750 $\pm$ 50 rpm from Mod. 83 650 $\pm$ 50 rpm 0.4 – 0.8 % (measured in front of catalytic converter with oxygen sensor plug disconnected)	

ADJUSTING IDLE - USA AND JAPAN
(from 1980 Models with L-Jetronic)

TOOLS







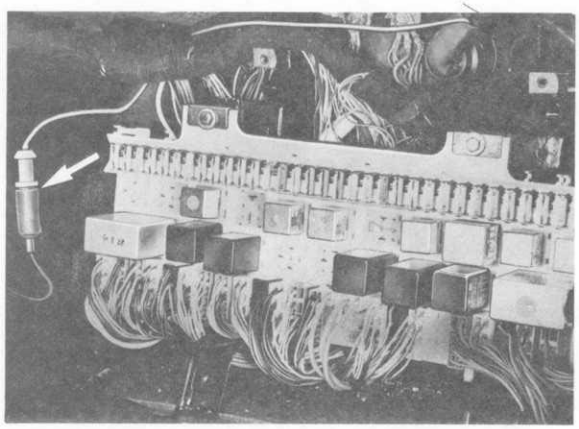
No.	Description	Special Tool	Remarks
1	Ball screwdriver	9187	
2	Oil temperature tester	9122	or US 8025
3	CO test line	US 8023	

ADJUSTING IDLE - USA and Japan (from 1980 Models with L-Jetronic)

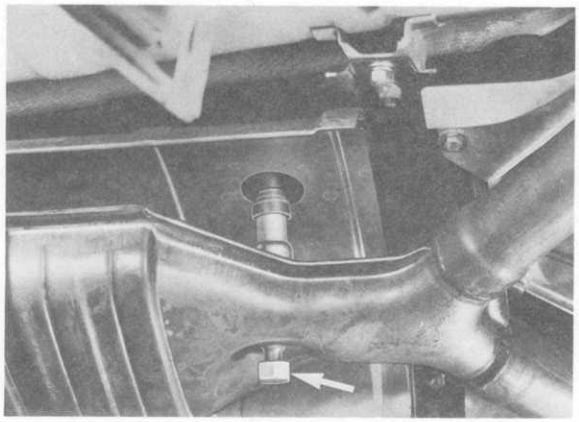
Remarks

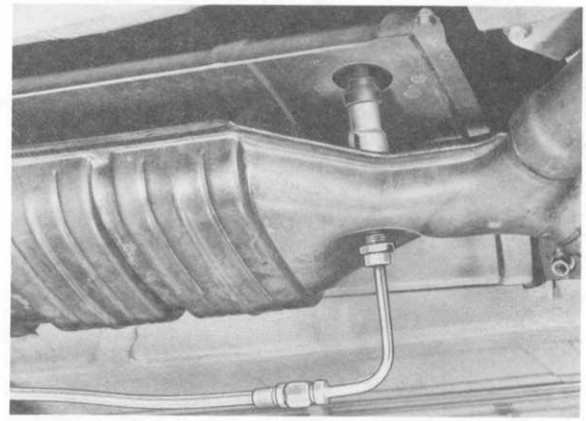
Requirements:
Engine in perfect mechanical condition and ignition timing adjusted correctly.

1. Fold up foot support in footwell of passenger's side and disconnect oxygen sensor plug.



2. Connect CO test line US 8023 or SUN 120-239 on test connection of catalytic converter.

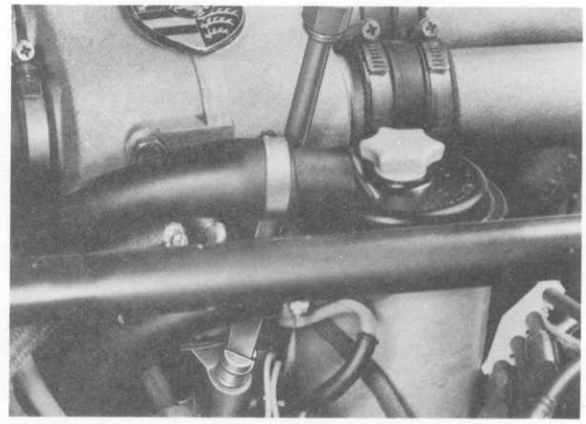




3. Run engine to operating temperature (oil temperature approx. 80° C). Use special tool US 8025.

4. Connect CO tester to supplier's instructions.

5. Turn control screw or bypass screw on throttle housing until specified speed is reached.

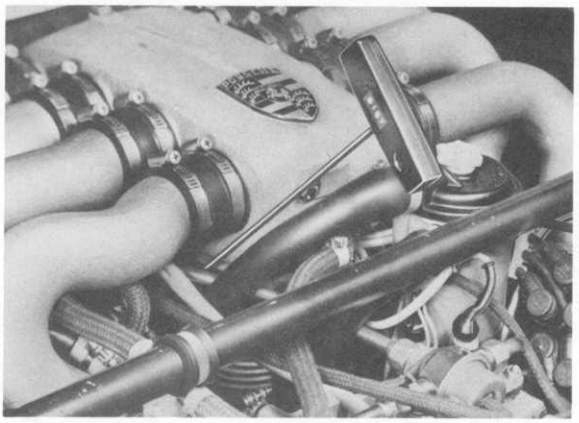


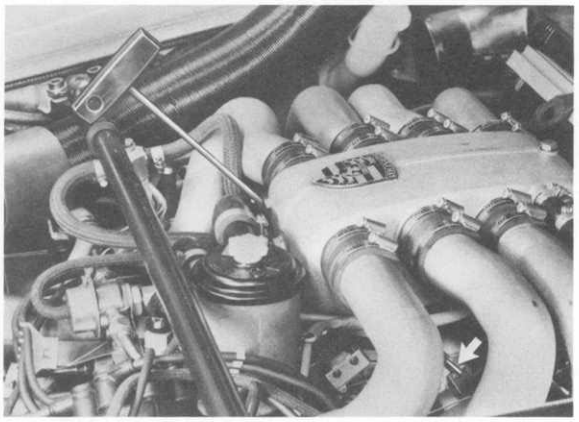
Important

Use separate tachometer of tester or similar.

Make adjustments as quickly as possible to avoid excessive heat in intake ports and consequently wrong CO values.

6. Adjust fuel/air mixture. Guide special tool 9187 into adjusting bore of air flow sensor and turn mixture control screw accordingly.





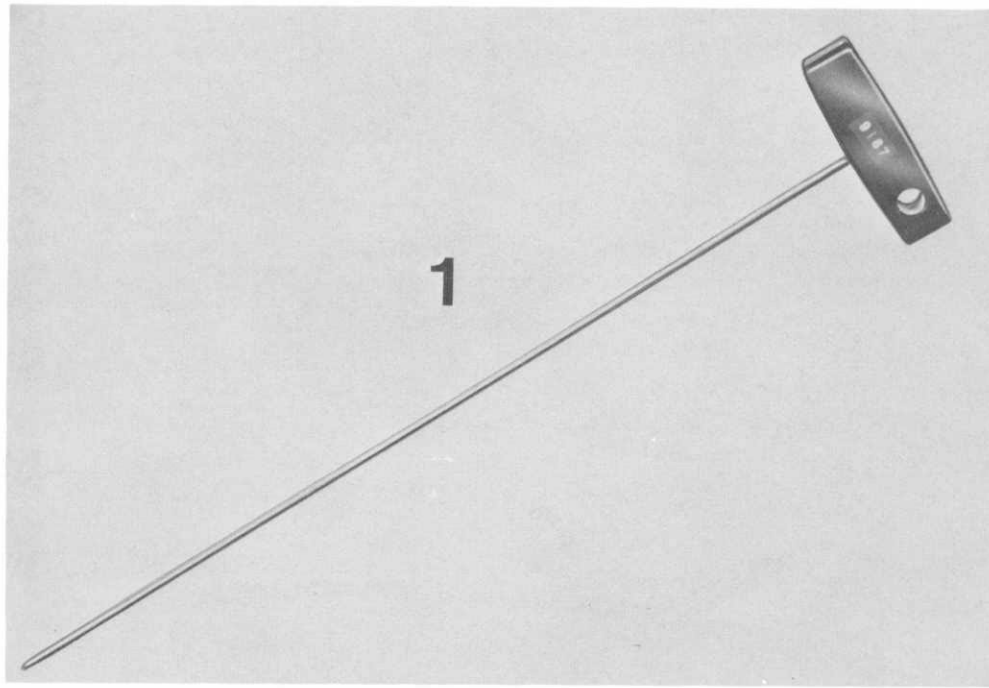
7. Turning clockwise = richer mixture.
   Turning anticlockwise = leaner mixture.

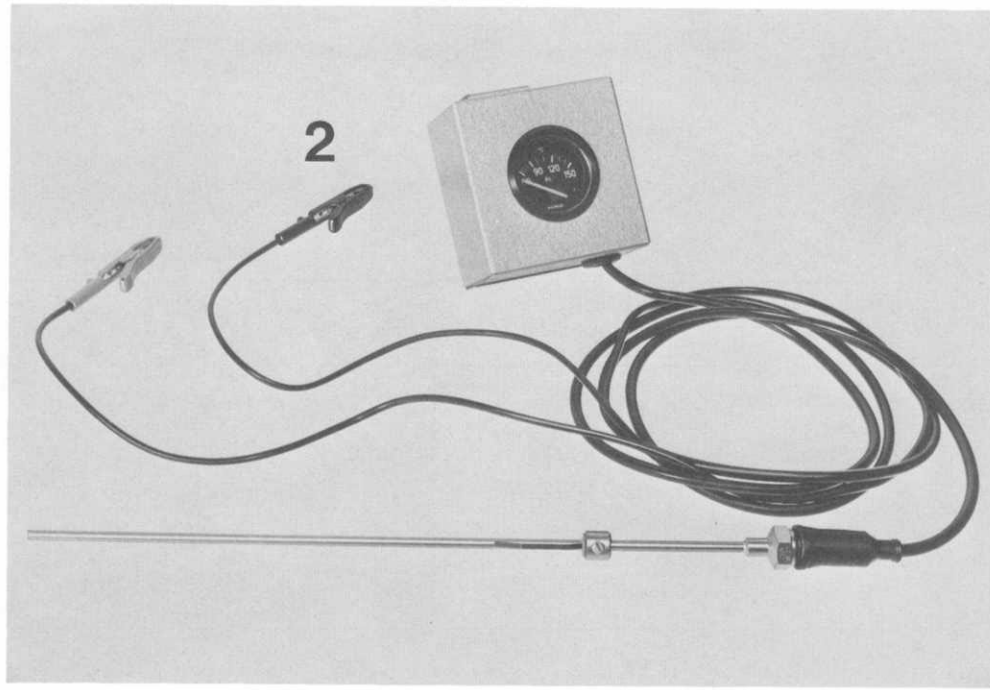
8. After finishing adjustment reconnect the oxygen sensor plug.

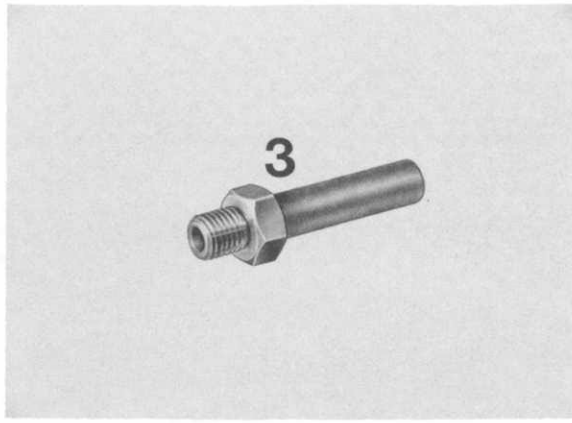
9. Coat threads of plug for test connection on catalytic converter with Bosch Paste VS 140 16 Ft or Optimoly HT.

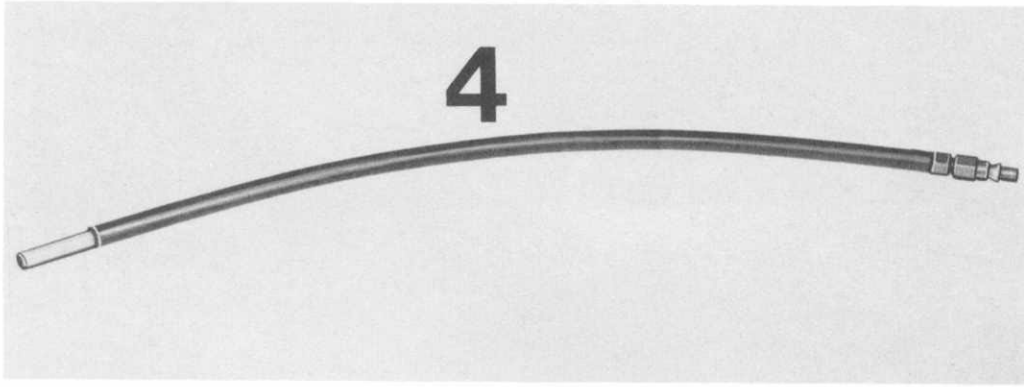
ADJUSTING IDLE SPEED AND CO – USA AND JAPAN
(Beginning with 1983 Models – L-Jetronic)

TOOLS









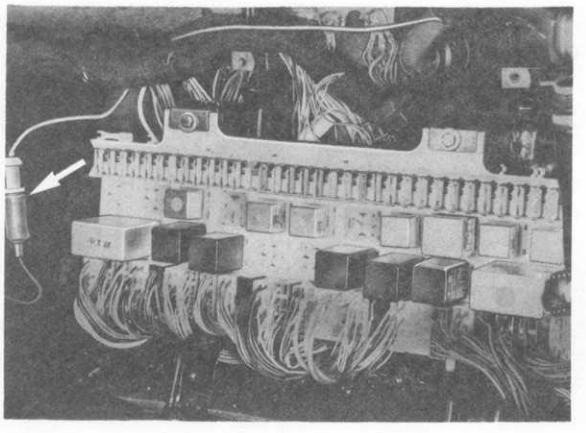
No.	Description	Special Tool	Remarks
1	CO adjusting tool	9187	
2	Oil temperature tester	9122	or US 8025
3	Adapter	US 8040	
4	Exhaust probe	US 4492	

ADJUSTING IDLE SPEED AND CO – USA AND JAPAN
(Beginning with 1983 Models – L-Jetronic)

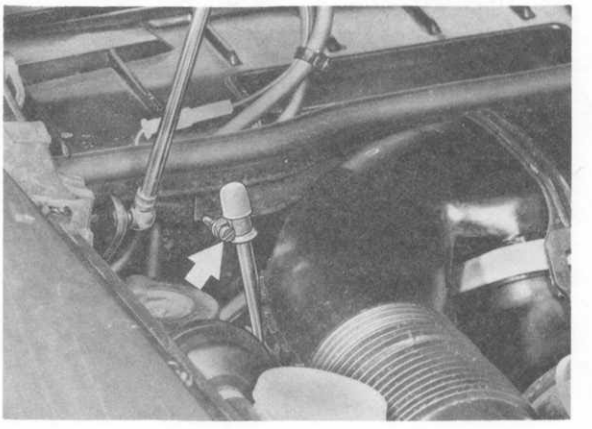
Note:

Requirements:
Engine in perfect mechanical condition and ignition timing adjusted correctly.

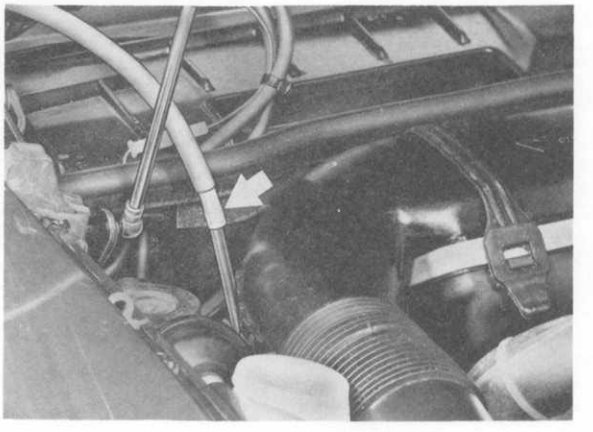
1. Fold up foot support in footwell on passenger's side and disconnect oxygen sensor plug.



2. Take off cover of exhaust source line in engine compartment.

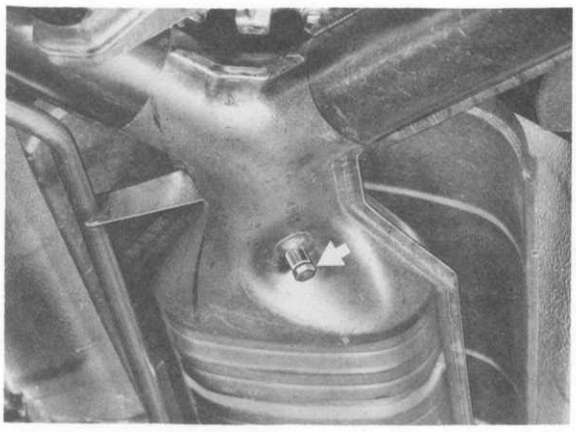


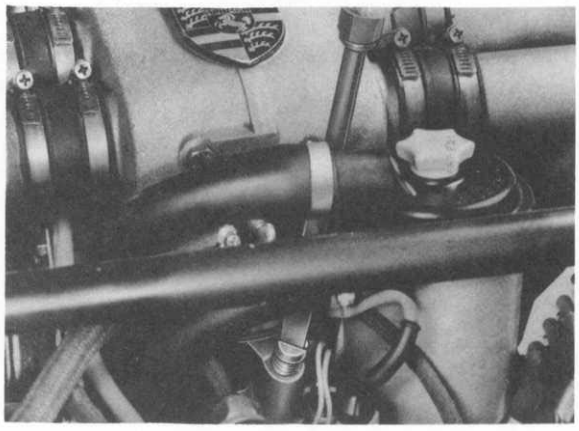
3. Connect exhaust probe US 4492 on exhaust source line.

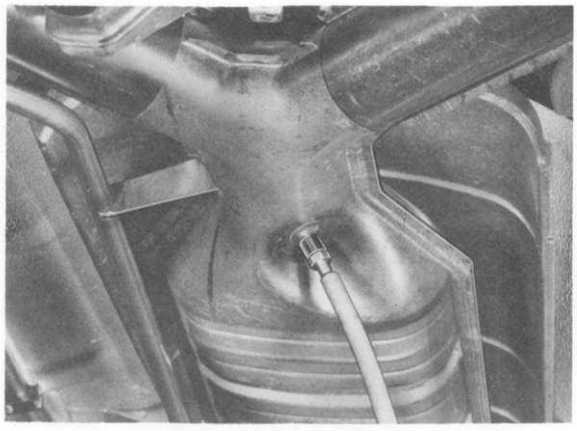


Note:

If there is suspicion of erratic engine running or when troubleshooting, it is advantageous to use test connection on the catalytic converter.







4. Run engine to operating temperature (oil temperature approx. 80 °C). Use Special Tool US 8025.

5. Connect CO tester to supplier's instructions.

6. Turn control screw or bypass screw on throttle housing until specified speed is reached.

Note:

Use separate tachometer from tester or similar.

Make adjustments as quickly as possible to avoid excessive heat in intake ports and consequently wrong CO values.

7. Check CO. If CO is not as specified, correct the air flow sensor adjustment.

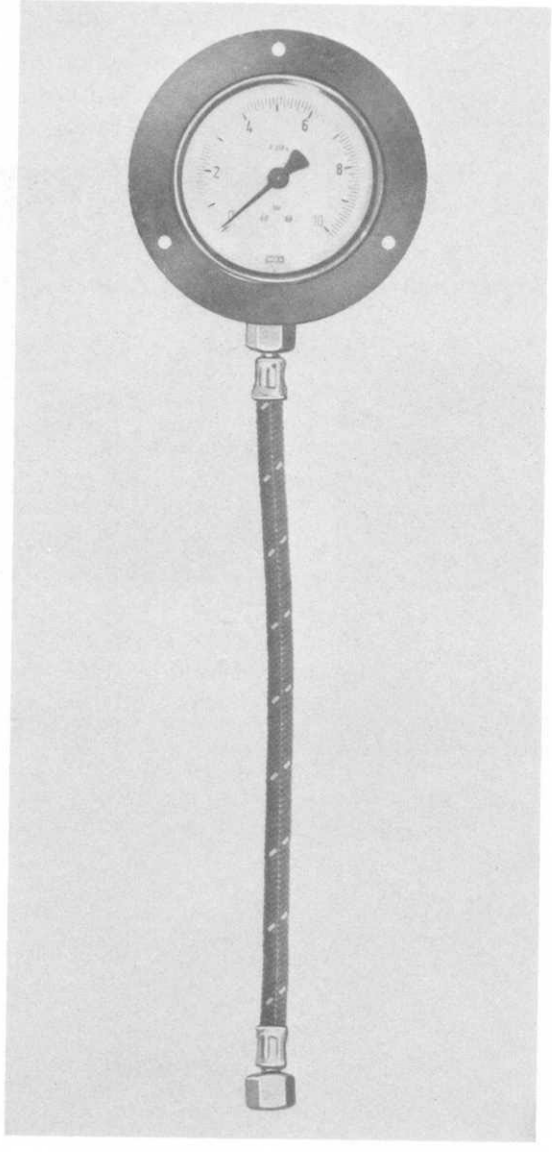
8. Reconnect oxygen sensor plug after finishing adjustments.

9. Coat threads of plug for test connection on catalytic converter with Bosch Paste VS 140 16 Ft or Optimoly HT.

   Tightening torque = 15 Nm.

CHECKING FUEL PRESSURE - USA and Japan
(from 1980 Models with L-Jetronic)

TOOLS



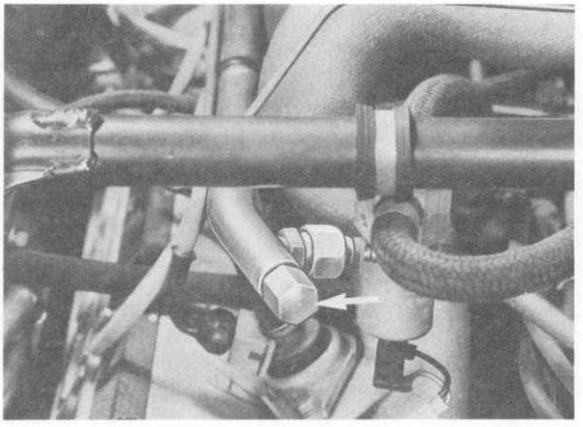
No.	Description	Special Tool	Remarks
1	Pressure gauge with hose from pressure tester	P 378	

CHECKING FUEL PRESSURE - USA and Japan (from 1980 Models with L-Jetronic)

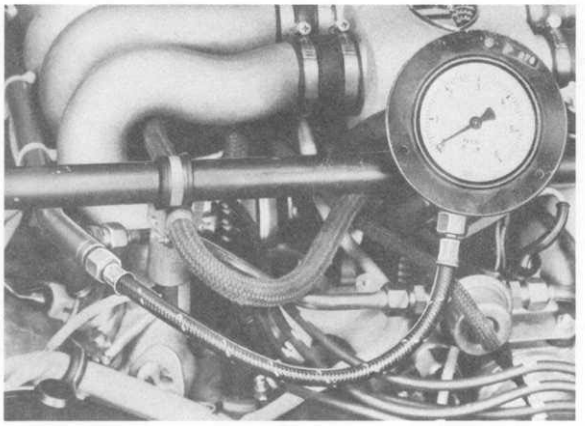
1. Unscrew and remove cap nut from test connection on fuel distribution line.

Note

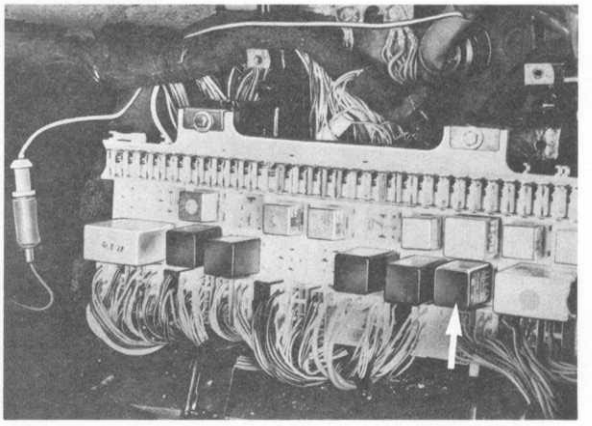
Watch sealing ball when removing cap nut.



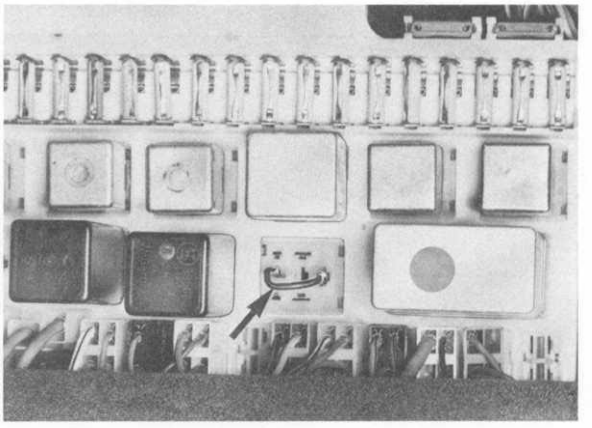
2. Connect pressure gauge with hose from pressure tester P 378 on the test connection.



3. Fold up foot support in footwell of passenger's side and pull fuel pump relay off of central electric board.



4. Bridge terminals 30 and 87 with an extra wire. Fuel pump should now run.



5. See page 24 - 1 for checking values.

6. Torque for cap nut: 22 Nm (2.2 kpm).

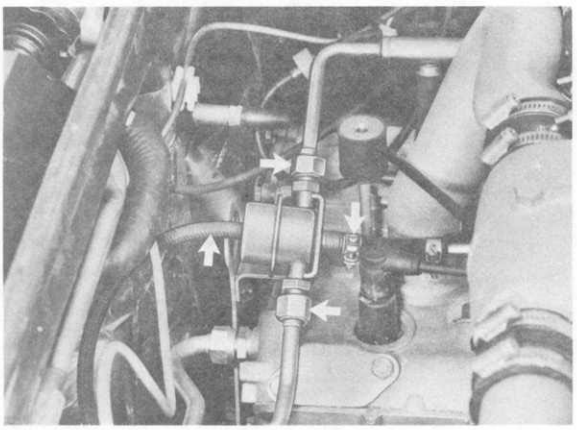
REMOVING AND INSTALLING PRESSURE REGULATOR

1. Disconnect ground wire at battery.

2. Take off air cleaner assembly.

3. Pull off vacuum hose and disconnect fuel lines, making sure to counterhold.

   Catch escaping fuel.

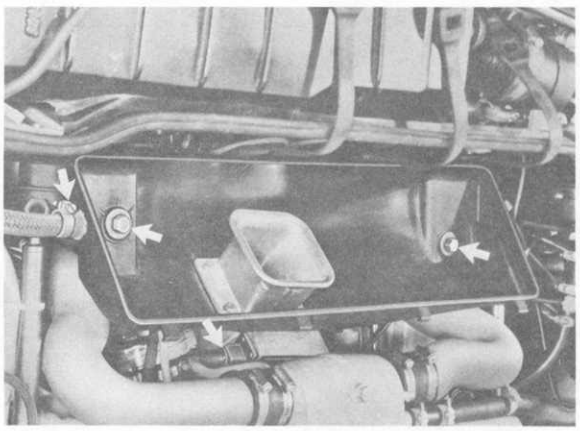


REMOVING AND INSTALLING INTAKE AIR SENSOR

Removing

1. Remove air cleaner upper section and air filter cartridge.

2. Disconnect carbon canister hose and unscrew captive bolts. Pull off multiple pin plug and remove lower section with intake air sensor.



3. Unscrew bolts on intake funnel and take intake air sensor and gasket off of air cleaner lower section.

Installing

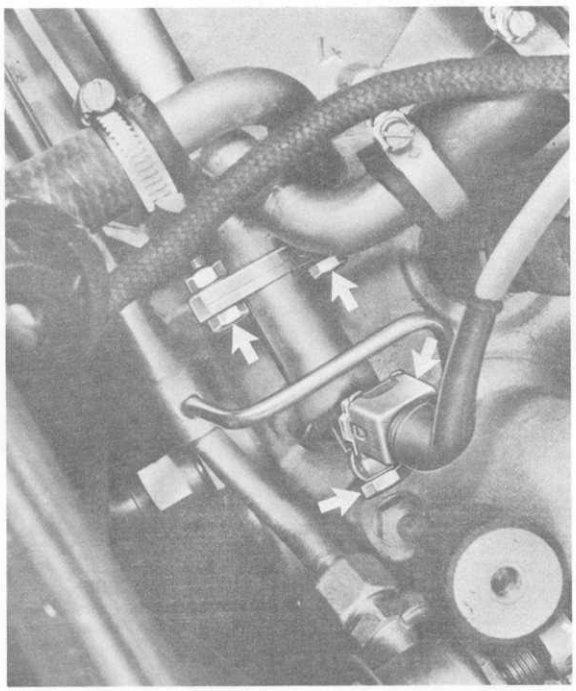
Check seal in air sensor housing and make sure of correct fit.

REMOVING AND INSTALLING COLD START VALVE

1. Disconnect ground wire at battery.

2. Take off air cleaner assembly.

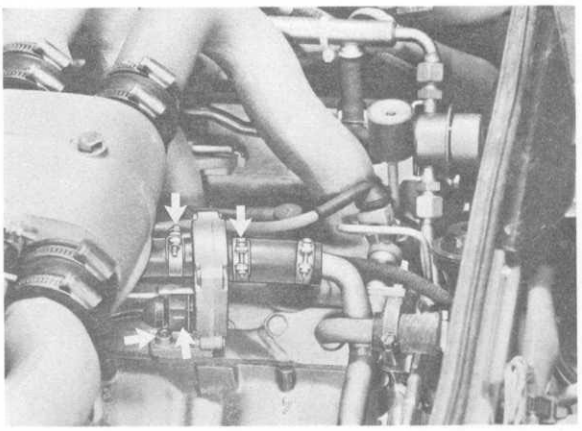
3. Pull off (blue) wire plug, unscrew fuel line and mounting bolts.



REMOVING AND INSTALLING AUXILIARY AIR REGULATOR

1. Take off air cleaner assembly.

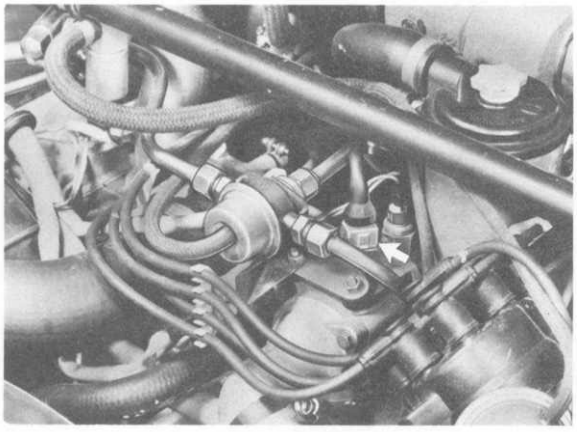
2. Pull off (black) wire plug, loosen hose clamps, unscrew socket head bolts and remove auxiliary air regulator.



REMOVING AND INSTALLING TEMPERATURE SENSOR II

Removing

Pull off electric plug and unscrew temperature sensor.



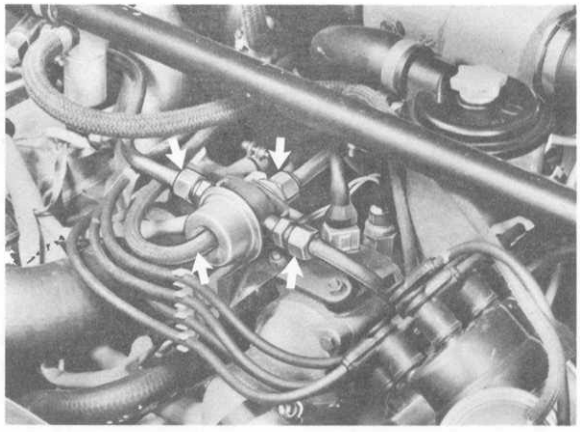
Installing

Use a new seal.

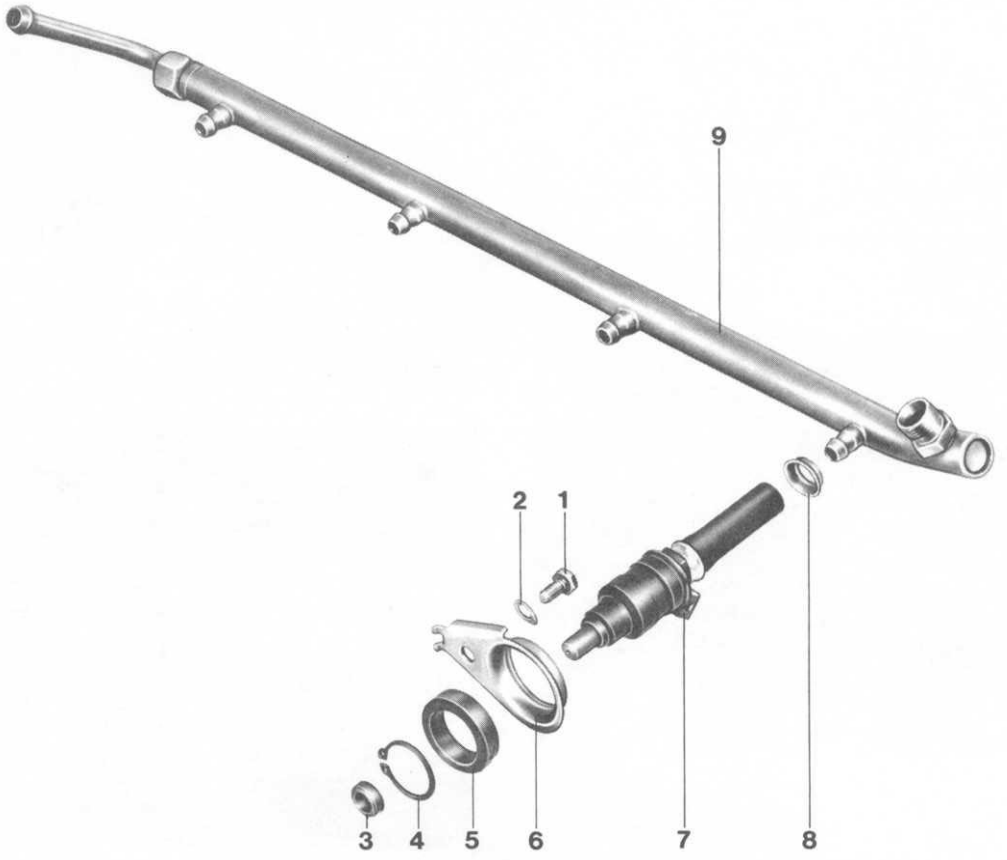
REMOVING AND INSTALLING PRESSURE DAMPER

1. Disconnect ground wire at battery.

2. Pull off vacuum hose and disconnect fuel lines, not forgetting to counterhold. Catch escaping fuel.



REMOVING AND INSTALLING FUEL INJECTORS



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	8			
2	Washer	8			
3	Injector bushing, inner	8		Always replace	
4	Circlip	8		Position correctly	
5	Injector bushing, outer	8		Check, replace if necessary	
6	Retaining plate	8		Position correctly in cast boss of intake manifold	
7	Fuel injector	8		Electric connection faces down	See page 24 - 13
8	Hose sleeve	8	Cut open		
9	Fuel distributor line	2			

DISASSEMBLING FUEL INJECTOR

1. Cut open hose sleeve with metal snips.

2. Burn off hose with a soldering iron and pull off.

ASSEMBLING FUEL INJECTOR

1. Clean outside of hose adapter on fuel distribution line.

2. Coat inside of new fuel hose with fuel and push hose sleeve on hose adapter against stop by hand.

   Hose sleeve must be a tight fit.

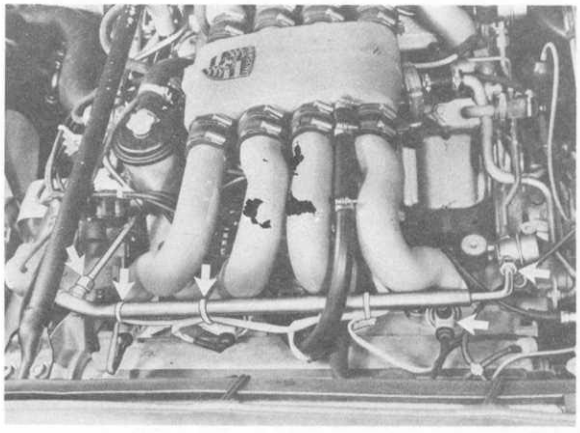
REMOVING AND INSTALLING FUEL INJECTORS

Note

Only four left or right fuel injectors can be removed together.

Cut off wire straps. Pull off wire plugs and disconnect retaining plates of fuel injectors at intake manifolds.

Unscrew fuel lines, remembering to counterhold. Catch escaping fuel.
Remove fuel distribution line.



REMOVING AND INSTALLING THROTTLE HOUSING

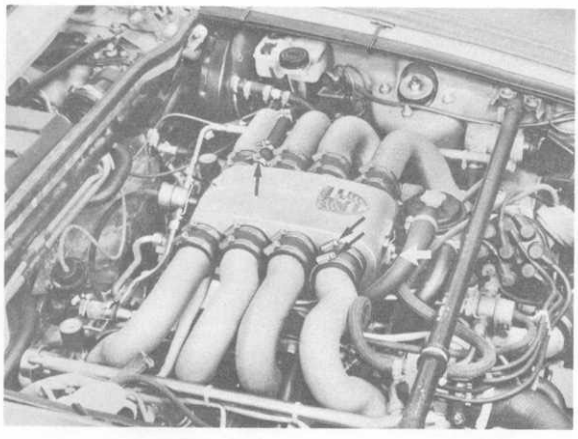
Removing

1. Take off air cleaner assembly.

2. Disconnect brake booster hose on connecting adapter of intake distributor.

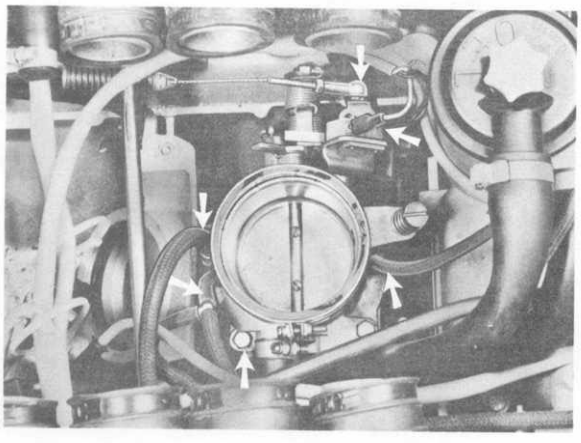
   a) Disconnect hose from A/C solenoid valve on intake distributor.

   b) Loosen hose clamps on intake pipes and push back rubber sleeves on intake pipes.



3. Loosen upper hose clamps on connector between intake distributor and throttle housing. Remove intake distributor from above.

4. Pull off hoses and disconnect throttle cable. Pull wires off of microswitches, unscrew mounting bolts and remove throttle housing.

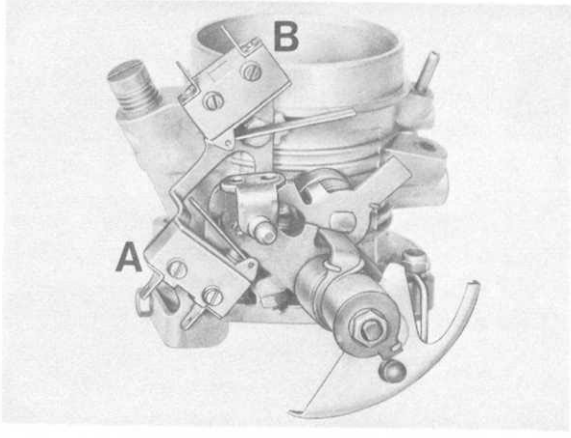


Installing

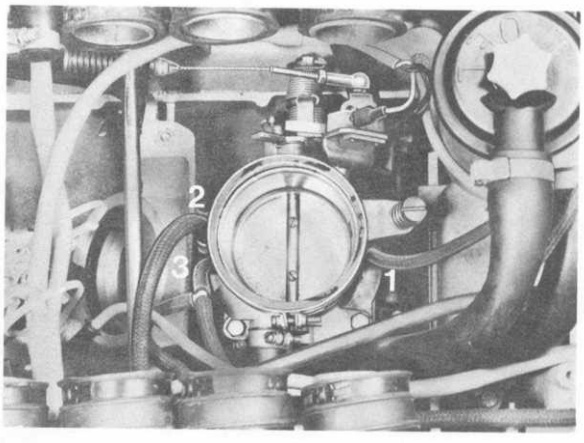
1. Connect wires on microswitches as follows:

   Term. 18 black and term. 2 black/white on microswitch A (idle contact).

   Term. 18 black and term. 3 white on microswitch B (full throttle contact).

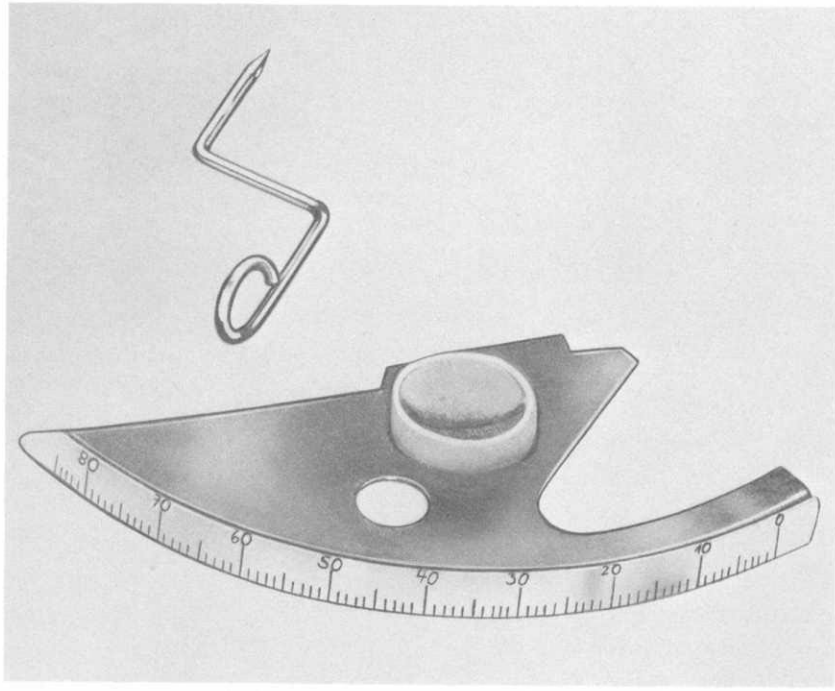


2. Connect vacuum hoses as follows:
   1 To distributor (retard).
   2 To decel valve/pressure regulator/pressure damper.
   3 To distributor (advance)/vacuum check valve (charcoal filter).



CHECKING AND ADJUSTING MICROSWITCHES ON THROTTLE HOUSING

TOOLS

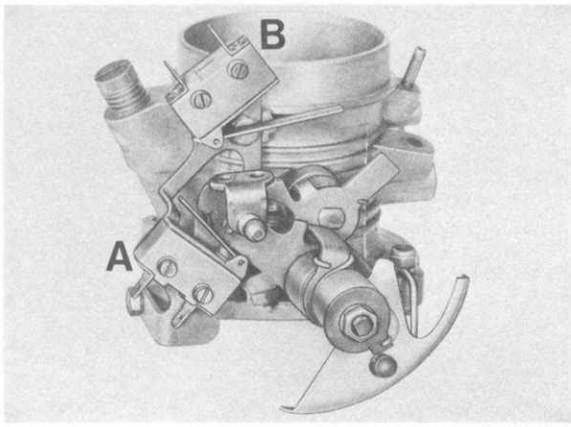


No.	Description	Special Tool	Remarks
1	Degree disc	from P 228 c	
2	Indicator		Made locally

CHECKING AND ADJUSTING MICROSWITCHES ON THROTTLE HOUSING

1. Remove throttle housing.

2. Check microswitch A (idle contact).

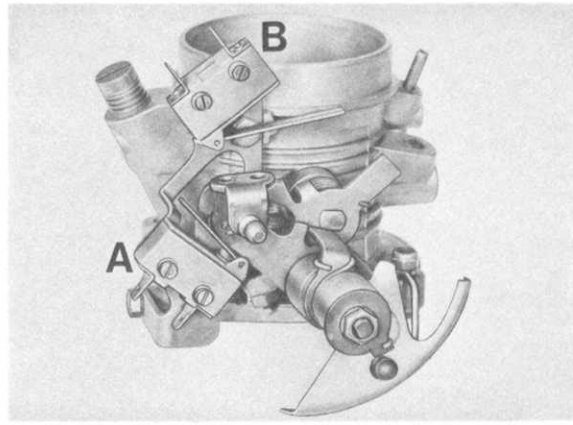


Note

The microswitch will already switch when play in accelerator linkage is eliminated by force on the pedal. The throttle valve should still be closed.

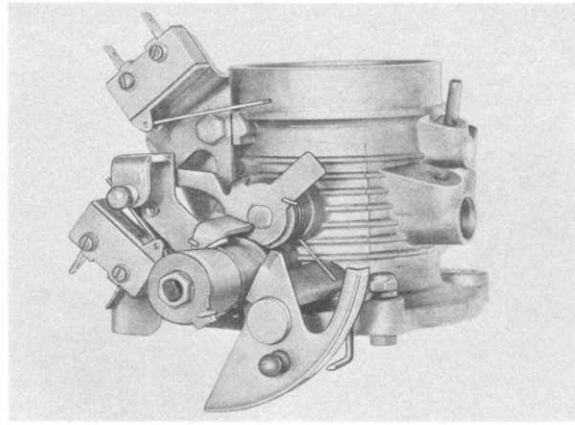
Connect a standard buzzer or ohmmeter on both contacts of microswitch. Power must be flowing through microswitch; adjust if necessary.

3. Check microswitch B (full throttle contact).



a) Place degree disc of special tool P 228 c on operating lever.

b) Mount and align (locally made) indicator.

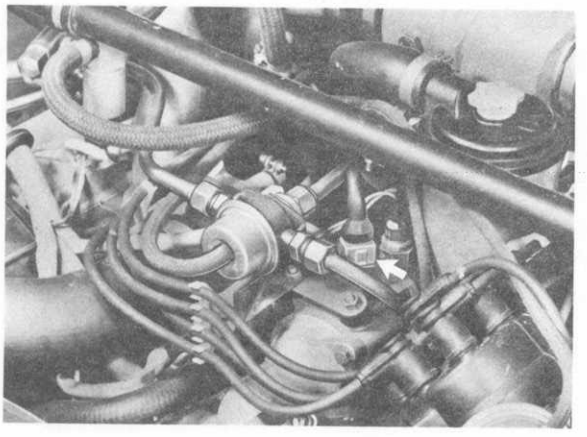


c) Operate throttle $30^{o} \pm 4^{o}$. Microswitch must close; adjust if necessary.

Printed in Germany

CHECKING TEMPERATURE SENSOR II (gray plug)

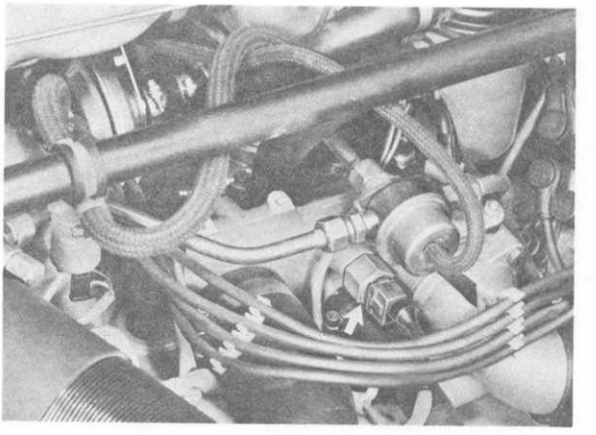
Measure resistance direct off of temperature sensor.



For - 10° C/14° F 7 ... 12 k-ohms
+ 20° C/68° F 2 ... 3 k-ohms
+ 80° C/176°F 250 ... 400 ohms

Replace, if necessary.

CHECKING TEMPERATURE TIME SWITCH (FOR COLD START VALVE) (brown plug)



1. Pull off plug and measure resistance direct off of temperature time switch.

   Check by measuring resistance between

   terminal "G" and "ground" (housing):
   below + 30° C/86° F: 0 ohms
   above + 40° C/104° F: 100 - 160 ohms

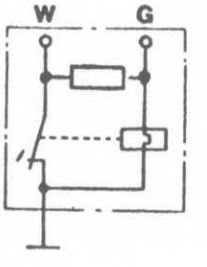
   terminal "W" and "ground" (housing):
   below + 30° C/86° F: 0 ohms
   above + 40° C/104° F: 100 - 160 ohms

   terminal "G" and terminal "W":
   below + 30° C/86° F: 25 - 40 ohms
   above + 40° C/104° F: 50 - 80 ohms

Note

Temperatures above + 40° C/104° F and below + 30° C/86° F can be produced with water of pertinent temperature.





CHECKING AUXILIARY AIR REGULATOR

1. Connect ohmmeter to both connection of auxiliary air regulator and measure resistance.

   Specification: 40 to 75 ohms.

2. Check power supply.
   Bridge fuel pump relay socket terminals 30 and 87.
   Disconnected plug should have battery voltage.

CHECKING COLD START VALVE

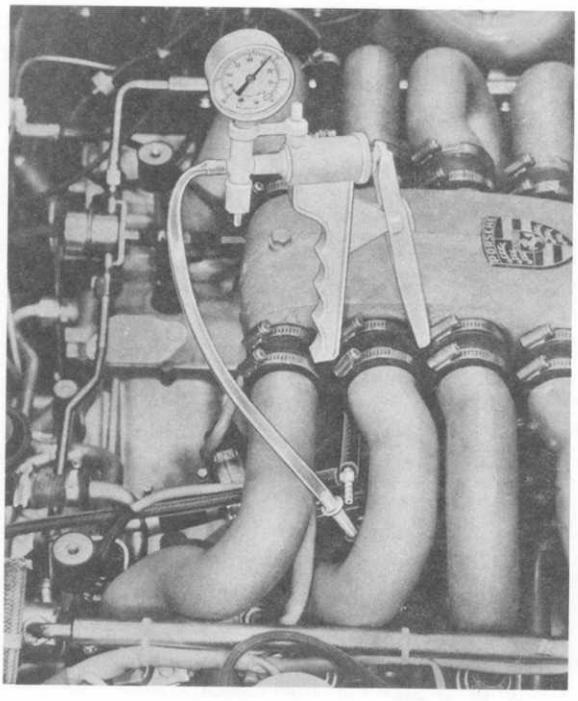
1. Check power supply of cold start valve. Pull off plug for this purpose and connect a test lamp on both contacts of disconnected plug.

   Start engine. Test lamp should come on at coolant temperature below + 30° C/86° F and not come on above + 40° C/104° F.

2. Check resistance of cold start valve.
   Resistance: approx. 4 ohms.

CHECKING VACUUM CONTROL

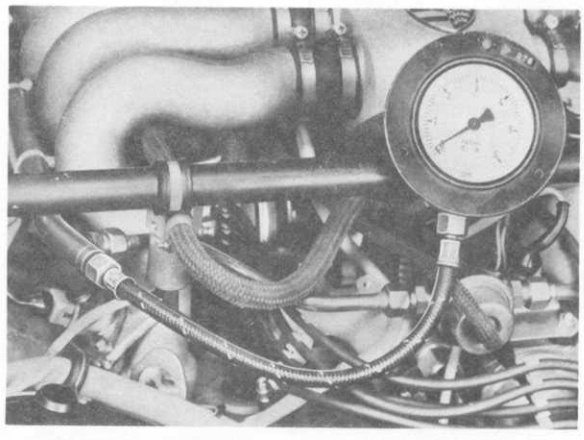
Run engine at idle speed.
Pull control hose for decel valve off of branch and connect hand vacuum pump US 8026.
Decel valve will open and idle speed rise when vacuum is sufficient.

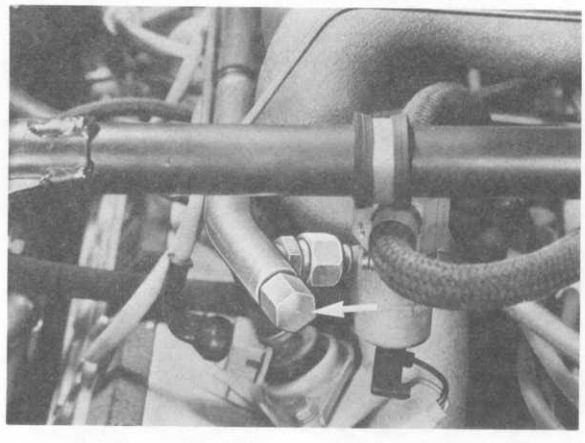


CHECKING PRESSURE REGULATOR

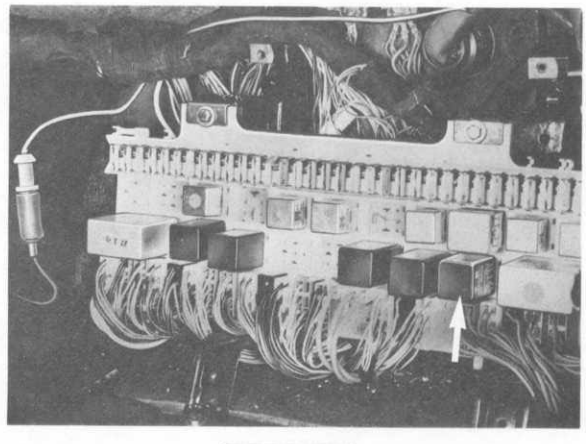
1. Take off air cleaner assembly.

2. Connect pressure gauge with hose from pressure tester P 378 on testing connection.

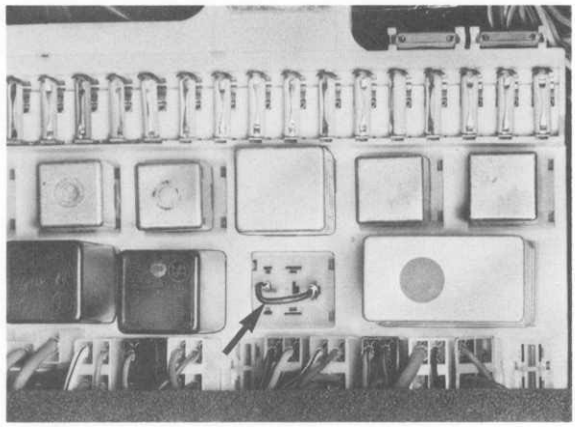




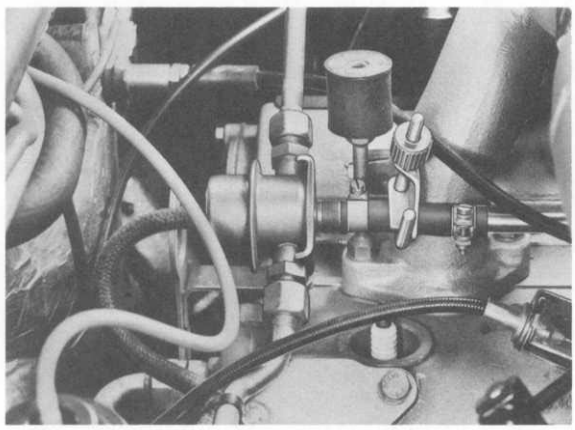
3. Fold up foot support in footwell of passenger' s side and pull fuel pump relay off of central fuse/relay plate.



4. Bridge terminals 30 and 87 with an extra wire. Fuel pump should now run.



5. Shut off return line of one pressure regulator with a standard hose clamp. Fuel pressure should rise only slightly (approx. 0.05 bar).
If pressure rises, return line of opposite pressure regulator is clogged or pressure regulator is defective.
Check second pressure regulator in same manner.



CHECKING AIR FLOW SENSOR

1. Pull off plugs on air flow sensor.

2. Connect ohmmeter on connections 6 and 9.
Specification: 200 – 400 ohms

Connections 6 and 8
Specification: 130 – 260 ohms

Connections 8 and 9
Specification: 70 – 140 ohms

Connections 6 and 7
Specification: 40 – 300 ohms

Connections 7 and 8
Specification: 100 – 500 ohms

Connections 27 and 6
Specification: 2 – 3 k-ohms at 20 °C/68 °F

Note

Beginning with manufacturing date 042 (stamped in housing of air flow sensor).

1. Pull off plugs on air flow sensor.

2. Connect ohmmeter on connections 6 and 9.
Specification: 400 – 800 ohms

Connections 6 and 8
Specification: 160 – 520 ohms

Connections 8 and 9
Specification: 140 – 280 ohms

Connections 6 and 7
Specification. 80 – 600 ohms

Connections 7 and 8
Specification: 200 – 1000 ohms

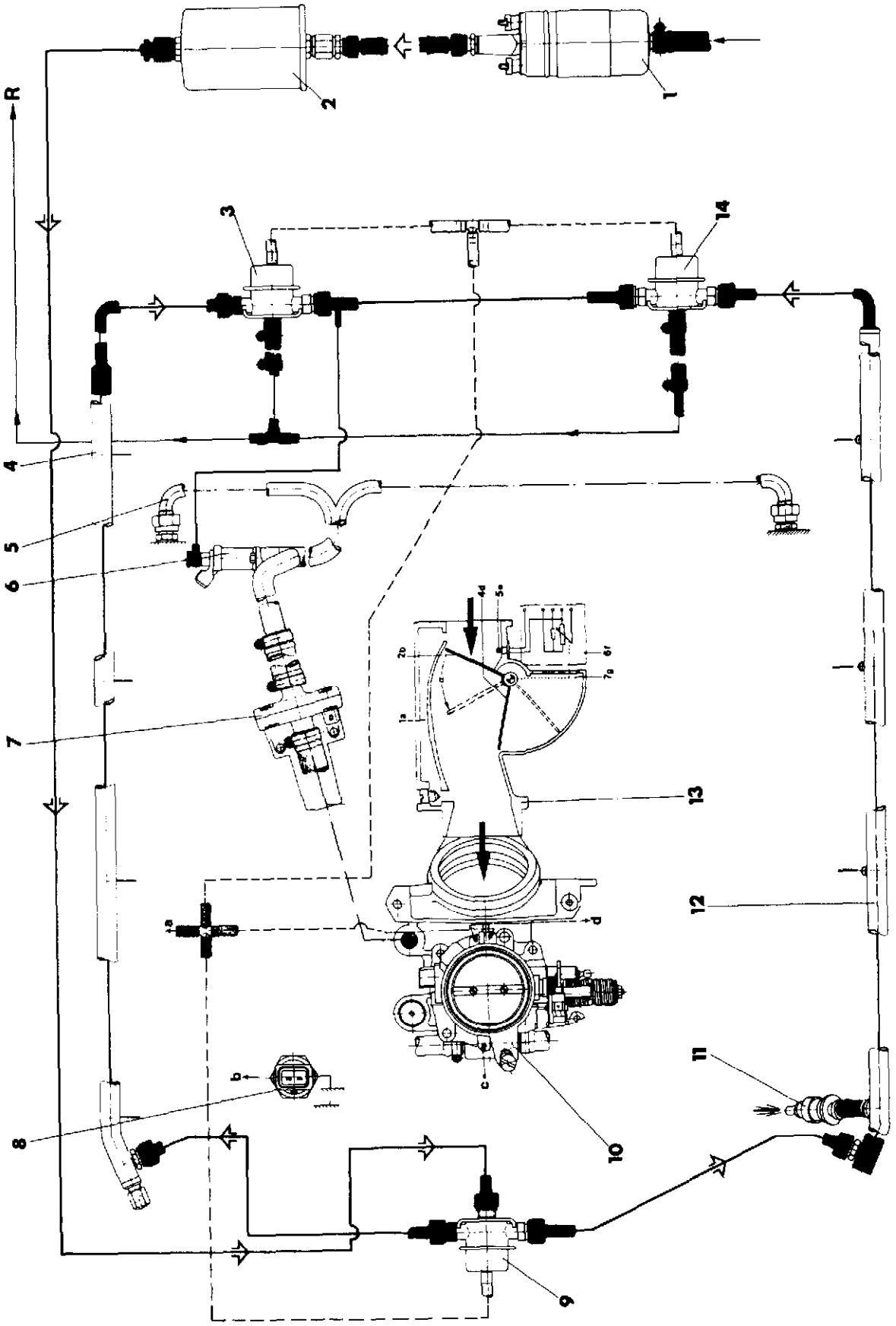
Connections 27 and 6
Specification: 4 – 6 k-ohms at 20 °C/68 °F

TROUBLESHOOTING AFC

Requirements for troubleshooting:
Ignition, electrical system and engine in perfect mechanical or operating condition.

1. Engine will not start or poor start	2. Engine starts, but stops again	3. Rough engine idling	4. Poor acceleration	5. Engine misfiring in all load conditions	6. Excessive fuel consumption	7. Max. power output not reached	8. CO level at idle speed too high	9. CO level at idle speed too low	Cause	Correction - Testing Instructions
X	X								AFC relay (XVI) defective.	Check power supply.
X									Fuel pump not running.	Check pump fuse. Voltage at relay and fuel pump?
X									Cold start valve won't open.	Resistance about 4 ohms. Check ejection.
X	X				X		X		Cold start valve leaks.	Check for leaks in pressure test.
X									Temp. time switch defective.	Check switching point.
X	X		X						Auxiliary air regulator won't open.	Visual inspection: warm engine - valve closed cold engine - valve opened, electrics okay
X	X		X		X	X	X	X	Intake air sensor defective.	Check movement of sensor plate. Eliminate dirt.
X									Pump relay defective.	Check power supply.
X		X	X				X		Leak in intake system.	Check intake pipes, bolted equipment and all hose connections for leaks.
X		X			X	X		X	Fuel injectors defective.	Check injection action by feeling.
X		X				X		X	Fuel pressure too low or zero.	Check pressure, filter, fuel lines, pressure regulator.
					X		X		Fuel pressure too high.	Pressure reg./intake pipe conn. hose connected? Fuel return line clogged or pinched? Pressure regulator defective?
X	X				X		X		Temp. sensor II in engine defective.	Measure resistance.
		X							Throttle won't close.	Service throttle valve. Align accelerator linkage. Then adjust throttle.
						X			Throttle won't open fully.	Adjust accelerator linkage and cable to final stop.
				X					Poor central ground. Loose contacts. Wrong plug connections.	Eliminate faults.
X	X	X	X	X	X	X	X	X	Break in wire harness and plugs.	Eliminate break.
		X	X			X			Throttle switch defective.	Check adjustment. Check full throttle and idle contacts.
					X		X		CO level setting too rich.	Check idle speed and CO level.
		X						X	CO level setting too lean.	Check idle speed and CO level.
							X		Oxygen sensor defective.	
X	X	X	X	X	X	X			Control unit defective.	

HOSE DIAGRAM FOR AFC



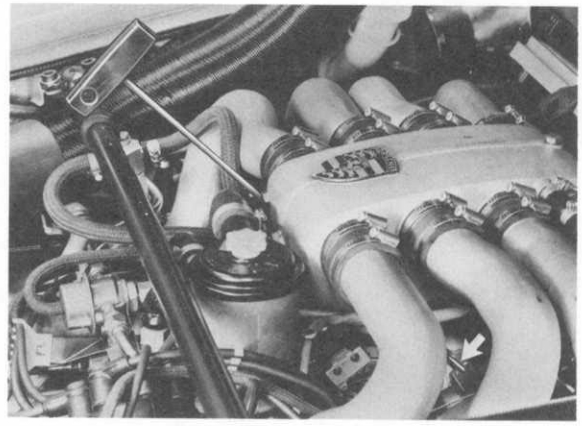
HOSE DIAGRAM FOR AFC

1 - Fuel pump
2 - Fuel filter
3 - Pressure regulator for cyl. 1 - 4
4 - Distributor line for cyl. 1 - 4
5 - Air line (central cold idle system)
6 - Cold start valve
7 - Auxiliary air regulator
8 - Temperature sensor II
9 - Pressure damper
10 - Throttle housing
11 - Fuel injector
12 - Distributor line for cyl. 5 - 8
13 - Intake air sensor
14 - Pressure regulator for cyl. 5 - 8
R - Return to tank
a - To vacuum control
b - To AFC control unit
c - To distributor (retard)
d - To distributor (advance)

CORRECTING CO LEVEL ON AIR FLOW SENSOR

Note

If CO level is not the specified value, remove plug from hole providing access to the mixture control screw. This requires removal of the air flow sensor.

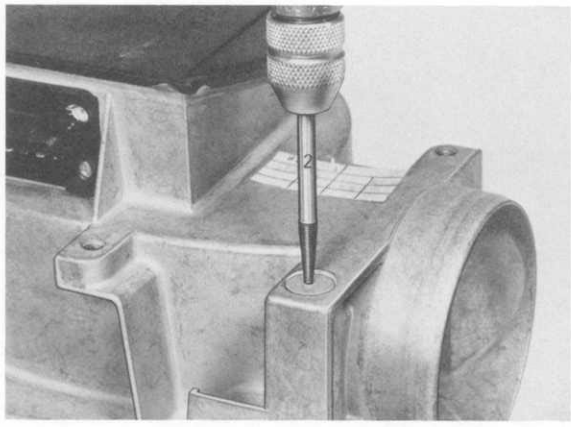


Removing

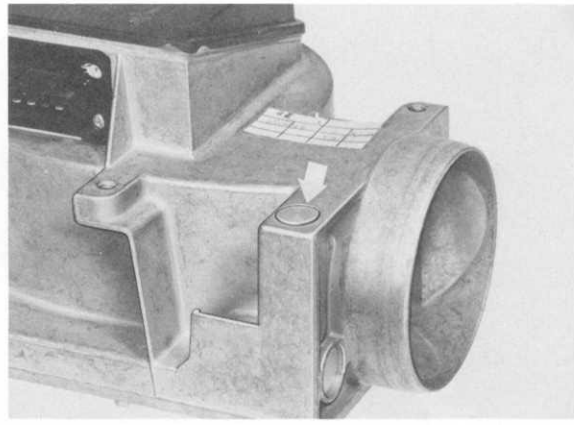
1. Remove air flow sensor.

2. Drill hole in plug with a 2 mm dia. drill bit (up to stop on steel insert).

3. Pull out plug with a left-turning drill (no. 2).



3. Close hole providing access to mixture control screw with a new plug after finishing adjustments. Press in plug flush.



Installing

1. Install air flow sensor.

2. Adjust engine idle speed and CO level. Turn mixture control screw accordingly with a screwdriver.
   Turning clockwise = richer mixture
   Turning anticlockwise = leaner mixture

Note

Never reuse a drilled plug!

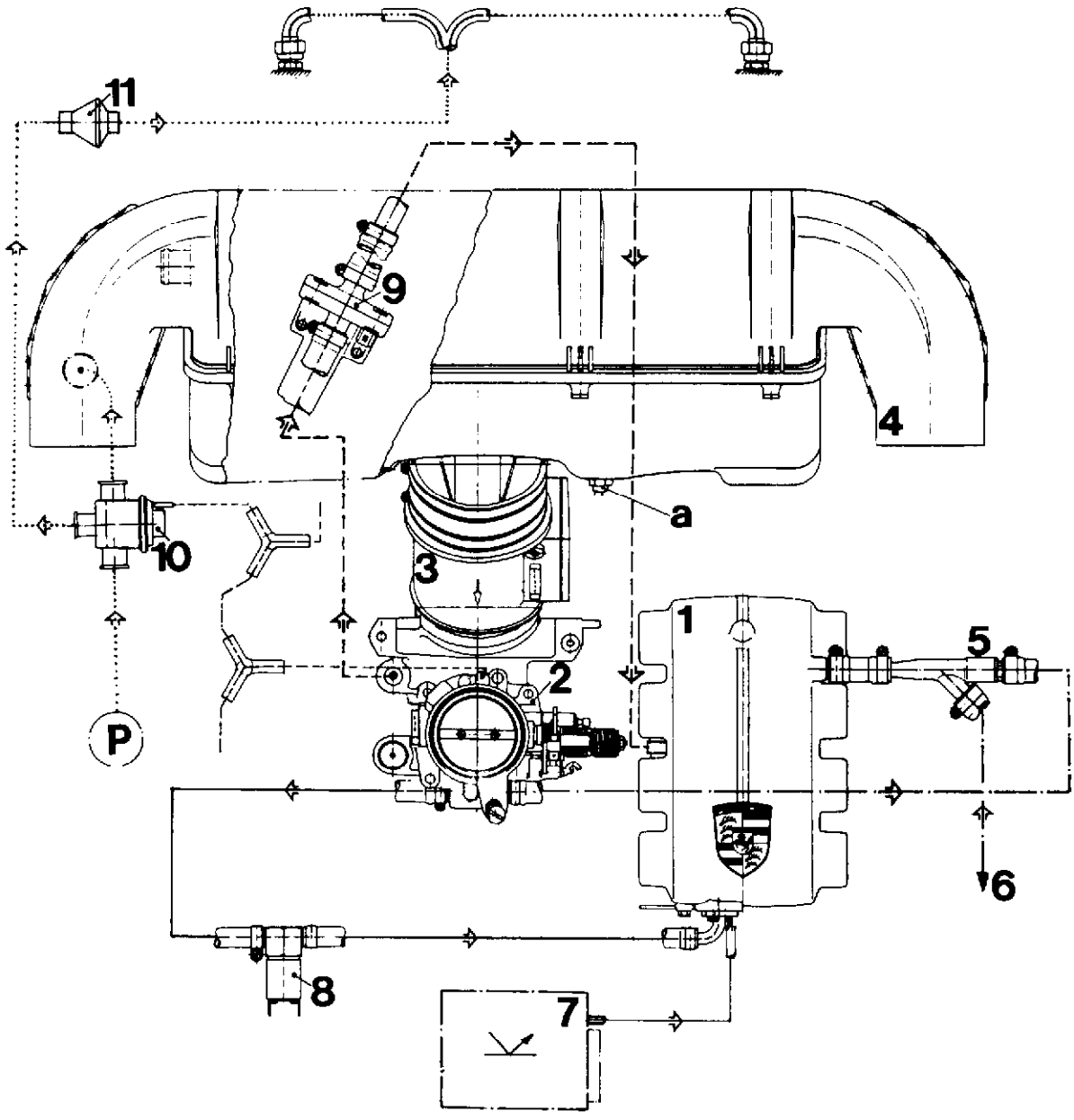
LH-JETRONIC EQUIPMENT TABLE – 928 S / from 1984 Models
Engine Type M 28-21/22

Electric Fuel Pump EKP 4	Fuel Filter	Fuel Pressure Damper	Fuel Pressure Regulator
928.608.104.01 Bosch No. 0580.464.017	928.110.253.00 Purolator No. PFC-6	928.110.202.00 Bosch No. 0280.161.008	928.110.198.01 Bosch No. 0280.160.215

Heated Wire Air Flow Sensor	NTC Temperature Sensor (Double Func.)	Throttle Switch	Auxiliary Air Regulator
928.606.141.00 Bosch No. 0280.214.001	928.606.126.00 Bosch No. 0280.130.032	931.606.119.00 Bosch No. 0280.120.301	928.606.102.00 Bosch No. 0280.140.228

Vacuum Control Switzerland, Sweden, Australia (Manual Transm.)	Electric Air Valve	Electric Fuel Injectors	LH-Jetronic Control Unit
930.110.173.00 Bosch No. 0280.160.302	944.606.215.00 Bosch No. 0280.141.012	928.606.119.00 Bosch No. 0280.150.252	928.618.123.00 Bosch No. 0280.002.501

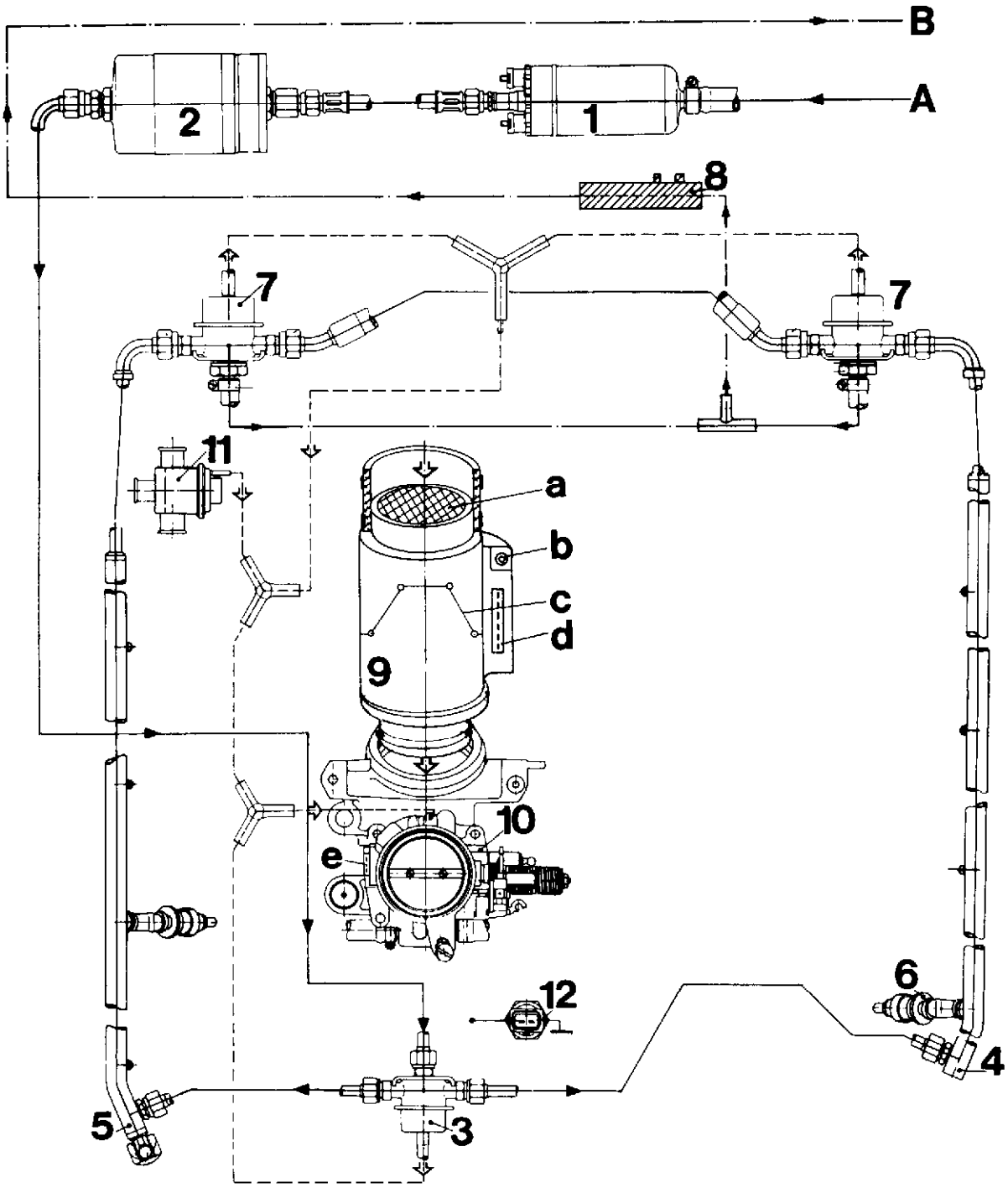
LH-JETRONIC AIR FLOW LAYOUT – 928 S – R. o. W. – 1984 Models
Engine Type 28-21/22



1 – Intake air distributor
2 – Throttle housing
3 – Heated wire air flow sensor
4 – Air cleaner
5 – Ejector
6 – To brake booster
7 – Electronic ignition control unit
8 – Electric air valve (air conditioner)
9 – Auxiliary air regulator
10 – Blowoff switching valve
11 – Check valve

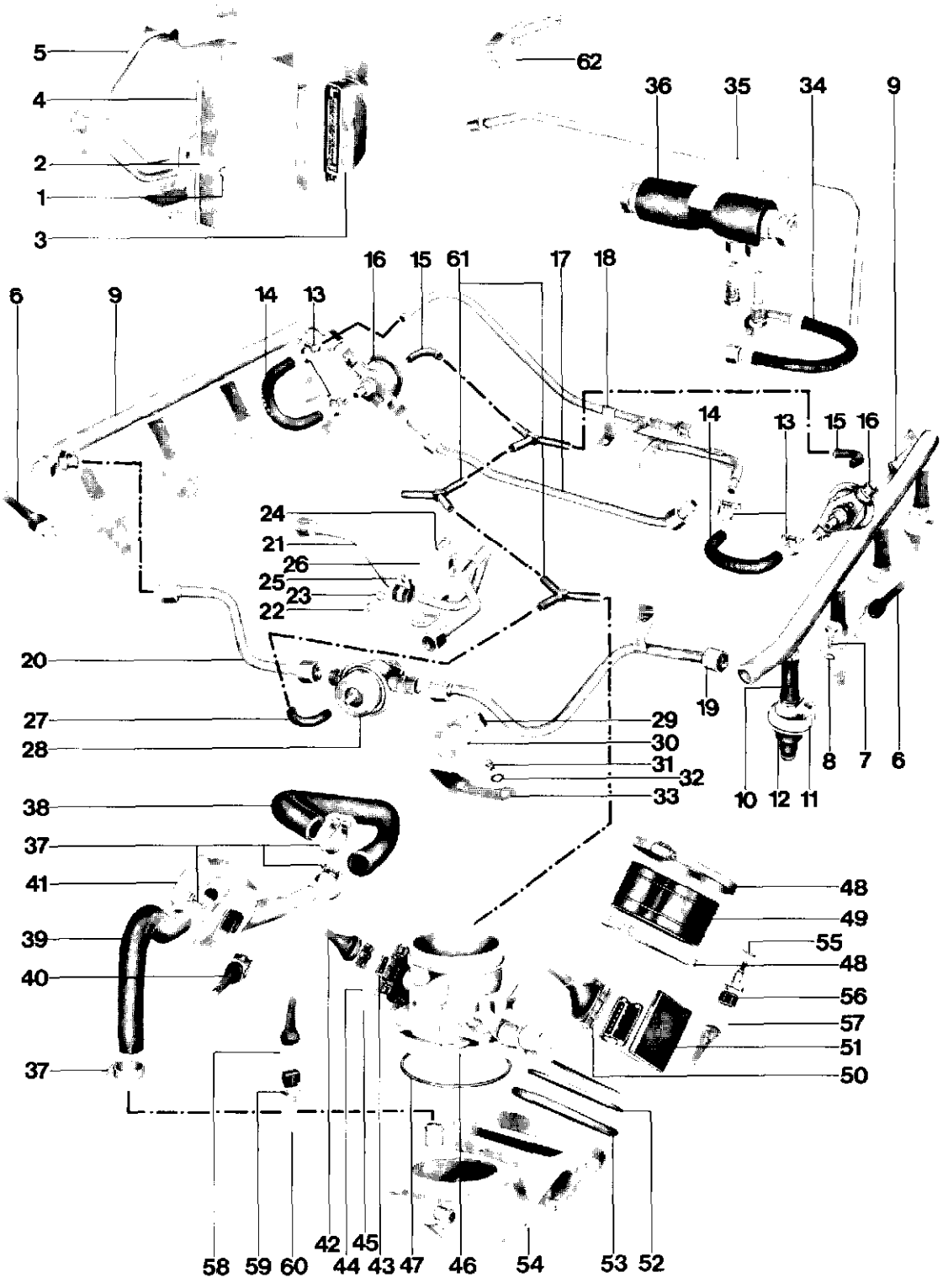
a – Temperature sensor I (intake air) for ignition
P – Auxiliary air pump

LH-JETRONIC FUEL FLOW LAYOUT – 928 S – R. o. W. – 1984 Models
Engine Type 28-21/22



1 – Fuel pump
2 – Fuel filter
3 – Pressure damper
4 – Fuel line Cyl. 5 – 8
5 – Fuel line with test connection
6 – Fuel injectors
7 – Pressure regulator
8 – Fuel cooler
9 – LH air flow sensor
10 – Throttle housing
11 – Blowoff switching valve
12 – Temperature sensor II
A – From fuel tank (feed)
B – To fuel tank (return)

LH-JETRONIC


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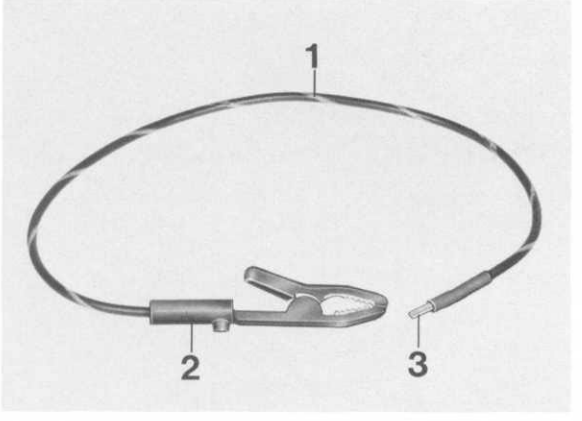
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Bolt	3			
2	Washer	3			
3	Multiple pin plug LH control unit	1		Make sure plug engages securely	
4	LH control unit	1			
5	Control unit holder	1			
6	Plug connector	8			
7	Bolt	8			
8	Washer	8			
9	Distributing injection tube	2			
10	Hose sleeve	8			
11	Thrust plate	8			
12	Fuel injector	8			
13	Hose clamp	4			
14	Hose	2			
15	Elbow hose	2			
16	Pressure regulator	2			
17	Fuel line	1			
18	Fuel line	1			
19	Fuel line	1			
20	Fuel line	1			
21	Fuel line (feed)	1			

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
22	Nut	1			
23	Washer	1			
24	Bolt	1			
25	Pipe clamp	1			
26	Holder	1			
27	Elbow hose	1			
28	Pressure damper	1			
29	Nut	1			
30	Washer				
31	Nut	2			
32	Washer	2			
33	Holder	1			
34	Fuel line	1			
35	Fuel line	1			
36	Fuel cooler	1			see page 24 - 126
37	Hose clamp	4			
38	Hose	1			
39	Hose	1			
40	Plug connector	1			
41	Auxiliary air regulator	1			
42	Plug connector	1			
43	Throttle switch	1			
44	Bolt	4			

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
45	Washer	4			
46	Throttle housing	1			
47	O-ring				
48	Hose clamp	2			
49	Connecting hose	1			
50	Plug connector	1			
51	Air flow sensor	1			
52	O-ring (dust guard)	1			
53	O-ring	1			
54	Air guide housing	1			
55	Seal	1			
56	Temperature sensor I	1			
57	Plug connector	1			
58	Plug connector	1			
59	Temperature sensor	1			
60	Seal	1			
61	Y-adapter	3			
62	Plug connector for central electric	1			

TESTERS AND TOOLS

- Engine tester with oscilloscope, e. g. 1010/1019, Bosch Mot 300/400
- Multiple tester (internal resistance at least 20 Kohm/V)
- Adapter line (Bosch "L-Jetronic" No. 1684 463 093)
- Pressure gauge with hose from pressure tester P 378
- Two test lines (made locally) for measuring on multiple pin plugs of control units and plug connectors with same type of contact (flat contacts)

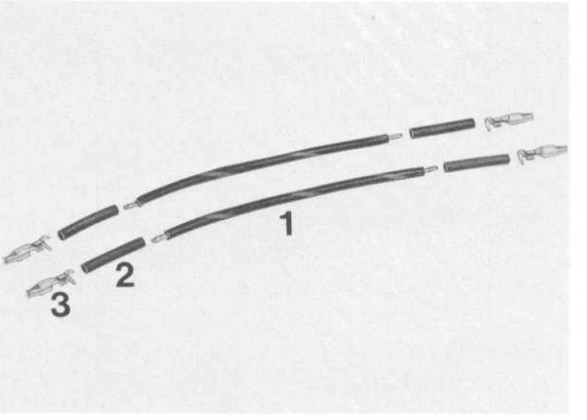


1 – Highly flexible line

2 – Alligator clips (standard)

3 – Flat male plug 2.8 (N 17.457.2)

- Two adapters – test lines (made locally)

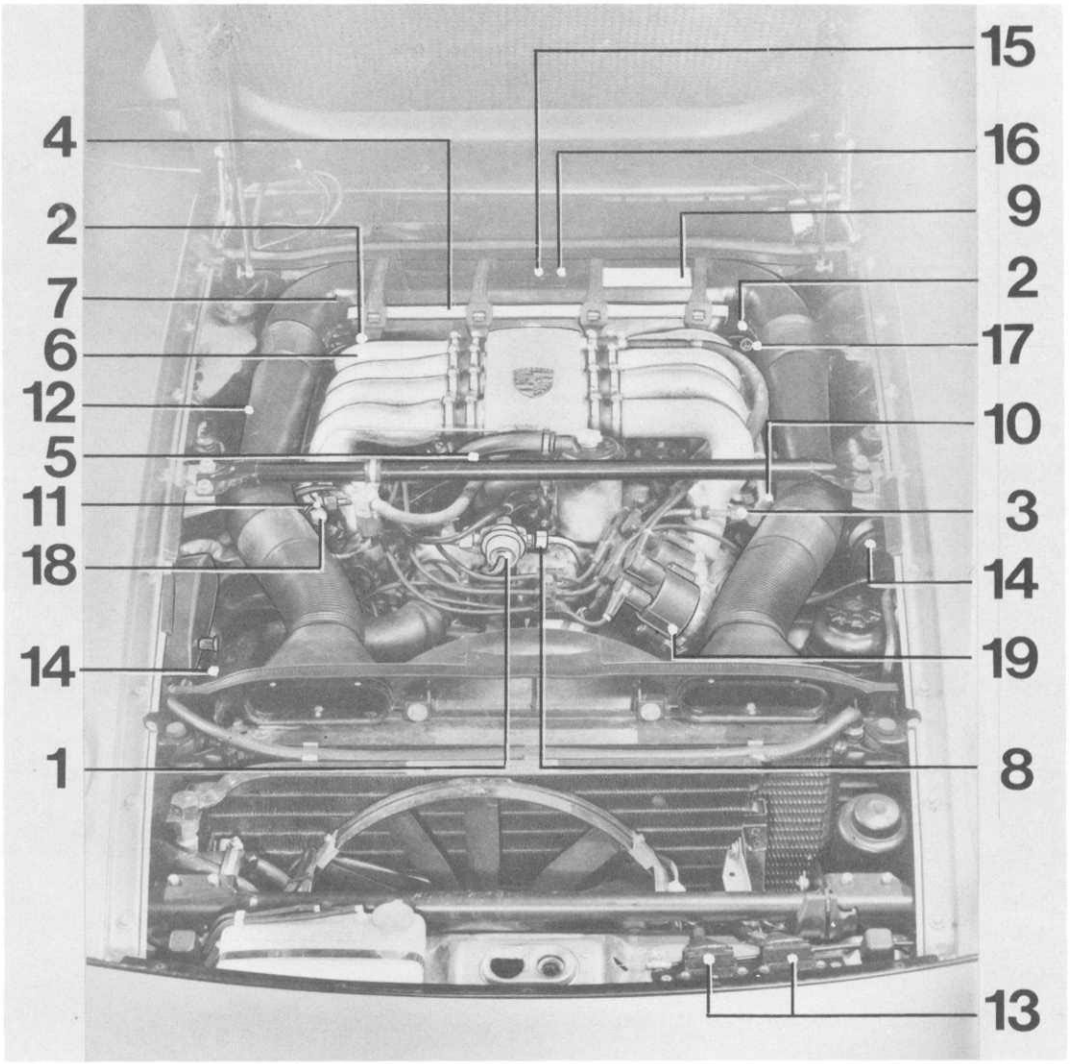


1 – Highly flexible line, approx. 10 cm long

2 – Insulating hose

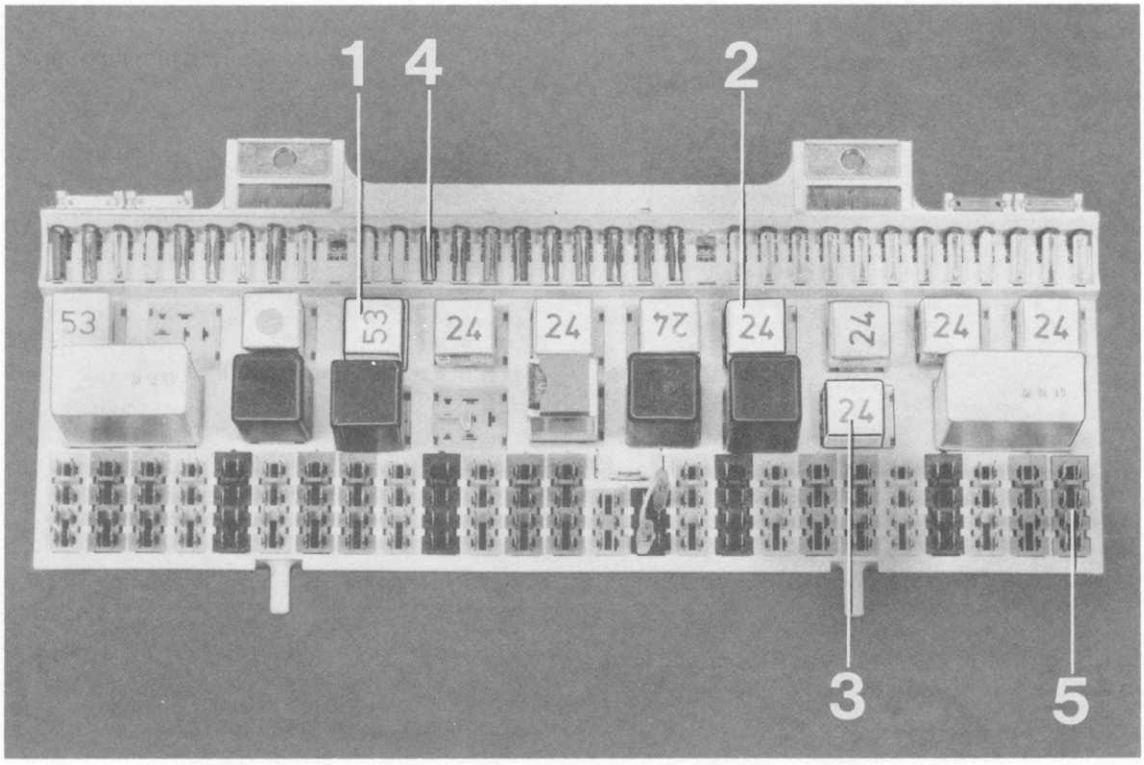
3 – Flat contact N 17.182.2

LOCATION OF COMPONENTS



1 – Pressure damper
2 – Pressure regulator (two)
3 – Fuel injectors, left
4 – LH air flow sensor
5 – Throttle switch
6 – Auxiliary air regulator
7 – Control units (ignition/LH)
8 – Temperature sensor II
9 – Temperature sensor I
10 – Fuel line
11 – Fuel injectors, right
12 – Blowoff switching valve
13 – Ignition control unit
14 – Ignition coils
15 – Speed/reference mark sensors
16 – TDC sensor
17 – TDC sensor test connection
18 – Fuel pressure test connection
19 – Distributor

CENTRAL ELECTRIC POWER SUPPLY FOR LH / ELECTRONIC IGNITION



1 – Electronic ignition relay VIII (power supply for electronic ignition and LH control units)

2 – LH-Jetronic relay XVI (power supply for LH control unit and air flow sensor)

3 – Fuel pump relay XVII (power supply for fuel pump, auxiliary air regulator and fuel injectors)

4 – Fuse no. 13 = fuel pump, auxiliary air regulator

5 – Plug X, red (power supply for electronic ignition/LH)

Testing Conditions	LH-Jetronic Possible Causes of Defects										
Engine in good operating condition Battery charged Starter turning	Ground and plug connections	Power supply for control unit and fuel pump	Air flow sensor	Temperature sensor II	Throttle switch	Fuel injectors/injection timing	Auxiliary air regulator	CO and idle speed adjustment	Leaks in intake	Fuel pressure	Alternator/regulator
See Test Point	1	2	3	4	5	6	7	8	9	10	11
Engine does not start	X	X		X		X				X	
Engine hard to start	X			X		X	X		X	X	
Erratic idling			X	X		X		X	X	X	
Poor pickup	X		X	X	X	X		X	X	X	
Misfiring	X		X		X	X			X	X	X
High fuel consumption			X	X	X	X		X		X	
Poor power output	X		X	X	X	X			X	X	
Engine hesitation	X	X	X	X		X	X	X	X	X	X

X = Check with suitable tester

TEST POINT 1

Checking Ground and Plug Connections

See page 28 - 53.

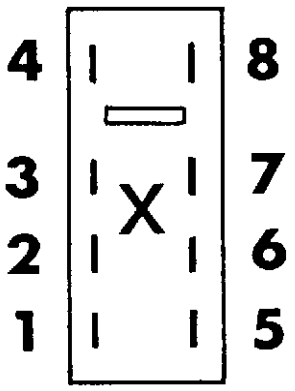
TEST POINT 2

Power Supply for LH Control Unit and Fuel Pump

1. LH Control Unit

Switch off ignition and pull off multiple pin plug on LH control unit.

1.1 Switch on ignition.
Measure voltage on multiple pin plug between terminals 9 and 5.
Specification: battery voltage.
If value deviates from specification, measure voltage on plug X connected on central electric board between terminal 8 and ground.



Specification: battery voltage

1.2 If battery voltage is not displayed, pull off relay XVI and bridge terminals 30 and 78.

Recheck voltage on LH multiple pin plug between terminals 9 and 5.

2. Fuel Pump

The fuel pump relay is activated negatively by the LH control unit.

2.1 Connect terminal 17 on disconnected LH control unit plug on ground with a piece of wire.

Fuel pump relay should be activated and fuel pump must run.

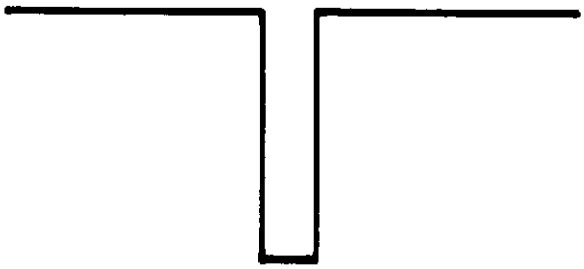
If pump does not run, check fuse no. 13 and relay XVII activation as well as fuel pump relay.

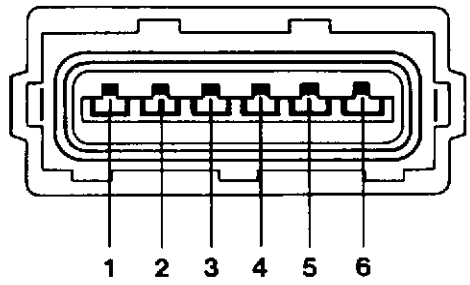
3. Checking Control Signal for Electronic Ignition to LH Control Unit

Pull off multiple pin plug on LH control unit; leave plug on electronic ignition control unit.

3.1 Connect positive test lead of oscilloscope on terminal 1 and negative test lead on ground.

Oscilloscope should display following control signal.





If no signal is displayed, check power flow from terminal 16 of electronic ignition control unit plug to terminal 1 of LH control unit plug.
If power flow is okay, replace electronic ignition control unit.

TEST POINT 3

LH Air Flow Sensor

1. Take off upper air cleaner housing and filter element.

2. Pull lower air cleaner housing and air flow sensor out of air guide housing.

3. Pull off multiple pin plug on air flow sensor.

   Measure voltage between terminals 4 and 2 (positive) on disconnected plug.

   Pull off relay XVI for this purpose and bridge terminals 30 and 87.

   Specification: battery voltage.

4. Measure resistance for idle mixture position.
   Connect ohmmeter on terminals 6 and 3 of air flow sensor.

   Specification: 0 . . . 1000 ohms.

5. Connect ohmmeter on terminals 5 and 3 of air flow sensor.

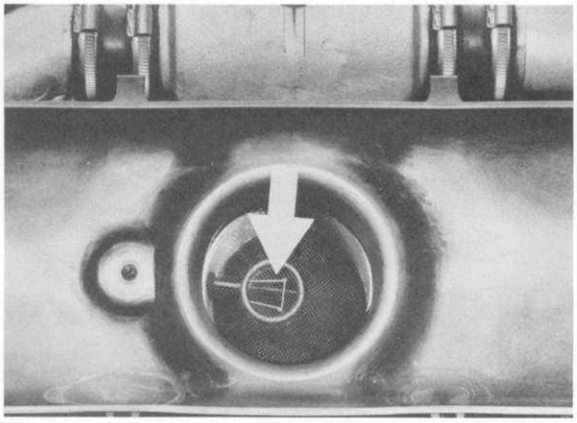
   Specification: 3.6 . . . 4.1 ohms.

6. Checking "Free Burning" of Heated Wire

6.1 Visually inspect
- plug connection and contacts,
- wire grid for damage and
- heated wire for breaks.

6.2 Install air flow sensor with lower air cleaner housing.
Coat O-ring in air guide housing with silicone for this purpose.
Connect plugs on air flow sensor and temperature sensor.
Push in air flow sensor carefully.

6.3 Do not install filter element and upper air cleaner housing.
Run engine having operating temperature at approx. 2,000 rpm and then switch off ignition.
Observe heated wire with help of a mirror.



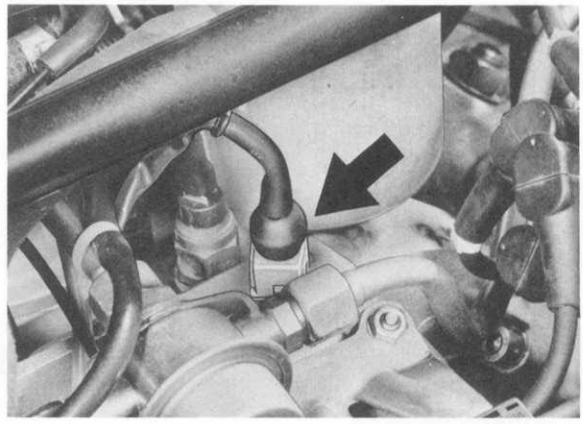
Heated wire must glow about 1 second after waiting approx. 4 seconds.

Check activation and wires in case of malfunction.
(LH plug terminal 8 to air flow sensor terminal 1).

TEST POINT 4

Temperature Sensor II (Engine Temperature)

1. Check plug connection on temperature sensor II for tight fit and clean contacts.



2. Connect ohmmeter on terminals 2 and 5 of disconnected LH multiple pin plug.

Specifications:

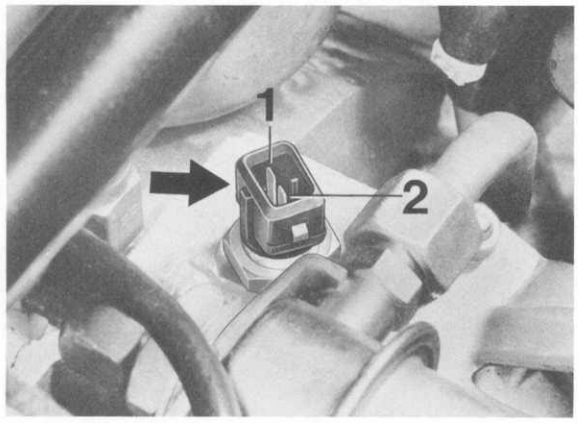
0 °C/	32 °F	= 4.4 – 6.8 kΩ
15 to 30 °C/	59 to 86 °F	= 1.4 – 3.6 kΩ
40 °C/	104 °F	= 0.9 – 1.3 kΩ
60 °C/	140 °F	= 480 – 720 Ω
80 °C/	176 °F	= 250 – 390 Ω

If specified values are not reached, repeat same tests on the temperature sensor direct.

Note:

Two independent temperature sensors are installed in the temperature sensor housing.

Connect tester on only one contact of the sensor and a second test lead on ground.



1 – Electronic ignition

2 – LH-Jetronic

Temperature sensor II provides the LH control unit with information on the instantaneous engine temperature.
It enriches the fuel/air mixture for cold starting and engine warm-up.

In case of interruption (inf. ohms):
excessively rich mixture, engine will not run in warm state and cannot be started.

In case of short circuit (0 ohm):
mixture too lean, no pickup in cold state.

In case of interruption, wires could be bridged for emergency operation of the car.

TEST POINT 5

Throttle Switch.

1. Idle Speed Contact

Pull off multiple pin plugs on LH and electronic ignition control units.

1.1 Connect ohmmeter between terminals 3 and 5 on LH plug.

Specifications:
throttle closed = 0 ohm
throttle opened = inf. ohms

Switching over must take place already with a throttle gap of approx. 1°.

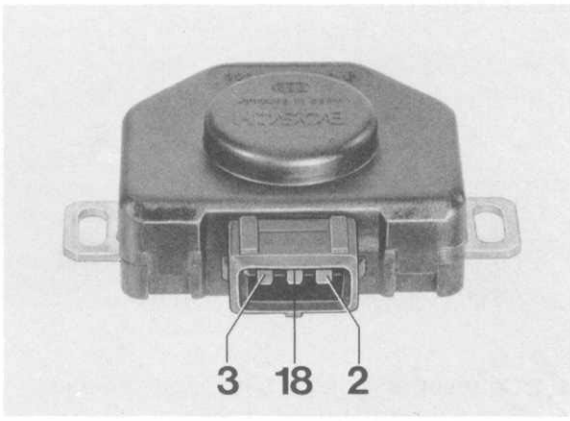
2. Full Load Contact

2.1 Connect ohmmeter between terminals 12 and 5 on LH plug.

Specifications:
throttle closed = inf. ohms
throttle in full load pos. = 0 ohm

Switching point is after approx. 3/4 throttle travel.

Make tests direct on throttle switch, if switching points are not reached.



2 = Idle speed contact

18 = Ground

3 = Full load contact

Note:

If idle speed switch has a break, there will be no coasting shutoff.

If idle speed switch has a short circuit, there will be a single cutout at high idle speed.

If full load switch has a break, there will be no full load enrichment.

If full load switch has a short circuit, enrichment will be too early and consequently fuel consumption too high.

TEST POINT 6

1. Checking Fuel Injectors

If engine can be operated, pull off plugs on injectors separately.
If fuel injectors are okay, engine speed should drop each time.

If engine cannot be operated, measure voltage on one plug of injectors against ground.
One of both terminals should have battery voltage.

Measure coil resistance of fuel injectors.

Specification: 15 – 17.5 ohms
(+ 15 . . . 30 °C/+ 59 . . . 86 °F).

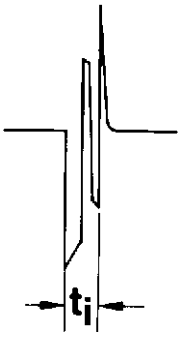
2. Checking Injection Timing

Adjust oscilloscope according to instructions supplied with tester.
Connect adapter line (Bosch "L-Jetronic" No. 1 684 463 093) between one fuel injector and corresponding plug.

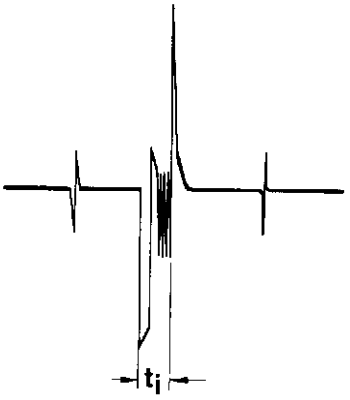
Caution!
Tester leads must not have contact with ground.

Start engine. If injection timing is working correctly, the oscilloscope will display the following oscillographs.

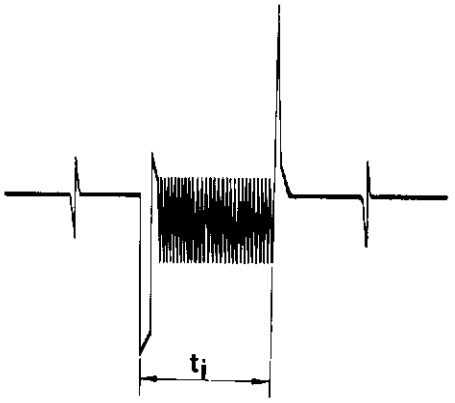
STARTER SPEED



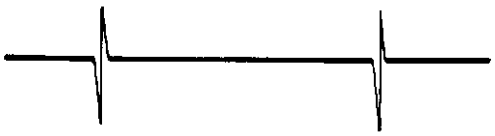
IDLE SPEED



ACCELERATION



DECELERATION



Note:
If engine does not start or the idle speed drops, exchange test connections on adapter line and check tester adjustment.

TEST POINT 7

Auxiliary Air Regulator

1. The auxiliary air regulator will be closed in heated state.
   Squeeze air hose tight – engine speed may only drop slightly.

2. Pull off plug on auxiliary air regulator and measure voltage between both terminals.

   Specification: battery voltage.

3. Measure resistance on auxiliary air regulator.

   Specification: 10 . . . 45 ohms.

TEST POINT 8

CO and Idle Speed Adjustment

See page 24 - 122.

TEST POINT 9

Leaks in Intake System

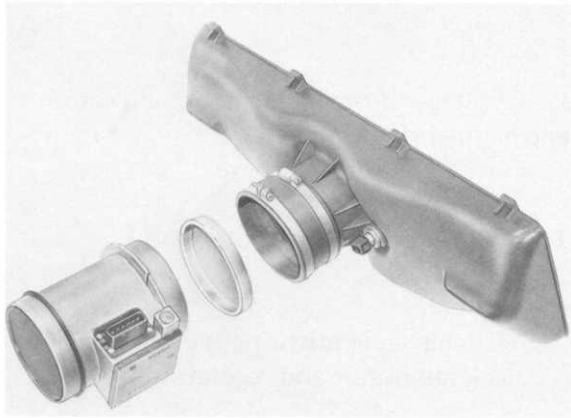
1. Remove air intake hoses.

2. Take off upper air cleaner housing and remove hose on blow-off switching valve.

3. Unscrew unlosable hexagon head screws (13 mm wrench size) in lower air cleaner housing and remove lower housing with heated wire air flow sensor. Pull off both multiple pin plugs.

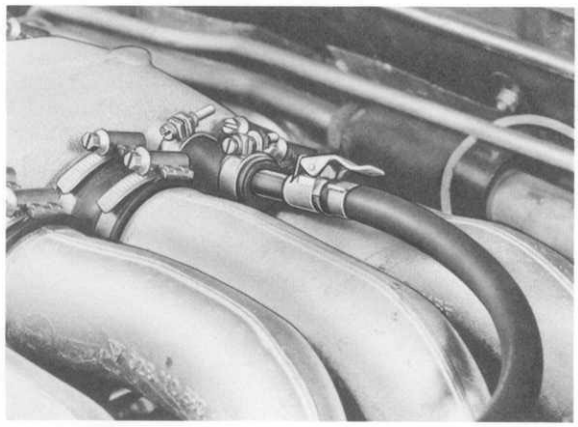


4. Unscrew heated wire air flow sensor on lower air cleaner housing and plug air inlet opening, e. g. with dust cap of original spare part package and heated wire air flow sensor.



5. Install lower air cleaner housing with air flow sensor.

6. Build up approx. 0.5 bar pressure.



7. Spray leak detecting spray on all connections. Bubbles will be produced at leaking points.

TEST POINT 10

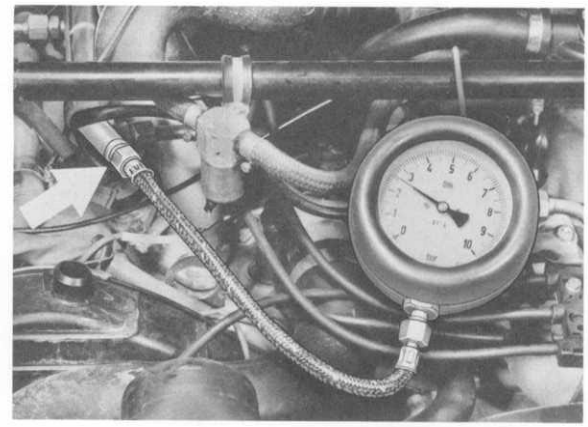
Fuel Pressure

1. Unscrew cap nut on injection line.

Note:

Be careful that sealing ball does not fall out when removing the cap nut.
Catch escaping fuel.

2. Connect pressure tester P 378.



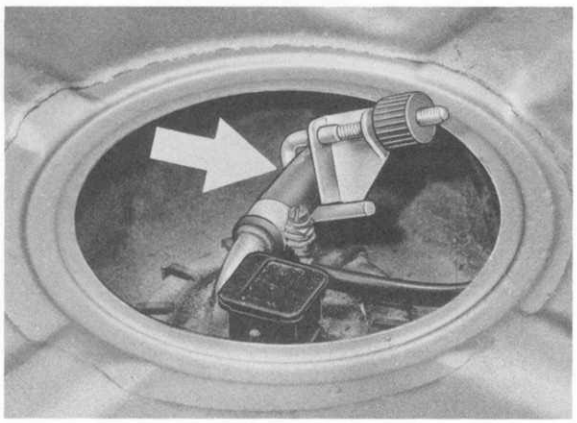
3. Start engine and measure fuel pressure at idle speed.

Specification: approx. 2.0 bar.

Pull off vacuum hose on left pressure regulator.

Specification: 2.3 . . . 2.7 bar.

4. If fuel pressure deviates from specified values, slowly squeeze return line with a clamp applied at rear next to the fuel level transmitter.



If pressure rises to less than 4 bar, check fuel filter or, if necessary, replace fuel pump.

5. If engine cannot be operated, pull off relay XVII and bridge terminals 30 and 87.
Fuel pump must run.

Specification: 2.3 . . . 2.7 bar.

TEST POINT 11

Alternator/Regulator

Peak voltage of the alternator could cause engine misfiring.

1. Remove drive belt and alternator.

2. Start engine. If misfiring is eliminated, check alternator and regulator.

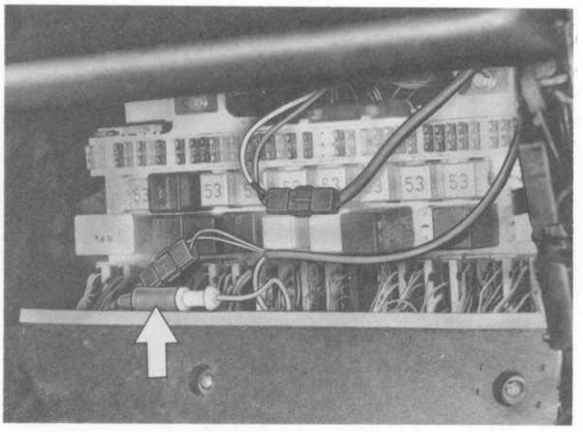
TESTING OXYGEN SENSOR OPERATION, UP TO '86 MODELS

Brief test

Precondition:

- Engine at operating temperature.
- Ideal speed correctly adjusted.
- Exhaust tester connected to extraction point in engine compartment.

1. Disconnect oxygen sensor plug, wait until state of equilibrium is reached and note CO value.



2. Disconnect vacuum line from fuel pressure regulator.
   The CO reading must show a considerable increase.

3. Reconnect oxygen sensor plug.
   The CO value must return to the specified 0.6 ± 0.2%.

If CO value does not change, there is a fault in either the oxygen sensor or the LH control unit.

Testing sensor voltage

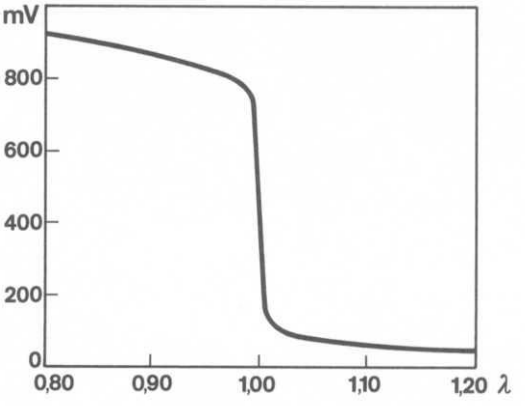
1. Precondition as for the "brief test"

2. Disconnect oxygen sensor plug.

3. Connect voltmeter to sensor half of plug and earth

4. The voltage must be in the 0.1 V - 1.0 V range (depending on level of oxygen in the exhaust).

Voltage characteristic of oxygen sensor for working temperature of 600°C.



Rich mixture (air deficiency) Lean mixture (excessive air)

Testing lambda control function

1.Test precondition as for "brief test".

2.Disconnect oxygen sensor plug.

3.With a length of cable, briefly connect cable of control-unit side of plug to ground.

The CO value must increase.

If there is no change in the CO value check connection to LH control unit, if necessary replace control unit.

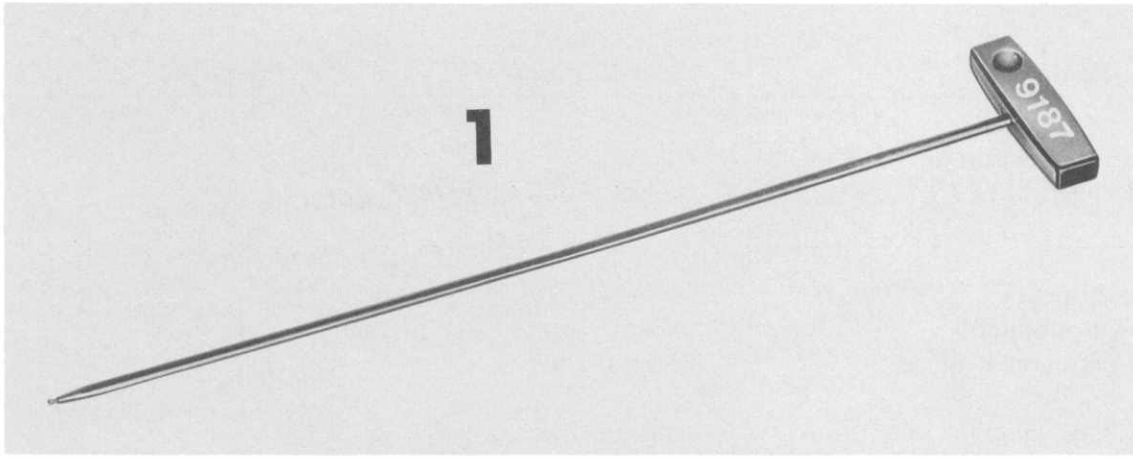
TESTING AND ADJUSTING SPECIFICATIONS FOR LH-JETRONIC –
TYPE 928 S Rest of World

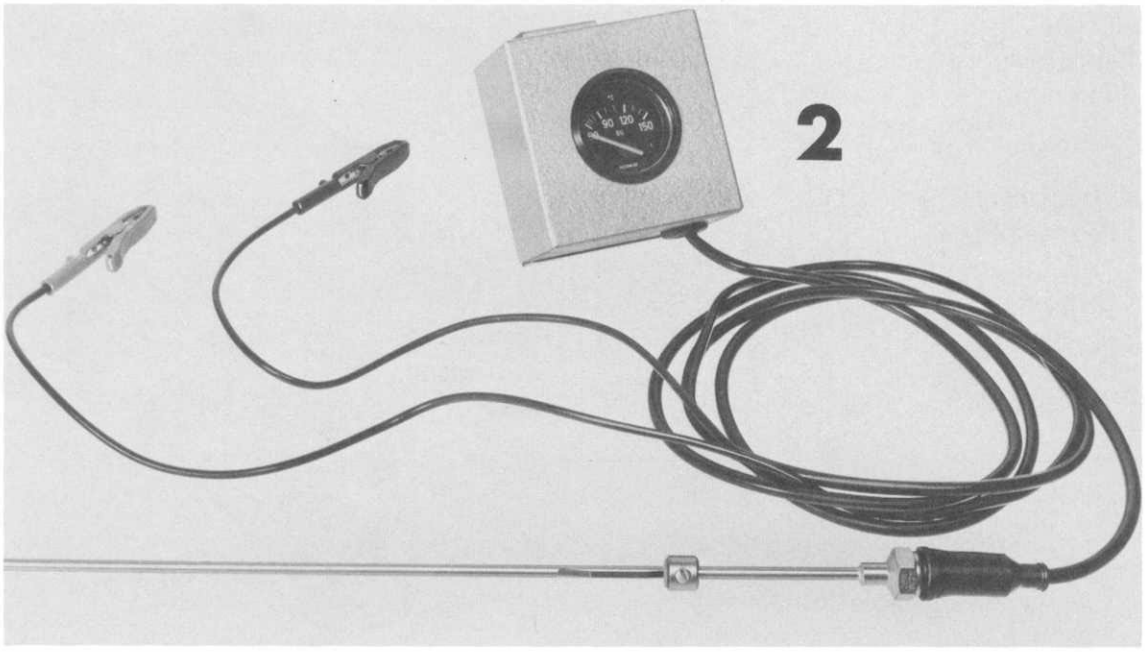
Beginning with 1984 Models
Engine Type M 28.21/22

Test Point	Specifications	Remarks
Electric fuel pump Delivery rate	at least 1350 cc/30 sec.	
Fuel pressure (engine stopped) Fuel pump bridged Check value for idle	 2.5 ± 0.2 bar approx. 2 bar	
Leak test Min. pressure after 20 minutes	 1 bar	
Idle adjustments Idle speed (rpm) CO (%)	 700 + 500 0.5 – 1.5 R. o. W. 0.5 – 1.0 Australia, Switzerland, Sweden	

ADJUSTING IDLE SPEED AND CO — beginning with 1984 models
Engine Type M 28.21/22

TOOLS





No.	Description	Special Tool	Remarks
1	CO adjusting tool	9187	
2	Oil temperature tester	9122	

ADJUSTING IDLE SPEED AND CO

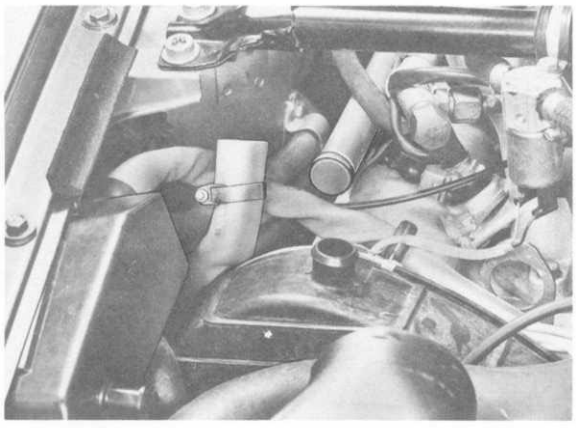
Note:

Requirement:
Engine in perfect mechanical condition.

Make adjustments as quickly as possible to avoid excessive heat in intake ports and consequently wrong CO values.

1. Take off right air intake hose.

2. Disconnect auxiliary air pump hose on air pipe and insert a suitable plug in open air pipe (e. g. rubber grommet for doors, Part No. 999.703.163.40).



3. Install air intake hose.

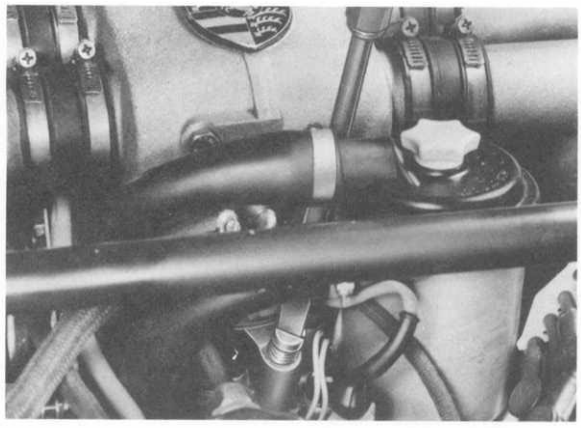
4. Run engine to operating temperature (oil temperature approx. 80 to 90 °C/ 176 to 194 °F).
   Use Special Tool 9122 to measure oil temperature.

   Intake air temperature:
   15 to 35 °C/59 to 95 °F.



5. Connect CO tester and separate tachometer to supplier's instructions.

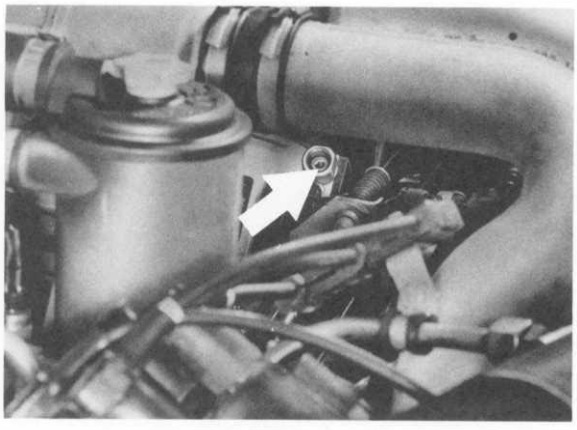
6. Turn control screw or bypass screw on throttle housing, until speed of 700 + 50 rpm is reached.



Note:

Use separate tachometer from tester or similar.

7. Adjust fuel/air mixture. Guide Special Tool 9187 into adjusting bore of heated wire air flow sensor and turn idle speed potentiometer accordingly.



Turning clockwise = richer mixture.
Turning counterclockwise = leaner mixture.

CO specifications:
0.5 – 1.5 % R. o. W.
0.5 – 1.0 % Australia,
Switzerland,
Sweden

8. Remove plug in air pipe and reconnect hose.

REMOVING AND INSTALLING HEATED WIRE AIR FLOW SENSOR

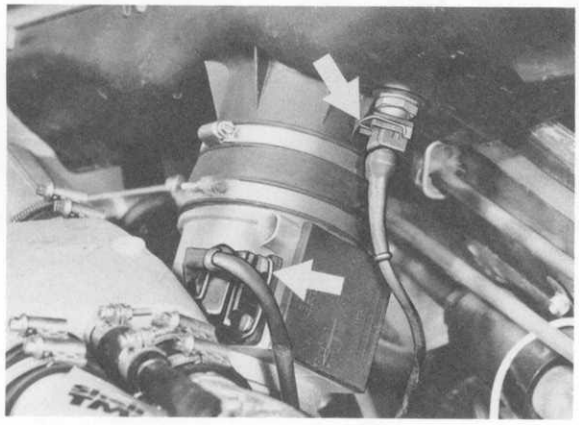
Removing

1. Remove air intake hoses.

2. Take off upper air cleaner housing and remove hose on blowoff switching valve.

3. Unscrew unlosable hexagon head screws (13 mm wrench size) in lower air cleaner housing and remove lower housing with heated wire air flow sensor.

4. Pull off both multiple pin plugs.

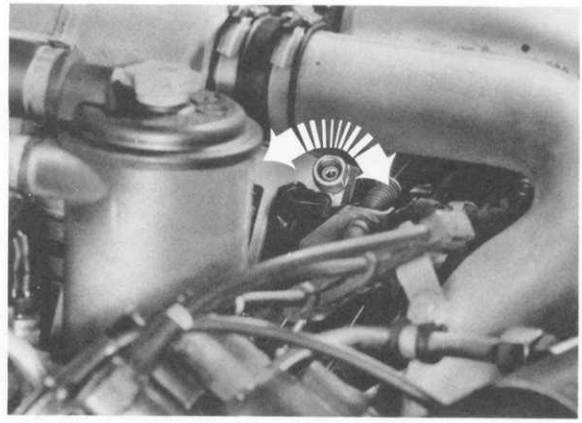


5. Loosen bottom hose clamp and take heated wire air flow sensor off of lower air cleaner housing.

Installing

1. Check O-ring in air guide housing for damage and correct fit. Lubricate O-ring with silicone grease, e. g. Bosch Ft 2v2.

2. Insert heated wire air flow sensor that access to adjusting bore for idle speed potentiometer with Special Tool 9187 is guaranteed.
Align air flow sensor if necessary.



3. Install and mount lower air cleaner housing and then tighten bottom hose clamp.

REMOVING AND INSTALLING FUEL COOLER

Removing

1. Discharge air conditioner as described in Group 87 of Repair Manual 928.

   Note:

   Conform with safety precautions for handling refrigerants.

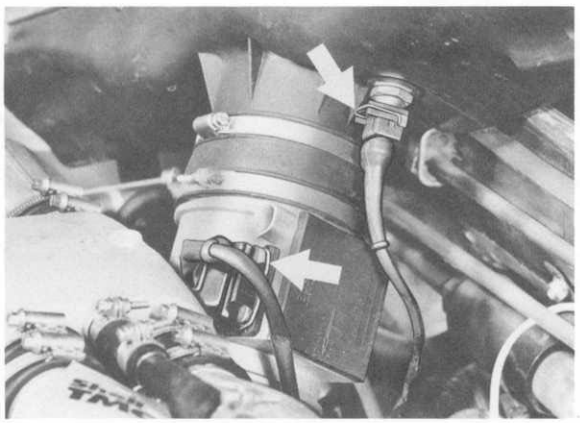
2. Disconnect battery.

3. Take off upper air cleaner housing and filter element.

   Pull off hose on blowoff switching valve and unscrew unlosable hexagon head screws (13 mm wrench size) in lower air cleaner housing.

4. Pull out lower air cleaner housing with air flow sensor and pull off plugs.

   Press bar in direction of arrow while pulling off plugs.



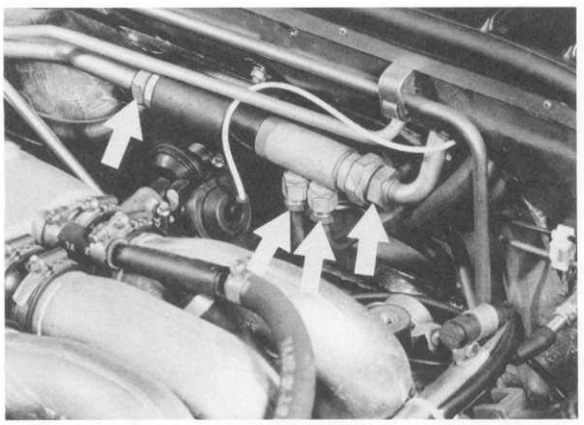
5. Remove fuel cooler.

   a) First unscrew right refrigerant line coupling completely, while holding on hexagon of line.

   b) Unscrew both fuel line connections on fuel cooler, while holding on cooler each time.

   c) Unscrew bracket for fuel cooler.

   d) Unscrew left refrigerant line coupling, while holding on hexagon of line.



Installing

1. Install fuel cooler.

   a) Check that seals on refrigerant line connections are not damaged, replacing if necessary.

   b) First connect left refrigerant line on fuel cooler. Do not tighten coupling fully at this point.

c) Connect and tighten both fuel lines on fuel cooler, while counterholding.

d) Connect right refrigerant line.

e) Tighten both refrigerant line couplings on fuel cooler, holding on hexagon each time and being careful that fuel cooler is not turned.

f) Install and bolt bracket for fuel cooler.

2. Mount air flow sensor together with lower air cleaner housing, connecting wires on air flow sensor and air cleaner.

   Tighten lower air cleaner housing mounting screws.

   Install filter element and upper air cleaner housing, connecting hose from blowoff switching valve on upper air cleaner housing.

3. Connect battery.

4. Start engine and run approx. 15 seconds while checking fuel line connections on fuel cooler for leaks.
   Tighten fuel line connections if necessary.

5. Flush, discharge and charge air conditioner as described in Group 87 of Repair Manual 928.

SPECIFICATIONS FOR TESTING AND ADJUSTING LH-JETRONIC TYPE 928 S

85 MODEL ONWARD (32-VALVE ENGINES)

ENGINE TYPE M28. 43/44/45/46

Test	Specification	Remarks
Electric fuel pump delivery rate	min. 1350 cm^3/ 30 s	
Fuel pressure (engine off) fuel pump bridged	2.3.....2.7 bar	
Overpressure at idle speed	approx. 2 bar	
Leak test minimum pressure after 20 minutes	1 bar	
Idle speed adjustment Idle speed in rpm 1/min CO-content %	 680 $\pm$ 20 0.6 % $\pm$ 0.2 %	

EQUIPMENT CHART LH - JETRONIC - TYPE 928 S

85 MODELS ONWARD (32-VALVE ENGINES)

ENGINE TYPE M 28. 43/44/45/46

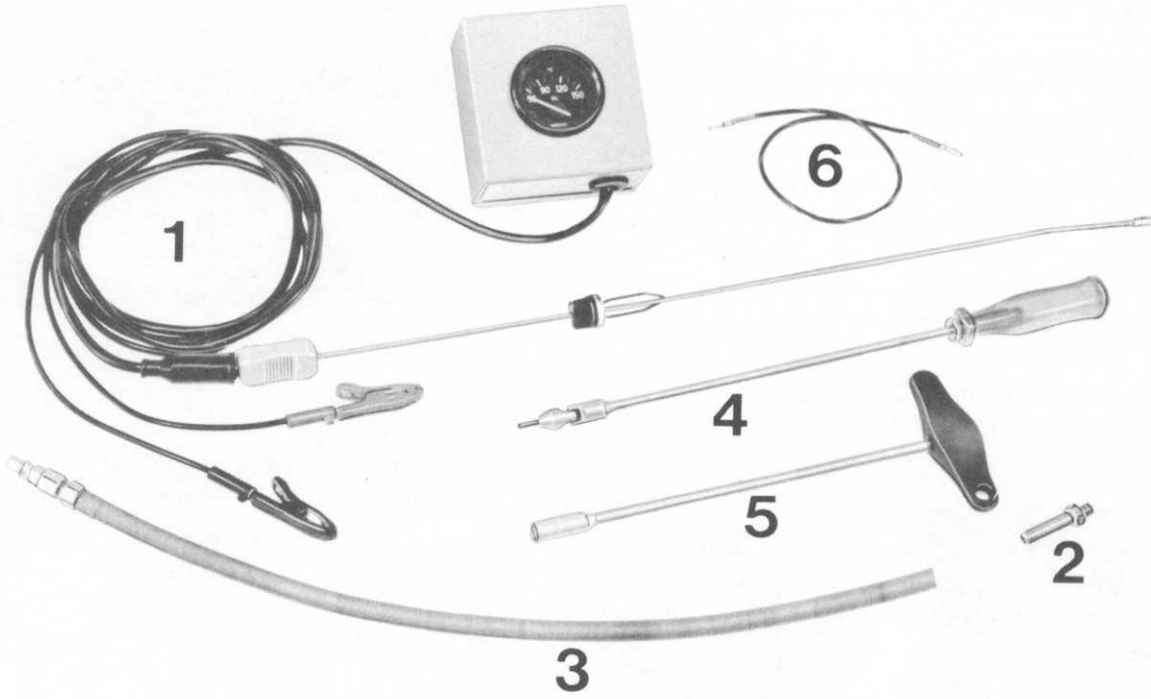
Electric fuel pump	Fuel filter	Fuel pressure damper (intake)	Fuel pressure regulator
928.608.104.01 Bosch No. 0580.464.017	928.110.253.00 Purolator No. 506.883.901.5	928.110.202.00 Bosch No. 0280.161.008	928.110.198.01 Bosch No. 0280.160.215

Hot wire air volume meter	NTC Temperature sensor II (dual function)	Throttle switch	Idle adjuster
928.606.141.00 Bosch No. 0280.214.001	928.606.126.00 Bosch No. 0280.130.032	944.606.113.01 Bosch No. 0280.120.308	928.606.161.00 Bosch No. 0280.140.509

Electric injection valves	LH-Jetronic control unit 85 models M28. 43/44	LH-Jetronic control unit 86 models M28. 43/44/45/46
928.606.120.00 Bosch No. 0280.150.706	928.618.123.03 Bosch No. 0280.002.50	928.618.123.04 Bosch No. 0280.002.503

ADJUSTING IDLE (32 VALVE ENGINE)

Tools



No.	Description	Special Tool	Remarks
1	Oil temperature tester with test probe	9122 + 9122/1	or US 8025
2	Adapter	US 8040	
3	Exhaust probe	US 4492	
4	Screwdriver	9230	
5	7 mm hexagon key		e.g. Hazet 428 - 7
6	Lead		Made locally

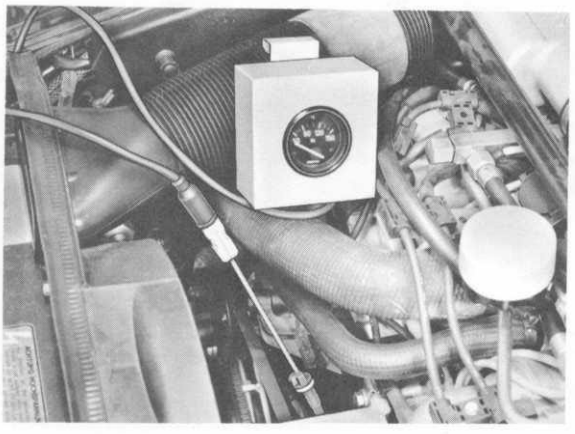
ADJUSTING IDLE (32 VALVE ENGINE)

Note

Adjusting Requirements:

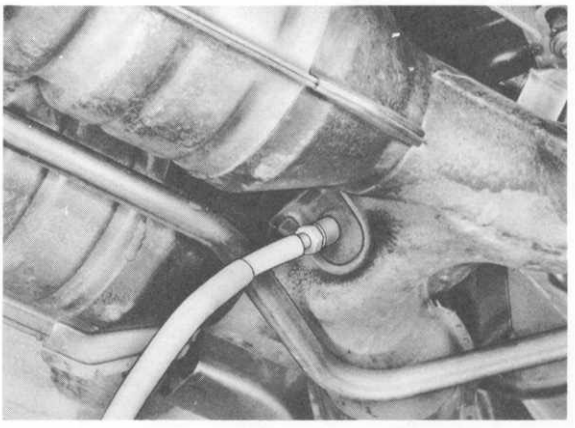
Engine in perfect mechanical condition. Electric equipment switched off during adjustments. Adjustments made as quickly as possible to prevent heating up the intake ports and consequently causing wrong CO values.

1. Run engine to operating temperature (oil temperature 80 to 90° C). Use Special Tools 9122 + 9122/1 to check oil temperature: 15 to 30° C.



2. Disconnect oxygen sensor plug and connect CO tester according to supplier's instructions.

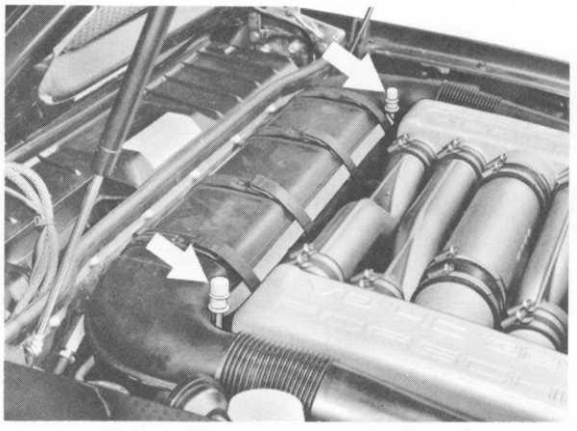
3. Install Special Tool US 4492 on CO testing pipe.



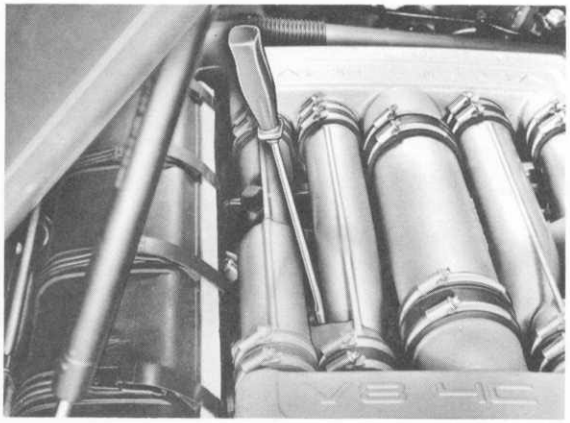
Note

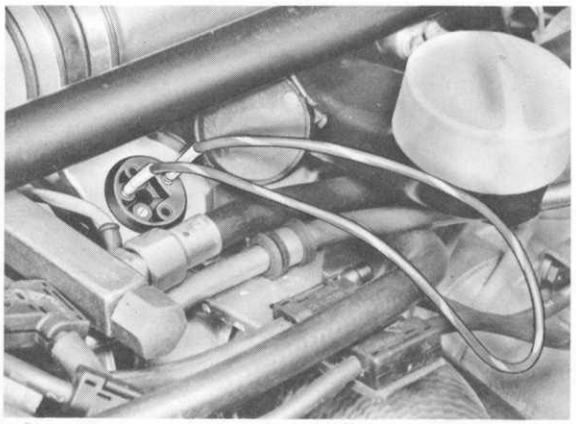
It is recommended to use the test connection in area of air cleaner housing, if there is suspicion of erratic engine running or when troubleshooting.

CO testing pipe for cylinders 1 - 4 is on righthand side, or lefthand side for cylinders 5 - 8.



4. Check CO. If CO level deviates from specified value, correct the adjustment on air volume sensor. Use Special Tool 9230.





CO adjusting value: 0.6 + 0.2 %
Turned clockwise - richer mixture
Turned anticlockwise - leaner mixture

Note

If the CO level has to be corrected on the air volume sensor, remove plug in bore affording access to the idle speed CO adjusting screw after removal of the air volume sensor.

5. Connect oxygen sensor plug and insert plug in CO testing pipe after finishing adjustments.

6. Connect separate tachometer to supplier's instructions.
Idle speed adjusting value: 680 ± 20 rpm.

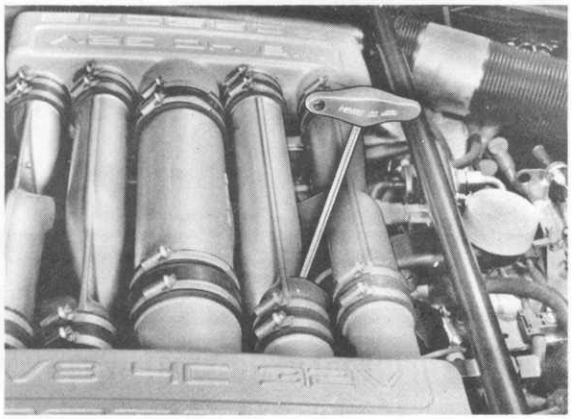
7. Check and adjust idle speed.
This requires stopping the idle speed charging control.



a) Connect test jacks B and C with a piece of locally made wire. This stops idle speed charging control.

b) Check and adjust speed with, for example, VAG Tester 1367.

8. Turn control screw (bypass) on throttle housing with a standard screwdriver, e.g. Hazet 428 - 7, until the specified speed of 680 ± 20 rpm.



9. Restore idle speed charging control after finishing adjustments (remove locally made wire on test jacks).

10. Recheck adjusted values.

Printed in Germany

CORRECTING CO ADJUSTMENT ON AIR VOLUME SENSOR (32 VALVE ENGINE)

Note

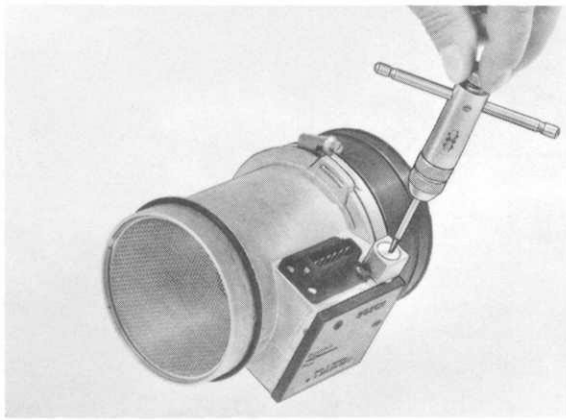
If CO level deviates from the specified value, remove plug in bore affording access to the CO adjusting screw after removal of the air sensor.

Removing

1. Remove air sensor.

2. Drill hole in plug with a 2 mm dia. drill (up to stop on steel insert).

3. Pull out plug with a lefthand spiral drill (size no. 2).

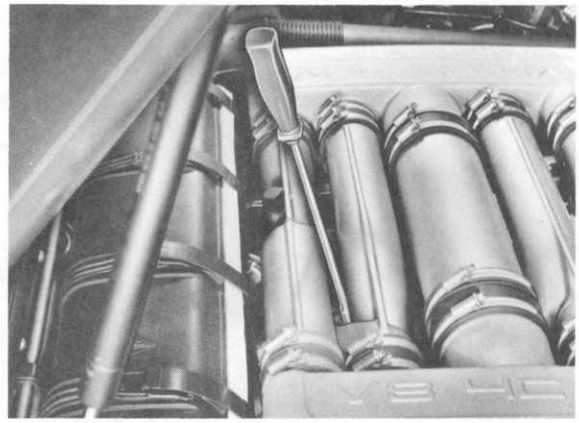


Installing

1. Install air sensor.

2. Adjust CO and engine idle speed. Turn CO adjusting screw accordingly with Special Tool 9230.

Turned clockwise - richer mixture
Turned anticlockwise - leaner mixture



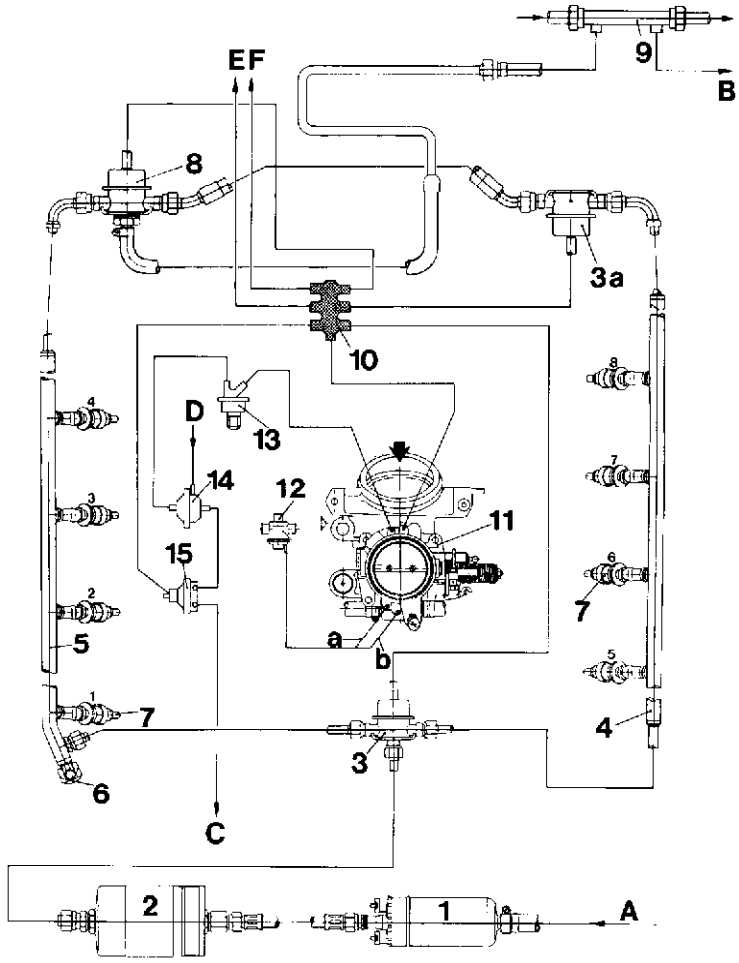
3. Install a new plug in bore affording access to CO adjusting screw after finishing adjustments. Press in plug flush.

Note

Drilled plugs must never be reused.

FUEL PATH - LH-JETRONIC 928 S 85 MODELS ONWARD (32-VALVE ENGINES)

ENGINE TYPE M28. 43/44/45/46



a - connection, USA
b - connection, California

A - from fuel tank
B - to fuel tank
C - vent to oil filter neck
D - from activated charcoal cannister
E - to automatic transmission
F - to ECU

1 - fuel pump
2 - fuel filter
3/3a - pressure damper
4 - left-hand injection line
5 - righ-hand injection line
6 - test point

7 - injectors
8 - pressure regulator

9 - fuel cooler
10 - underpressure distributor
11 - throttle valve body
12 - Blow-off valve
13 - Thermo switch

14 - air-bleed valve

15 - diaphragm valve

Removing and installing injection valves (32-valve engine)

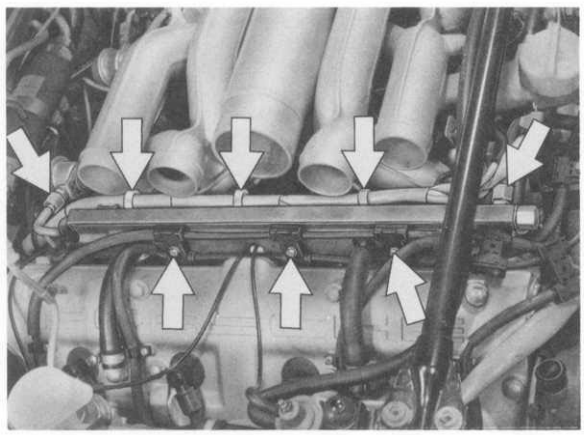
Removal

1. Remove air intake hoses and air filter system as a unit.

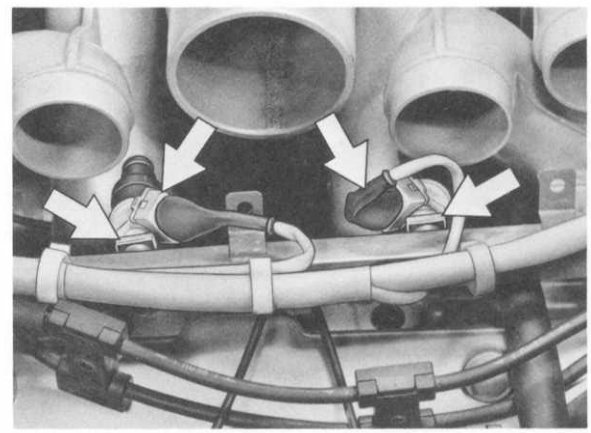
2. Slacken holder of exhaust sampler and hose clamps on intake pipe and lift off intake manifold.

3. Remove both untion nuts from fuel-distribution pipe, using a second open-end wrench to counter the nuts. Catch the fuel from the pipe in a suitable container.

4. Remove ignition lead and cable clip from distribution pipe. Disconnect distribution pipe from intake pipes and lift off.



5. Disconnect electrical connections, remove retainers and extract injection valves.



Installation

1. Replace injection valve seals. Apply a thin coat of oil to the housing bore.

2. Visual check to ensure system leak tightness.

Printed in Germany – XXVII, 1991

Testing and adjustment values for Type 928 S 4 - 928 GT - 928 GTS (5,4l)

As from Model 87
Engine type M 28. 41/42/47/49/50

Test step	Test values		Special notes
Electric fuel pump Delivery quantity	min. 1250 cm^3/30 s		
Fuel pressure (Engine standstill) Fuel pump relay bypassed	3.8 ± 0.2 bar		
Check value in idling condition	approx. 3.3 bar		
Leak test Minimum pressure after 20 min	3.0 bar		
Idle setting	without catalytic converter	Catalytic converter vehicles	* Idle and CO level adjustment is no longer possible on vehicles fitted with catalytic converter
928 GT **Engine Type M28.47** Idle speed, rpm	775 ± 25	775 ± 25	
Idling speed rpm	675 ± 25	675 ± 25	rpm 775 ± 25
CO values %	0.5 - 1.5**	0.4 - 1.2*	* Measured before catalytic converter and Lambda probe connector not disconnected
HC values ppm	≤ 300	≤ 300*	

* Only CO adjustment is possible on vehicles without catalytic converter.

Printed in Germany – XXIV, 1989

EQUIPMENT CHART - LH - JETRONIC - TYPE 928 S -

'87 MODELS ONWARD

ENGINE TYPE M28. 41/42

Electric fuel pump	Fuel filter	Fuel-line-pressure damper (feed)	Fuel pressure regulator ('87 models)
928.608.104.02 Bosch no. 0580.464.045	928.110.253.00 Purolator no. 506.883.901.5	928.110.202.01 Bosch no. 0280.161.034	928.110.198.02 Bosch no. 0280.160.262

Hot-wire airflow sensor	NTC Temperature sensor II (dual function)	Throttle-valve switch	Idle actuator
928.606.141.00 Bosch no. 0280.214.001	928.606.126.00 Bosch no. 0280.130.032	928.606.157.00 Bosch no. 0280.120.322	928.606.161.01 Bosch no. 0280.140.515

Electric injection valve	LH-Jetronic control unit	Ignition control unit	Knock sensor
928.606.119.02 Bosch no. 0280.150.730	928.618.123.10 Bosch no. 0280.002.504	928.618.124.11 Bosch no. 0227.400.035	911.606.141.00 Bosch no. 0261.231.008

Fuel pressure regulator ('88 models)	LH-Jetronic control unit ('88 models)	Ignition control unit ('88 models)
928.110.198.03 Bosch no. 0280.160.297	928.618.123.11 Bosch no. 0280.002.504	928.618.124.12 Bosch no. 0227.400.035

CHECKING IDLE - USA - and cars with catalytic converters

'87 MODELS ONWARD

ENGINE TYPE M28. 41/42

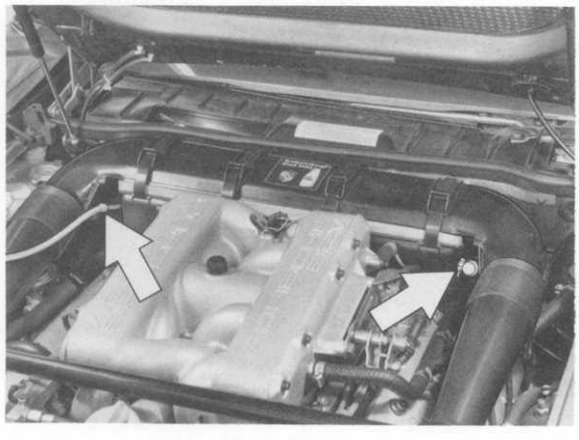
Note:

It is no longer necessary to adjust the idle speed and CO level of USA cars and cars with catalytic converters. Do not disconnect the oxygen sensor plug for the idle speed CO level check.

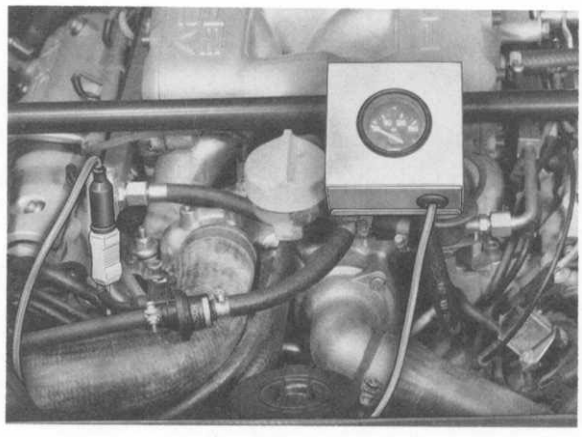
Test requirement:

Engine in perfect mechanical condition. Switch off all consumers during adjustment. Make adjustments as quickly as possible to avoid excessive heat at intake ports which would produce wrong CO values. Intake air temperature 15 - 35°C/59 - 95°F.

1. Push exhaust-gas extraction line over CO-connector of cylinders 1-4 or cylinders 5-8 in engine compartment.



2. Run engine to operating temperature (70 - 90°C oil temperature). Use oil-temperature tester, Special Tools 9122 + 9122/2.



3. Do not disconnect oxygen sensor plug. Connect CO meter and separate rev. counter in accordance with manufacturer's instructions.

Specified CO-level	0.4 - 1.2%
Idle speed	675 ± 25 rpm

ADJUSTING IDLE WITHOUT CATALYTIC CONVERTER

87 MODELS ONWARD

ENGINE TYPE M28. 41/42

N o t e :

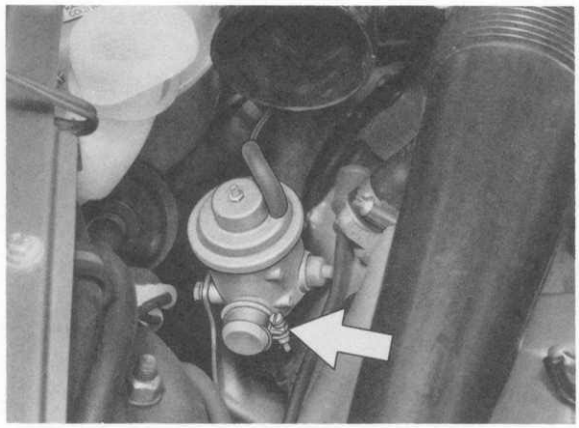
No provision is made for adjusting the idle speed. The adjustment at the throttle nozzle is no longer necessary.

I d l e S p e e d C O - L e v e l A d j u s t m e n t

Precondition for adjustment:

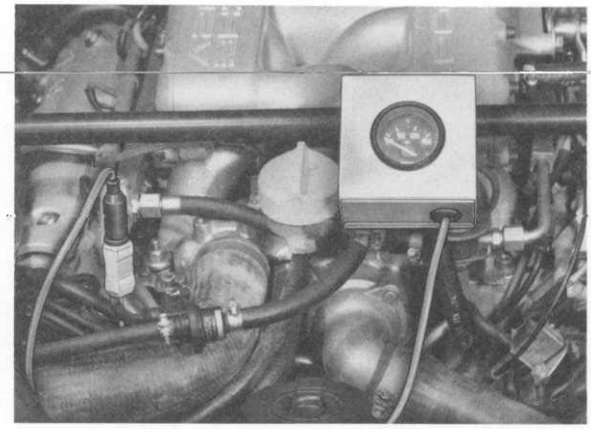
Engine in perfect mechanical order. Switch off all consumers during adjustment. Make adjustments as quickly as possible to avoid excessive heat at intake ports which would result in incorrect CO readings. Intake air temperature 15 - 35°C.

1. Disconnect additional air pump hose at changeover valve and seal changeover valve with a suitable plug.

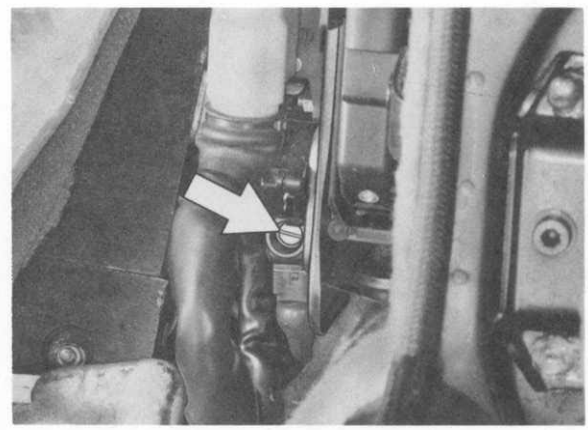


2. Reconnect air intake hose

3. Run engine to operating temperature (70-90°C oil temperature). Use oil temperature meter, special tool 9122 +9122/2.



4. Check CO-level. If the CO-level is not within specified limits, correct setting of CO-potentiometer. Remove plug covering hole which provides access to CO-adjustment.



Specified CO-value: 0.5 - 1.5%
Turning clockwise = richer mixture
Turning anticlockwise = leaner mixture

5. Insert plug (blue) spare part No. 944 606 935 01 in CO-adjustment screw apperture.

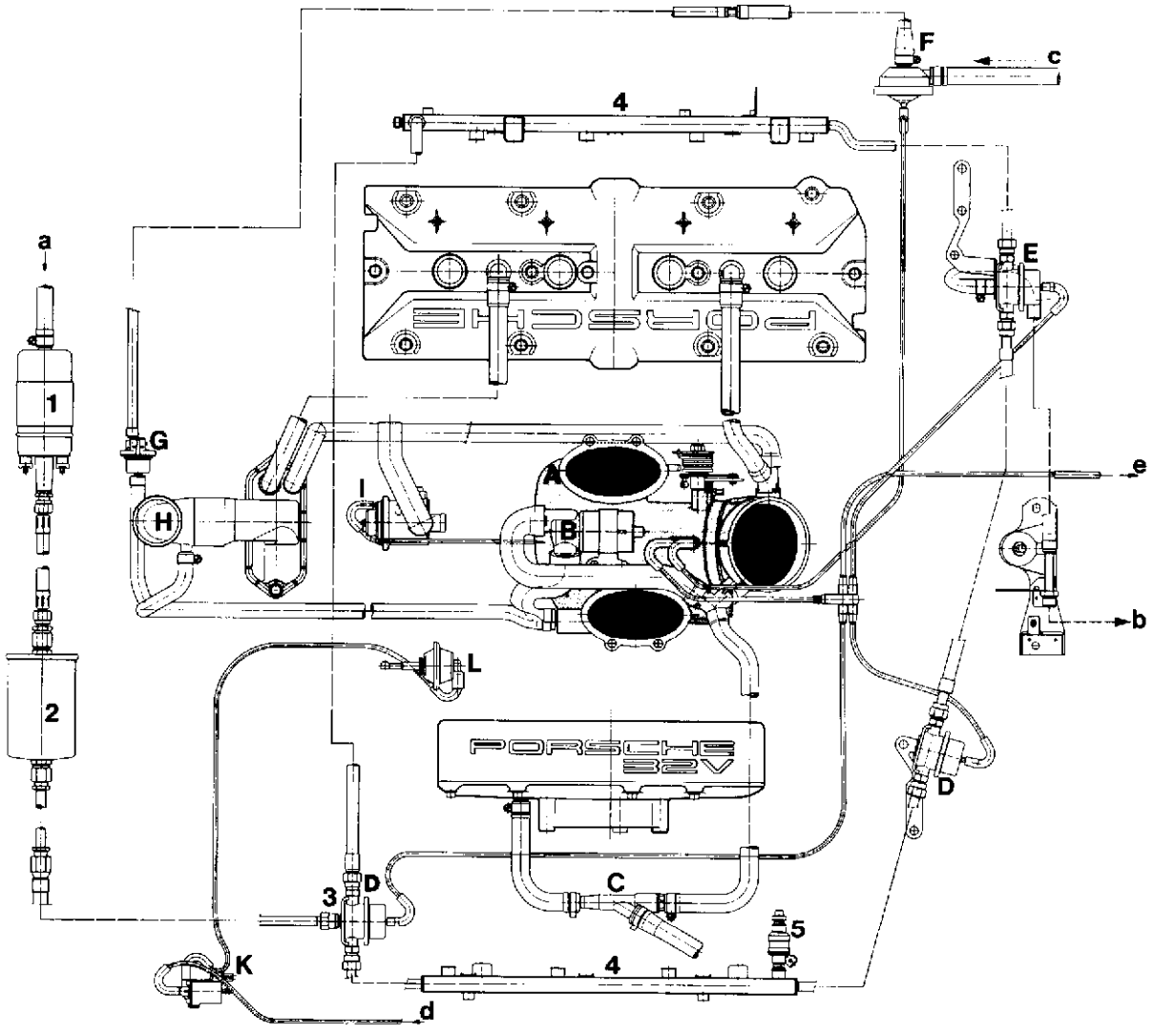
Recheck idle speed

Connect separate rev. counter in accordance with manufacturer's instructions

Idle speed 675 ± 25 rpm

FUEL PATH - LH-JETRONIC 928 S, 87 MODELS ONWARD

ENGINE TYPE M28. 41/42



FUEL PATH - LH-JETRONIC 928 S, 87 MODELS ONWARD

ENGINE TYPE M28.41/42

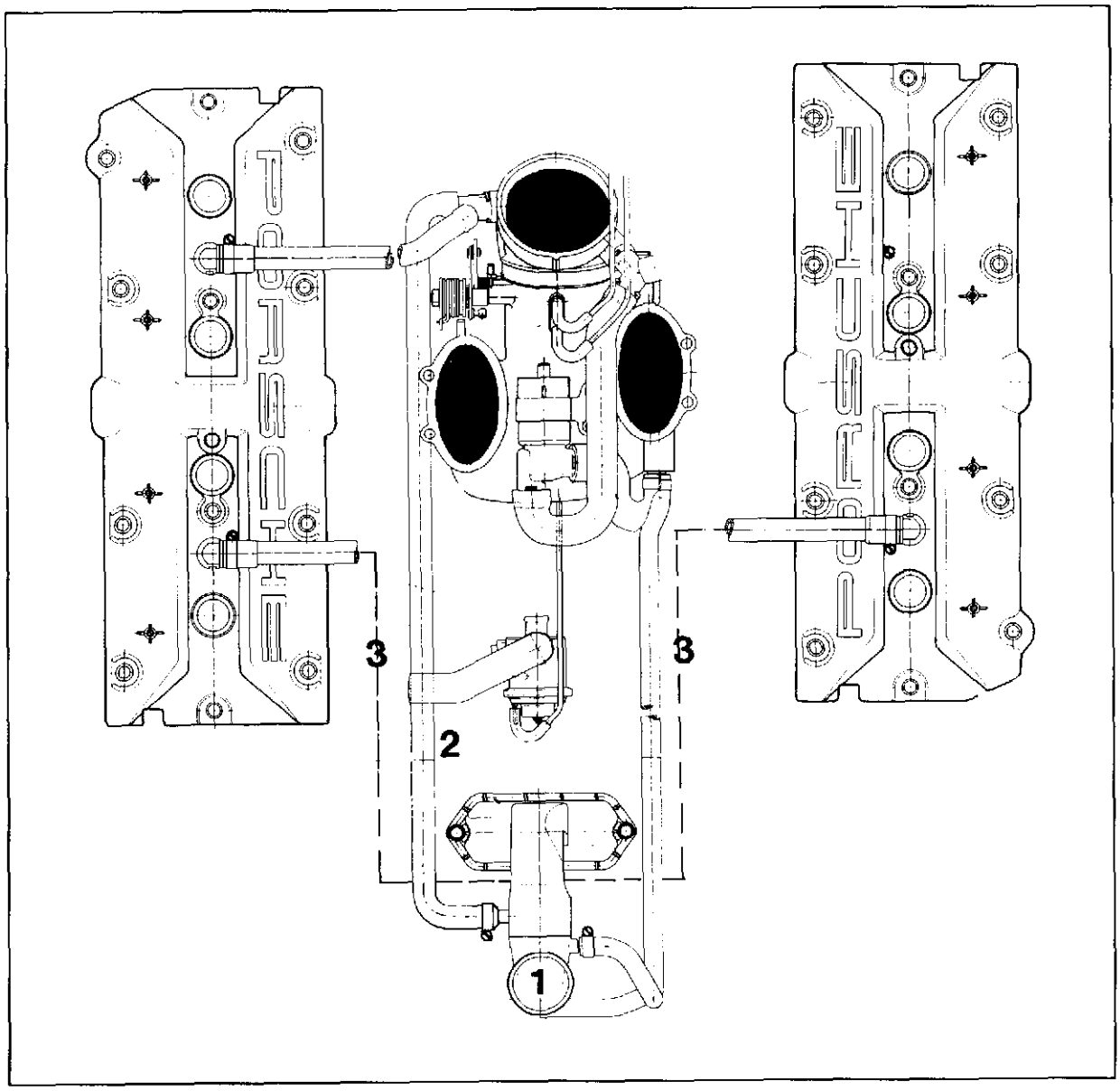
1 - Fuel pump
2 - Fuel filter
3 - Fuel line
4 - Distributor-type fuel-injection tubes
5 - Injectors

A - Throttle housing
B - Idle speed actuator
C - Intake jet pump
D - Pressure damper
E - Pressure regulator
F - Vacuum valve
G - Electric tank breather valve
H - Oil filler neck
I - Secondary-air valve
K - Vacuum-operated switch valve (tune-intake flap)
L - Vacuum unit (tune-intake flap)

a - from fuel tank
b - to fuel tank
c - from activated charcoal cannister
d - from vacuum reservoir
e - to automatic transmission

Modified breather for crankcase and cylinder heads

Engine Type M 28.49/50



1337-24

1 Oil filler neck: de-icer valve is deleted.

2 Hose connection between oil filler neck and throttle body modified, throttle bore – Ø 5 mm – for this breather hose is now located in the oil filler neck.

3 Additional breather hose between right-hand and left-hand rocker cover, throttle bores in the rocker cover for cylinder nos. 1 to 4 are deleted.

Printed in Germany – XXXI, 1993

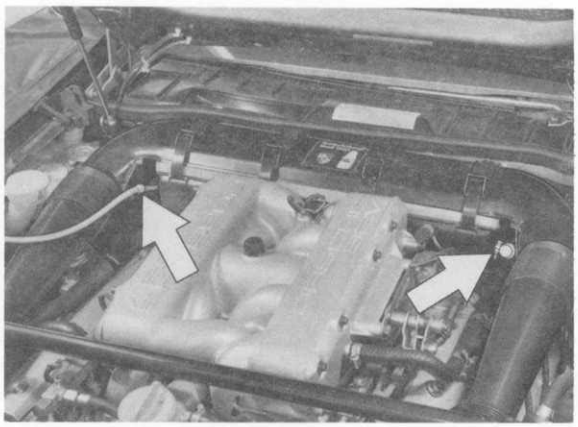
TESTING OXYGEN SENSOR OPERATION,
'87 MODELS ONWARD

Testing sensor voltage

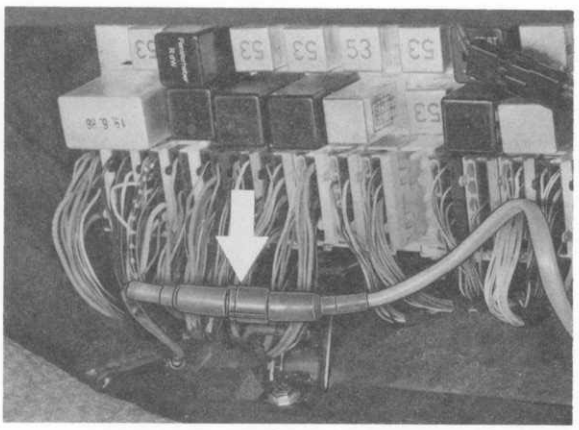
Precondition:

- Engine at operating temperature.

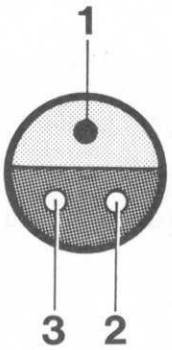
1.Connect exhaust tester to an extraction point in engine compartment.



2.Disconnect oxygen sensor plug.

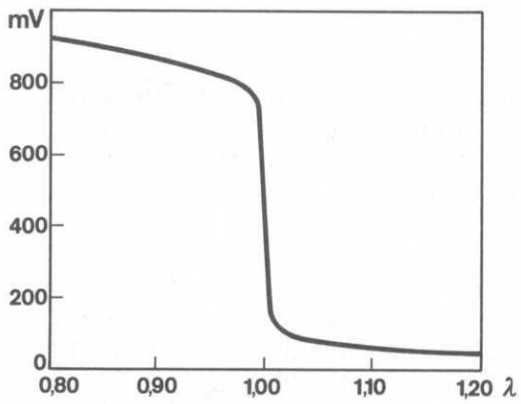


3.Connect voltmeter to terminal 1 (sensor half of plug) and ground.



4.The voltage must be in 0.1 V to 1.0 V range (depending on concentration of oxygen in exhaust)

Voltage characteristic of oxygen sensor for working temperature of 600°C.



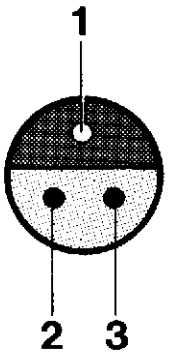
Rich mixture (air deficiency) Lean mixture (excessive air)

5.Disconnect vacuum line from fuel pressure regulator. The voltage signal must increase.

Testing lambda control function.

1. Precondition as for the "sensor voltage" test.

2. Disconnect oxygen sensor plug. With length of cable, briefly connect terminal 1 of control-unit side of plug to ground.



The CO reading must increase.

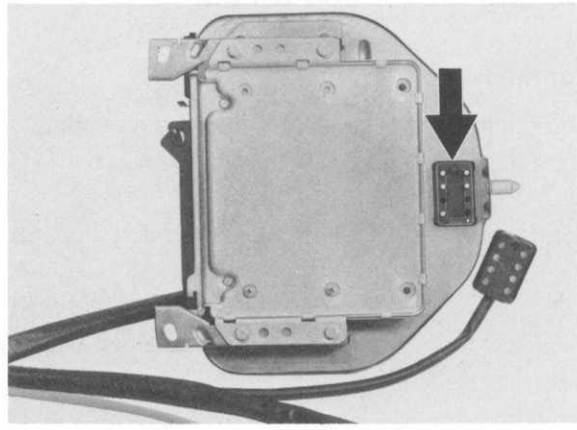
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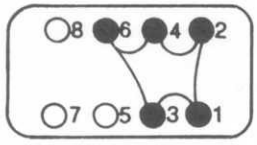
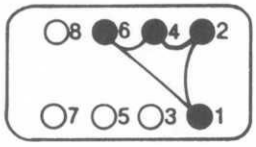
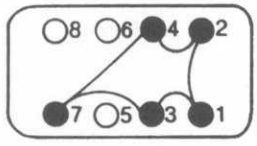
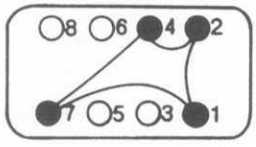
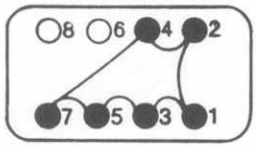
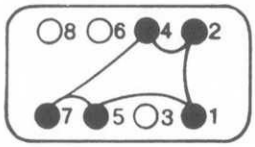
Do not conduct this test for any longer than required to detect a change in the CO reading of the exhaust tester.

If there is no change in the CO reading, check connection to LH control unit and LH control unit coding (see page 24 - 221), if necessary, replace control unit.

LH 2.3 CONTROL UNIT CODING, 87 MODELS ONWARD

Only one controlled unit is used. The appropriate characteristic can be called up by means of the coding plug on the rear of the control-unit holder.

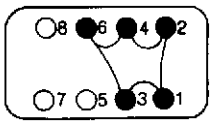
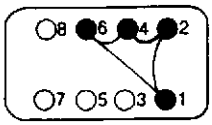
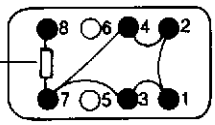
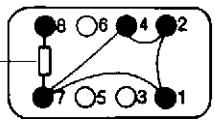
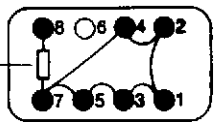
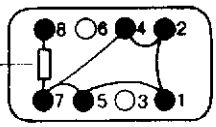


Switching diagram	Type
	R.o.W. without catalytic converter, manual transmission
	R.o.W. without catalytic converter, automatic transmission
	R.o.W. with catalytic converter and USA, manual transmission
	R.o.W. with catalytic converter and USA, automatic transmission
	Australia, manual transmission
	Australia, automatic transmission

Coding for LH control unit

For Model 89 onwards

The coding connector is fitted to the mounting plate for the LH and EZK control units.

Wiring diagram	Version
	Rest of world without catalytic converter, manual transmission
	Rest of world without catalytic converter, automatic transmission
1 	Rest of world, USA with catalytic converter, manual transmission
1 	Rest of world, USA with catalytic converter, automatic transmission
1 	Fuel grade 91 RON, with catalytic converter, manual transmission
1 	Fuel grade 91 RON, with catalytic converter, automatic transmission

162 - 24

1 - resistor 150 Ω

Printed in Germany – XXII, 1989

REMOVING AND INSTALLING ROTARY IDLE ACTUATOR

'87 MODELS ONWARD

ENGINE TYPE M28. 41/42

Removing:

1. Disconnect battery ground strap behind tool tray. Place fender and bumper guards in position.

2. Unbolt and remove transverse strut.

Note:

Car must be standing on its wheels, transverse strut is under tension.

3. Remove air intake hoses and air filter as a complete unit. Disconnect vacuum hose from brake booster and remove.

4. Unbolt bracket for accelerator linkage and TDC sender from intake manifold.

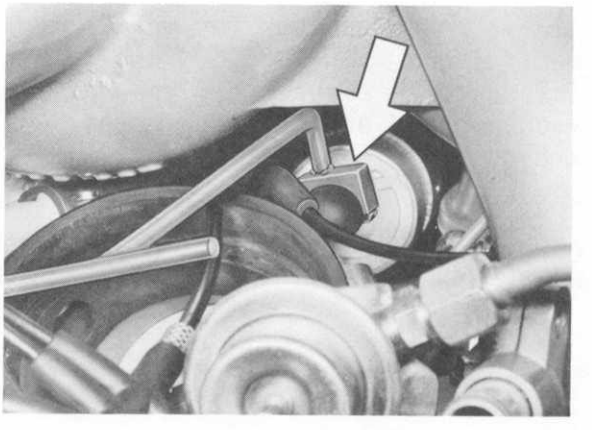
5. Unbolt holder for fuel line and crankcase breather. Remove air-flow sensor.

6. Remove left-hand and right-hand injection-valve covers. Remove both union nuts from fuel-distribution line, counterholding with a second open-ended wrench. Catch any escaping fuel in a suitable container. Disconnect distribution line from intake pipes and lift out.

7. Mark vacuum hoses and disconnect. Break electrical connection between thermostatic switch and intake pipe.

8. Unbolt fuel-line-pressure damper and holder. Disengage throttle valve actuator cable and disconnect plug from throttle valve.

9. Remove air-guide dome from throttle-valve housing. Use Special Tool 9266 to disconnect electrical plug from rotary idle actuator.

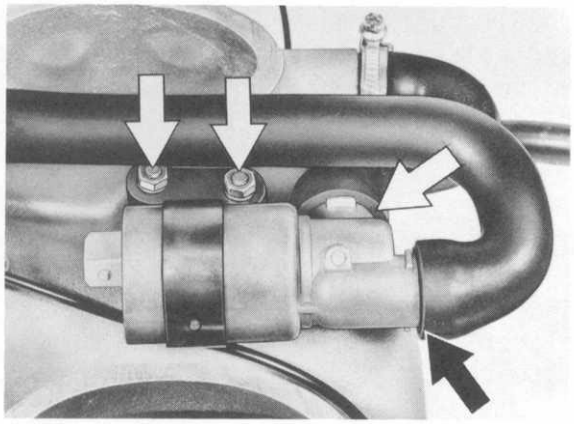


Note:

Take care to ensure that the plug gasket remains in the male half once the connection is broken and does not become detached.

10. Unbolt intake manifold from cylinder head and lift slightly. Disconnect all remaining vacuum and crankcase breather hoses and remove intake manifold.

11. Unbolt throttle-valve housing from intake manifold and remove rotary idle actuator.



Installing

1. Always renew gaskets for intake manifold.
   Take care to ensure that the vacuum hoses and breather hoses are correctly routed.

2. Carry out visual inspection to check for leaks.

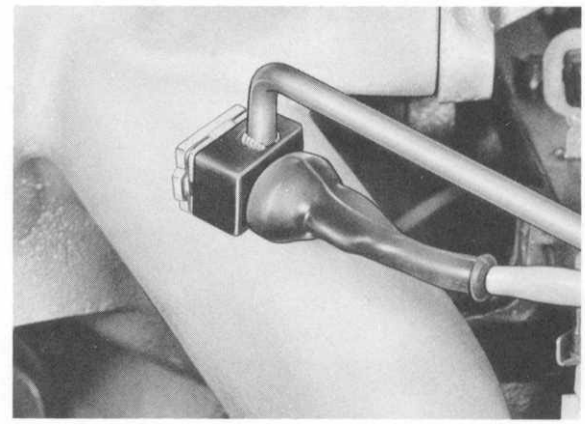
3. Check that vacuum hoses and hose clamps are correctly seated.

   Throttle-valve housing to intake manifold attachment, tightening torque 20 Nm (14 ftlb).

   Intake manifold to cylinder head attachment, self-locking nuts, tightening torque 15 Nm (11 ftlb).

Note:

Special Tool 9266 can also be used to open other 2-pole connectors.



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TIGHTENING TORQUE FOR FUEL SYSTEM

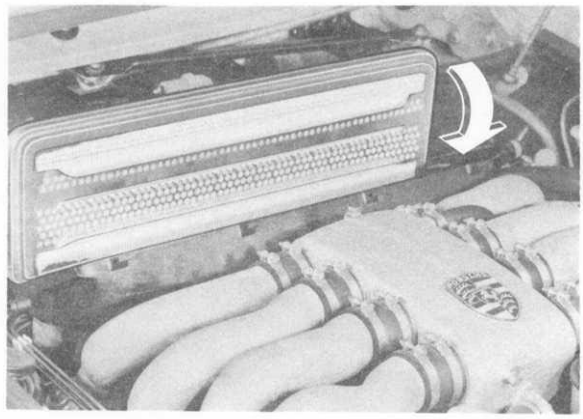
Location	Description	Torque Nm (ftlb)	Threads
Insert for fuel injector in cylinder head		15 (11)	M 24 x 1.5
Injection line to fuel distributor	Hollow bolt	11 (8)	M 10 x 1
Injection line to fuel injector	Coupling nut	20 (14)	M 12 x 1.5
Feed line to fuel distributor	Coupling nut	30 (22)	M 16 x 1.5
Feed line to fuel damper	Coupling nut	15 (11)	M 10 x 1
Return line to control pressure regulator	Hollow bolt	11 (8)	M 8 x 1
to mixture control	Coupling nut	15 (11)	M 10 x 1
Feed line to cold start valve	Hollow bolt	15 (11)	M 10 x 1.5
to mixture control	Coupling nut	15 (11)	M 10 x 1
Return line to mixture control	Hollow bolt	15 (11)	M 8 x 1
Feed line to fuel distributor	Coupling nut	20 (14)	M 12 x 1.5
to fuel damper	Coupling nut	20 (14)	M 12 x 1.5
Feed line to fuel damper	Coupling nut	20 (14)	M 12 x 1.5
Return line	Hollow bolt	32 (23)	M 12 x 1.5
Control pressure regulator adapter		15 (11)	M 10 x 1
Distributor injection tube collar nut	Collar nut	22 (16)	M 12 x 1.5
Mixture control to rubber mount	Hexagon nut	6 (4)	M 6

REPLACING AIR CLEANER ELEMENT

1. Detach air intake hoses form air cleaner housing, making sure that each hose is still connected to the camshaft drive belt cover.

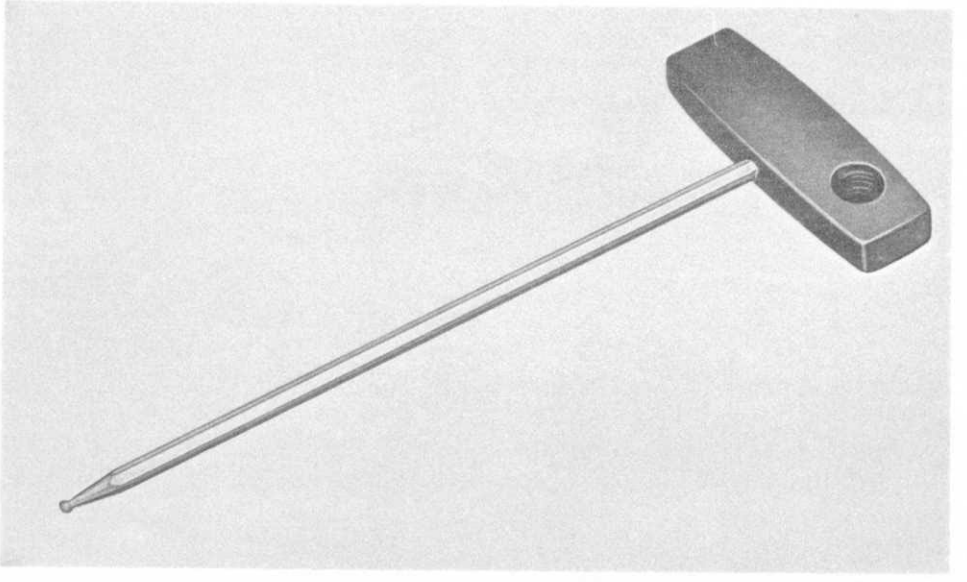
2. Release rubber fasteners, take off air cleaner upper section and remove filter element.

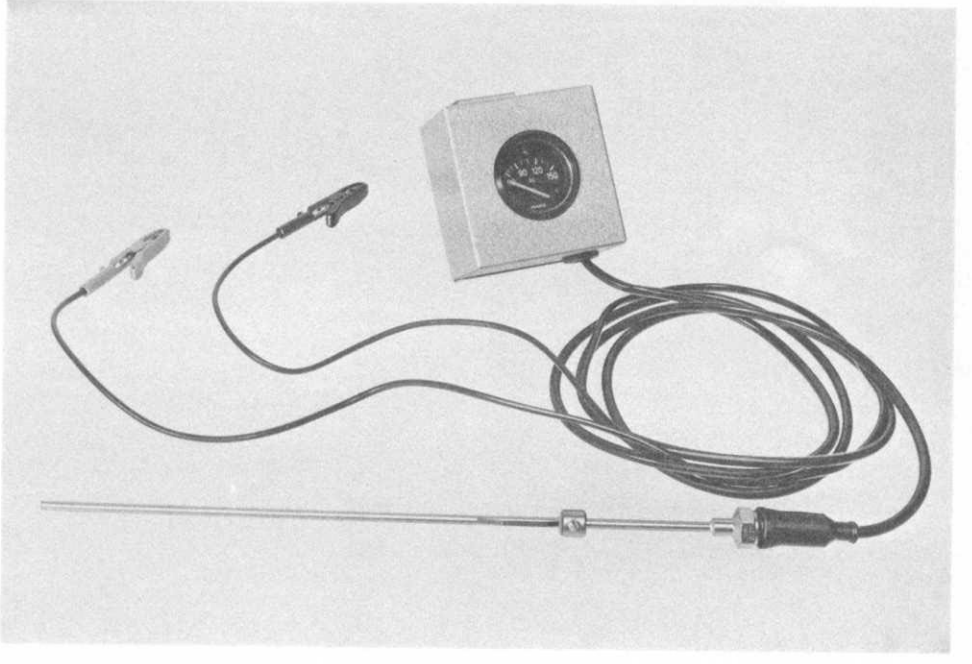
3. Make sure that filter element has correct position and fit.



ADJUSTING IDLE AND CO

TOOLS





No.	Description	Special Tool	Remarks
1	Adjusting wrench	9134	
2	Oil temperature tester	9122	or US 8025

ADJUSTING IDLE AND CO

Note

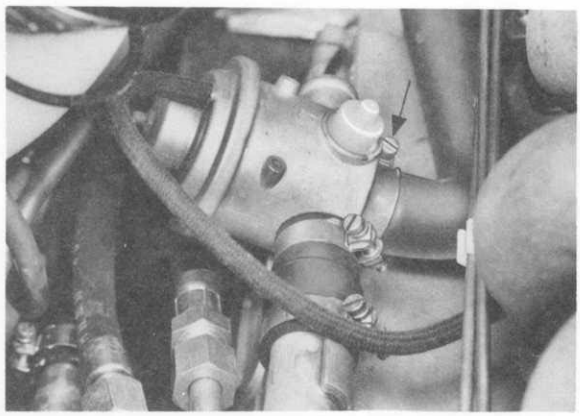
Requirements:
Engine in perfect mechanical condition.
Ignition timing set correctly.

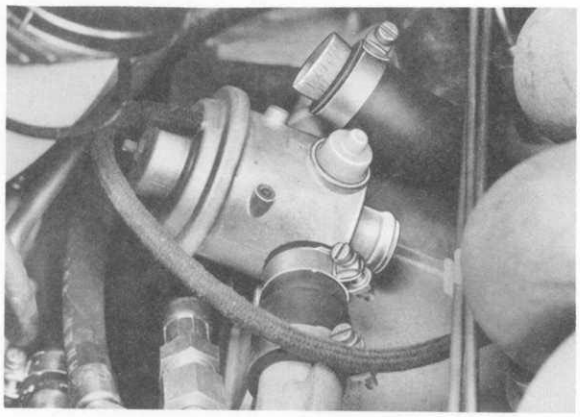
Adjustments must be made as quickly as possible, to prevent excessive heat in the intake ports.

1. Detach right air intake hose.

2. Remove air cleaner upper section.

3. Detach air hose at diverter valve and insert a suitable plug.





4. Install air cleaner upper section and air intake hose.

5. Run engine to operating temperature (80 to 90° C/ 176 to 194° F oil temperature).
Use Special Tool 9122 or US 8025.

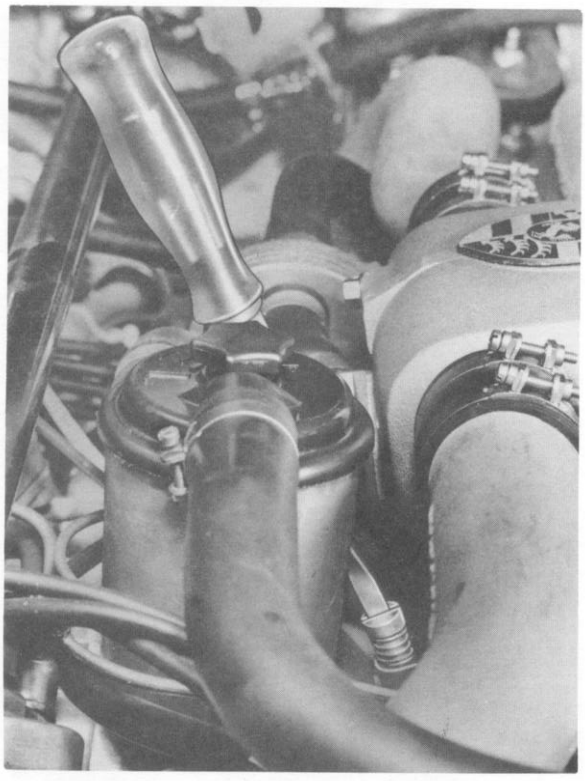


6. Connect CO level tester and separate tachometer according to instructions of manufacturer.

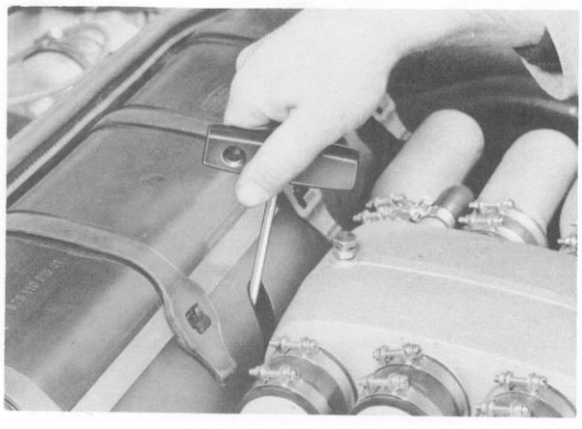
Note

Make adjustments as quickly as possible to avoid excessive heat in intake ports and consequently wrong CO values.

7. Adjust control screw on throttle housing until specified speed is reached.



8. Adjust mixture. Insert Special Tool 9134 through funnel-shaped opening into spring-loaded driver in mixture control unit. Press down special tool approx. 18 mm to engage spring-loaded drive in mixture control screw.



Important

It is essential to conform with the following points.

a) Always make CO level adjustments from lean to rich. Example: when mixture is too rich, first turn mixture control screw counterclockwise further than necessary and then clockwise to adjust to specifications.

b) Just turn control slightly, since the smallest adjustment will change CO level considerably.

9. Turn clockwise for richer
or
counterclockwise for leaner mixture.

10. Remove special tool.

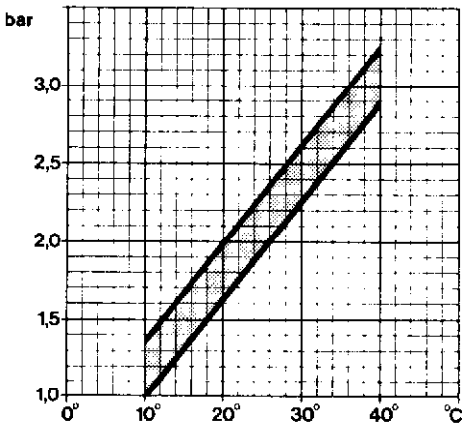
11. Accelerate engine briefly.

12. Wait until CO tester shows exhaust gas concentration at idle speed.
See page 25 - 6 for adjusting data.
If necessary, repeat adjusting procedures.

13. Recheck idle speed and correct, if necessary.

14. Remove plug after completion of adjustments.
Attach air hose to diverter valve.

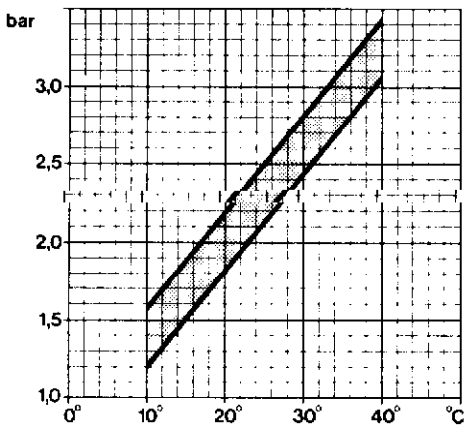
TESTING AND ADJUSTING SPECIFICATIONS FOR CIS
(1978/1979 Models Automatics)

Test	Specification	Remarks
Electric fuel pump Delivery rate with 1 fuel pump with 2 fuel pumps	 at least 1120 cc/30 sec. at least 1360 cc/30 sec.	
Control pressure "cold" (= ambient temperature)	Diagram for control pressure regulator Part No. 928.606.109.02 Bosch No. 0438.140.053 Test vacuum 460 - 600 mbar (350 - 450 mmHg)  	
Control pressure "warm" Test with pressure (without vacuum) Vacuum pump connected on intake connection of control pressure regulator. With test pressure of 460 - 600 mbar (350 - 450 mmHg)	 2.8 ... 3.2 bar 3.4 ... 3.8 bar	

Test	Specification	Remarks
System pressure		
Testing value	5.2 ... 5.8 bar	
Adjusting value	5.3 ... 5.5 bar	
Leak test (engine warm)		
Min. pressure after		
10 minutes	2.0 bar	
20 minutes	1.7 bar	
30 minutes	1.6 bar	
Fuel injectors		
Opening pressure	3.0 ... 4.1 bar	

Pressures listed in Test Value Chart in bar.

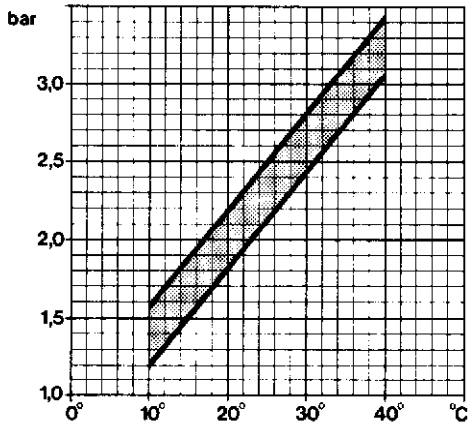
TESTING AND ADJUSTING SPECIFICATIONS FOR AFC
(1979 Models - Manuals)

Test	Specification	Remarks
Electric fuel pump Delivery rate with 2 fuel pumps	at least 1360 cc/ 30 seconds	
Control pressure "cold" (= ambient temperature)	Diagram for control pressure regulator Part No. 928.606.109.03 Bosch No. 0438.140.063 Test vacuum 450 - 550 mbar (340 - 420 mmHg)  	
Control pressure "warm"		
Test with pressure (without vacuum)	2.8 ... 3.2 bar	
Connect vacuum pump on intake pressure connection of control pressure regulator. Test pressure 450 - 550 mbar (340 - 420 mmHg)	3.4 ... 3.8 bar	

Test	Specification	Remarks
System pressure		
Testing value	5.2 ... 5.8 bar	
Adjusting value	5.3 ... 5.5 bar	
Leak test		
(engine warm)		
Min. pressure after		
10 minutes	2.0 bar	
20 minutes	1.7 bar	
30 minutes	1.6 bar	
Fuel injectors		
Opening pressure	3.0 ... 4.1 bar	

Pressures listed in Test Value Chart in bar.

TESTING AND ADJUSTING SPECIFICATIONS FOR K-JETRONIC
(1979 Models - Manuals - USA and Japan)

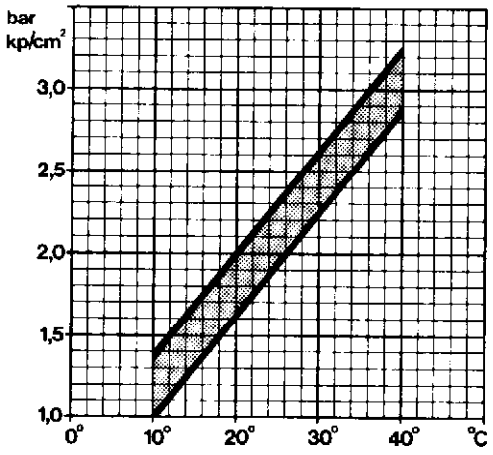
Test Point	Specification	Remarks
Electric fuel pump Delivery rate with 2 fuel pumps	at least 1360 cc/30 seconds	
Control pressure "cold" (= ambient temperature)	Diagram for warm-up control Part No. 928.606.109.03 Bosch No. 0438.140.063 Test vacuum 450 - 550 mbar (340 - 420 mmHg)  	
Control pressure "warm" Test with pressure (without vacuum) Connect vacuum pump for test on intake pressure connection of warm-up control. Test pressure 450 - 550 mbar (340 - 420 mmHg)	 2.8 ... 3.2 bar 3.4 ... 3.8 bar	

Test Point	Specification	Remarks
System pressure		
Testing value	5.2 ... 5.8 bar	
Adjusting value	5.3 ... 5.5 bar	
Leak test (engine warm)		
Min. pressure after		
10 minutes	2.0 bar	
20 minutes	1.7 bar	
30 minutes	1.6 bar	
Fuel injectors		
Opening pressure	3.0 ... 4.1 bar	

Pressures listed in Test Value Chart in bar.

TESTING AND ADJUSTING SPECIFICATIONS FOR K–JETRONIC
(1981/1982 Models)

Engine M 28.09 and M 28.10

Test Point	Specification	Remarks
Electric fuel pump Delivery rate with 1 fuel pump	at least 1120 cc/30 sec.	
Control pressure "cold" (= ambient temp.)	Diagram for warm-up control Part No. 928.606.109.05 Bosch No. 0438.140.087 Test vacuum 450 - 550 mbar (340 - 420 mmHg)  	
Control pressure "warm" Test with pressure (without vacuum) Connect vacuum pump for test on intake pressure connection of warm-up control. Test pressure 460 - 600 mbar (350 - 450 mmHg)	 2,8 . . . 3,2 bar 3,4 . . . 3,8 bar	

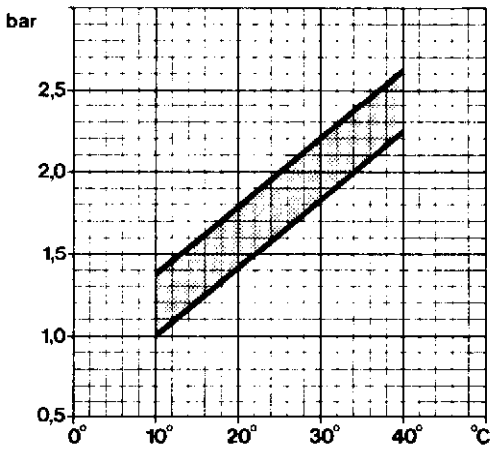
Test Point	Specification	Remarks
System pressure		
Testing value	5,2 . . . 5,8 bar	
Adjusting value	5,3 . . . 5,5 bar	
Leak test (engine warm)		
Min. pressure after		
10 minutes	2,7 bar	
20 minutes	2,6 bar	
30 minutes	2,5 bar	
Fuel injectors		
Opening pressure	3,0 . . . 4,1 bar	

Pressures listed in Test Value Chart in bar.

TESTING AND ADJUSTING SPECIFICATIONS FOR K-JETRONIC
(1981/1982/1983 Models) 928 S

Engine M 28.11 and M 28.12

Test Point	Specification	Special Instructions
Electric fuel pump Delivery rate with 1 fuel pump	at least 1120 cc/30 sec.	
Control pressure "cold" (equal to ambient temperature)	Diagram for warm-up regulator Part No. 928.606.109.04 Bosch No. 0438.140.086 With test vacuum 450 - 550 mbar (340 - 420 mmHg)	
Control pressure "warm"		
Test with atmospheric pressure (without vacuum)	2,8 . . . 3,2 bar	
Connect vacuum pump to test on intake connection of warm-up regulator. With test pressure 460 - 600 mbar (350 - 450 mmHg)	3,4 . . . 3,8 bar	



Test Point	Specification	Special Instructions
System pressure		
Testing value	5,2 . . . 5,8 bar	
Adjusting value	5,3 . . . 5,5 bar	
Leak test		
(engine warm)		
Min. pressure after		
10 minutes	2,7 bar	
20 minutes	2,6 bar	
30 minutes	2,5 bar	
Fuel injectors		
Opening pressure	3,0 . . . 4,1 bar	

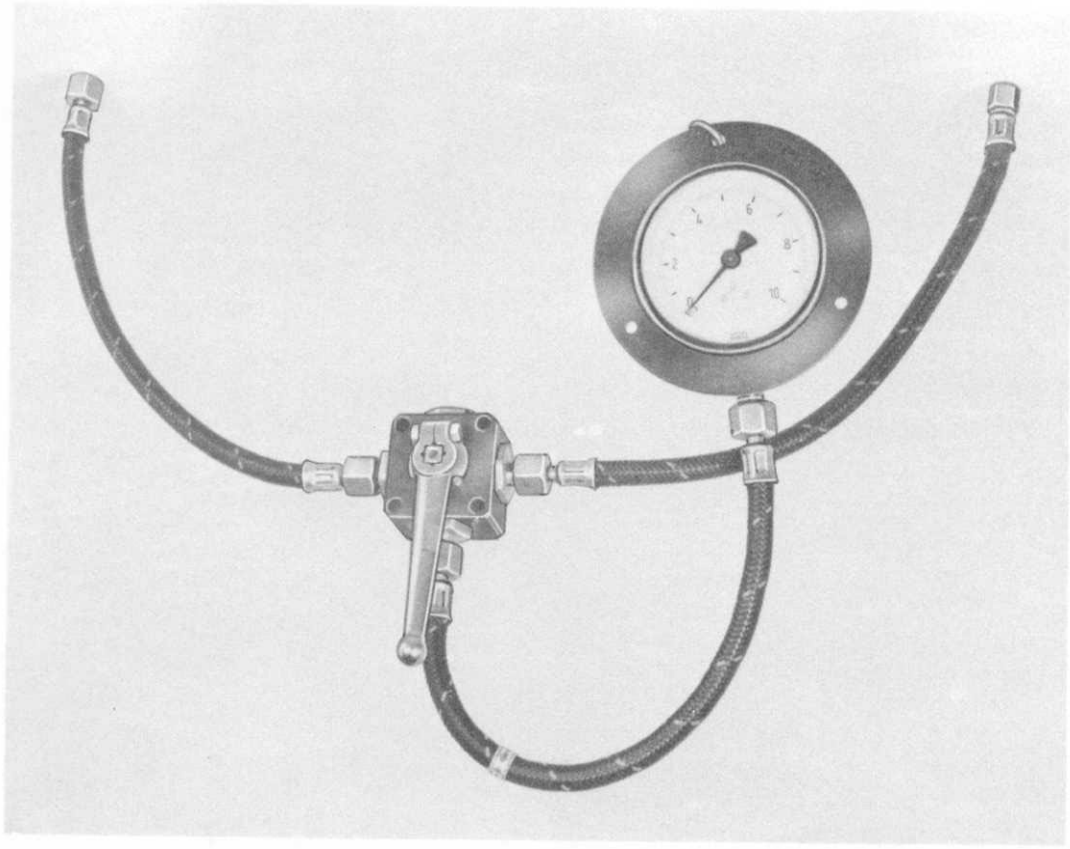
Pressures listed in Test Value Chart in bar.

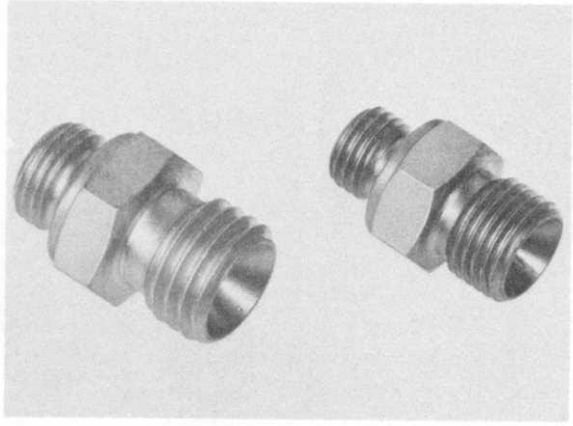
Test Point	Specification				Special Instructions
Idle adjustment		Europe	USA, Japan + Canada	Australia + Sweden	
Idle speed (rpm)	78/79 models	700 + 50	800 ± 50	700 ± 50	
	80/81/82 mod.	700 ± 50	750 ± 50	700 ± 50	
	80/81/82 mod. 928 S	700 + 50	- - -	700 ± 50	
CO level (%)	78/79 models	2,0 to 3,0 *	2,0 to 4,0 *	2,0 to 3,0 *	
	80/81/82 mod.	1,0 to 2,0 *	0,4 to 0,8 **	1,0 to 2,0 *	
	80/81/82 mod. 928 S	1,5 to 2,5 *	- - -	1,0 to 2,0 *	

* Air pump disconnected.

* * Measured in front of catalytic converter with oxygen sensor plug disconnected.

TOOLS



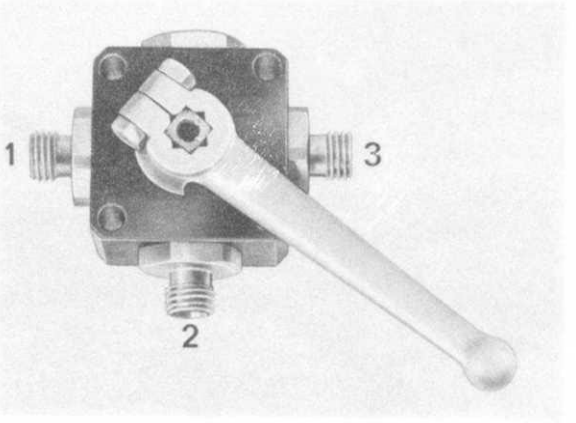


No.	Description	Special Tool	Remarks
1	Pressure gauge	P 378	Used with P 378 a
2	Adapter	9114/1	

PRESSURE TESTS

General

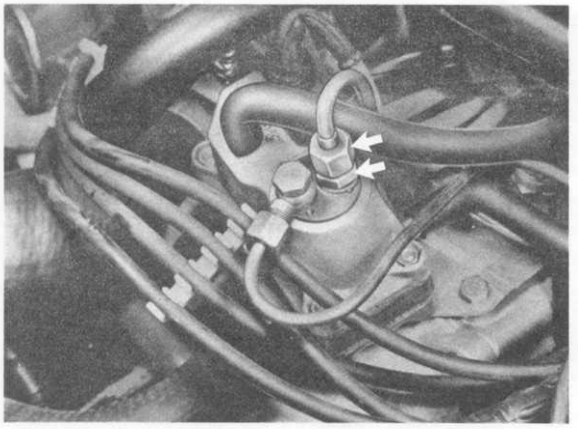
For better understanding the connections and lever positions of the selector valve are numbered in the following descriptions.



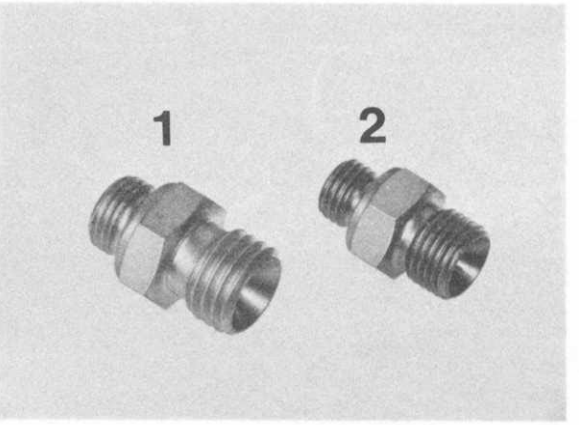
CONNECTING AND BLEEDING PRESSURE GAUGE

Connecting

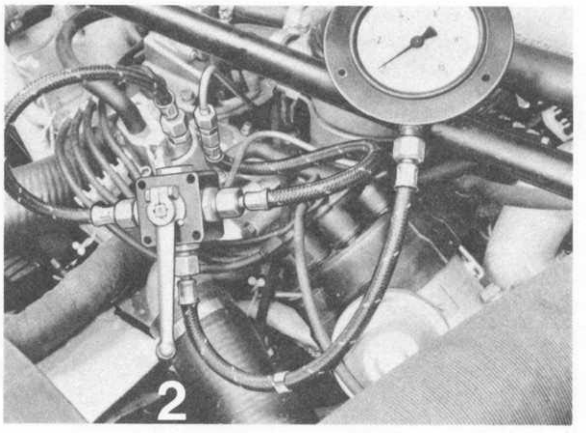
1. Unscrew control pressure line and standard adapter from control pressure regulator.



2. Screw adapter (1) from Special Tool 9114/1 with a seal in control pressure regulator and connect left hose from Special Tool P 378.



3. Connect adapter (2) between detached control pressure line and right hose.



Note

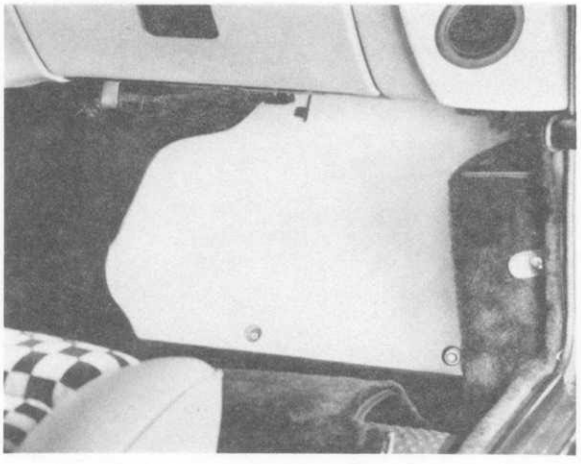
Do not bend control pressure line when connecting.

Bleeding

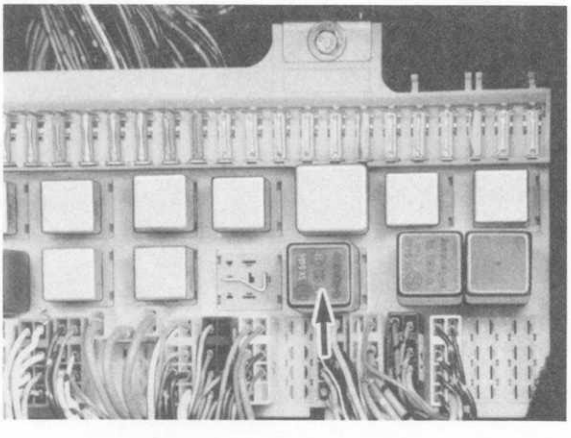
1. Pull off electric plugs from control pressure regulator and auxiliary air regulator, so that parts will not run hot during the following tests.

2. Bridge electric safety circuit.

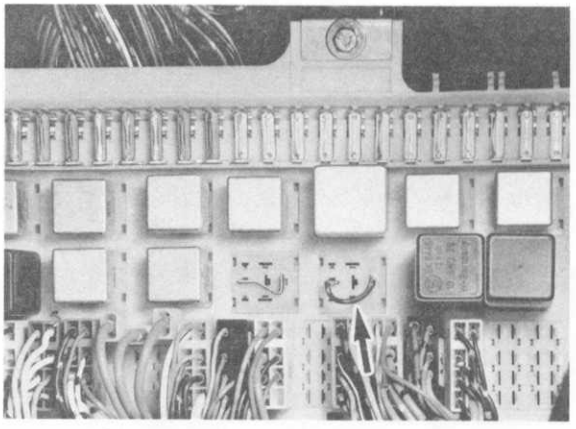
a) Remove cover in footwell on front passenger's side.



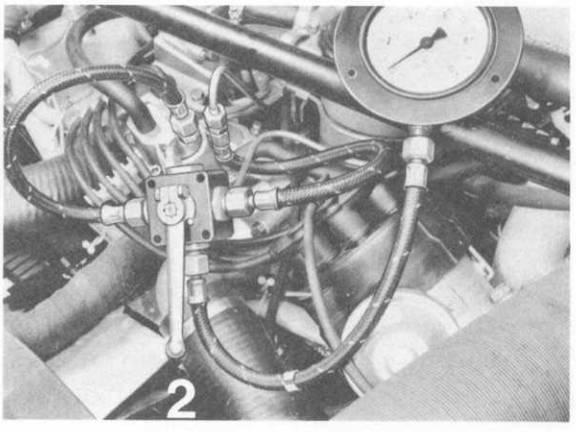
b) Pull off fuel pump relay.



c) Bridge terminals 30 and 87 with a piece of wire. Fuel pump or pumps must now run.



3. Position selector lever at 2. Let pressure gauge hang down (stretched hose). Move selector lever to position 3 about 5 times at intervals of 10 seconds.

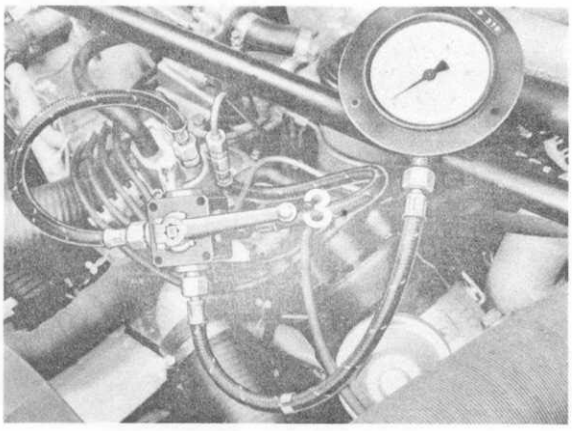


CHECKING SYSTEM PRESSURE

1. Connect and bleed pressure gauge.

2. Bridge terminals 30 and 87.

3. Set selector valve at position 3.



4. System pressure should now agree with specifications.

CHECKING CONTROL PRESSURE "WARM"

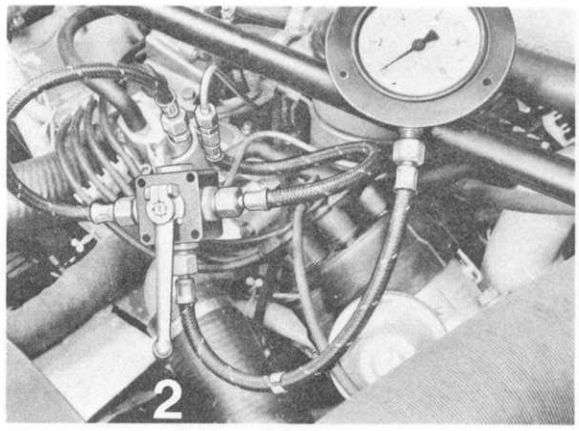
Engine could be cold or warm for this test.

1. Connect and bleed pressure gauge.

2. Electric plug remains connected on control pressure regulator.

3. Bridge terminals 30 and 87.

4. Set selector valve at position 2. Control pressure will now rise slowly and reach the specified value when control pressure regulator has been operated. Operating time will vary depending on ambient temperature.

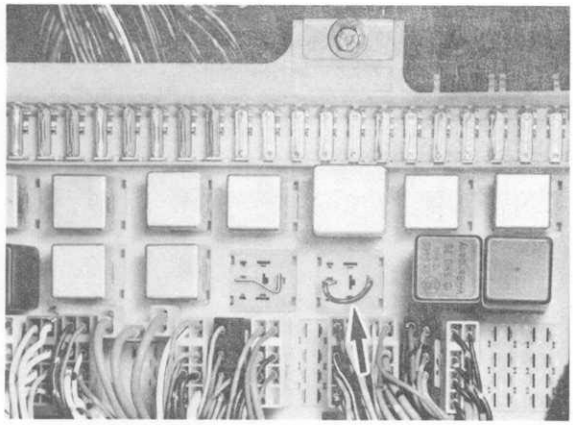


CHECKING ENTIRE FUEL SYSTEM FOR LEAKS

Engine must be warm for this test.

1. Connect and bleed pressure gauge.

2. Bridge terminals 30 and 87.



3. Move selector valve to position 2 and wait until "warm" control pressure is reached.

4. Take off bridge at terminals 30 and 87.

5. Observe pressure drop on pressure gauge and compare it with Testing and Adjusting Data on page 25 - 6.

6. If pressure drop is too fast, repeat test with control pressure circuit broken by moving selector valve to position 3. If results are the same, leak is in system pressure circuit.
If results of second test are good, leak is in control pressure circuit.

Possible Leaks in System Pressure Circuit:

1. Check valve in pressure neck of electric fuel pump(s).

2. Cold start valve.

3. O-ring in system pressure regulator.

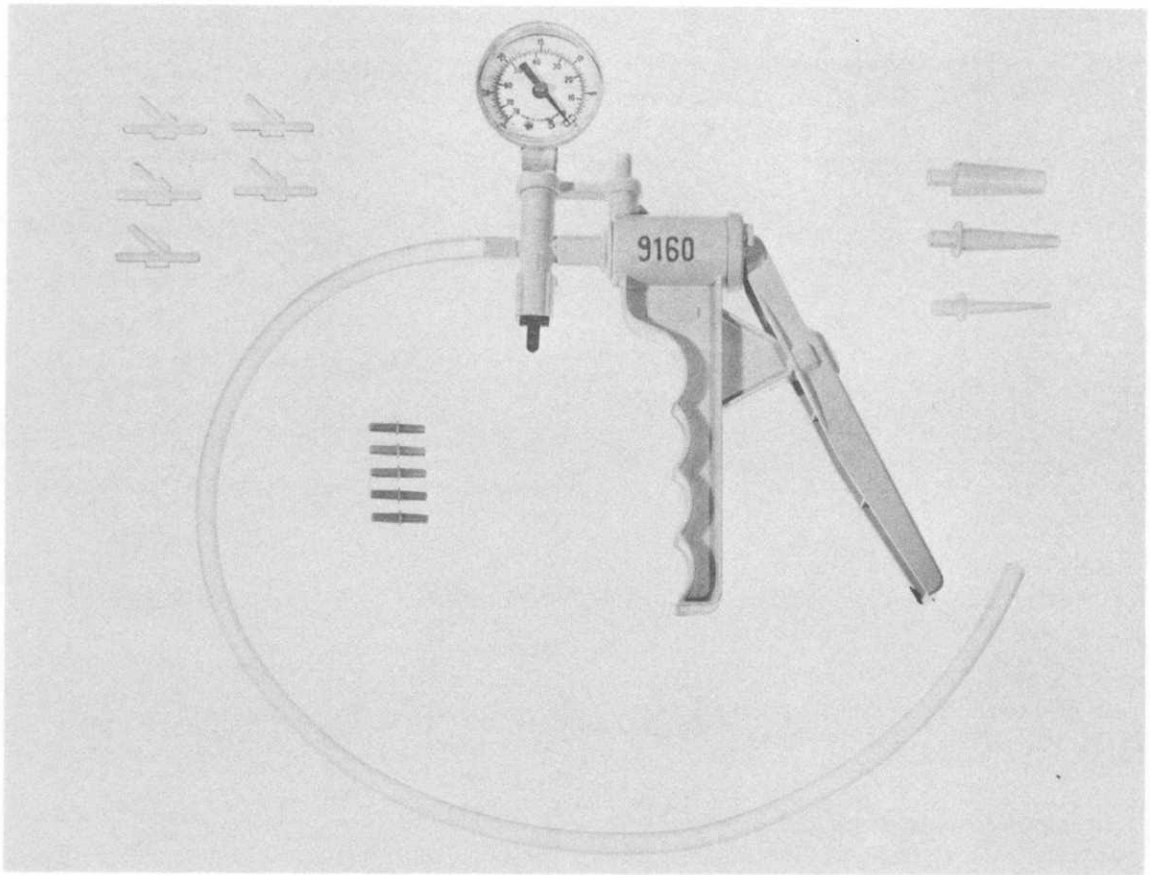
4. Fuel injector(s).

Possible Leaks in Control Pressure Circuit:

Pressure relief/residual pressure valve.

CHECKING CONTROL PRESSURE "COLD"
(Vacuum Controlled Control Pressure Regulator)

TOOLS



No.	Description	Special Tool	Remarks
1	Hand vacuum pump	9160	or US 8026

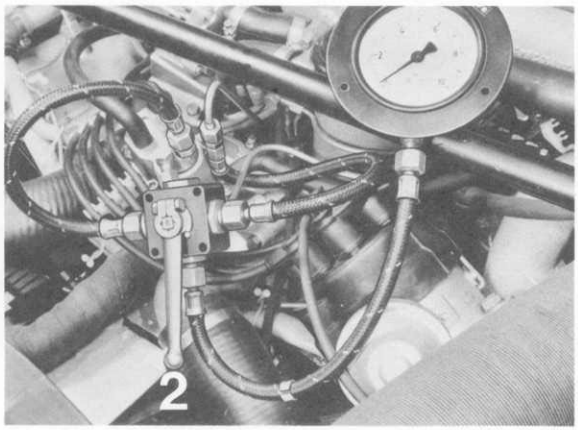
CHECKING CONTROL PRESSURE "COLD"

Note

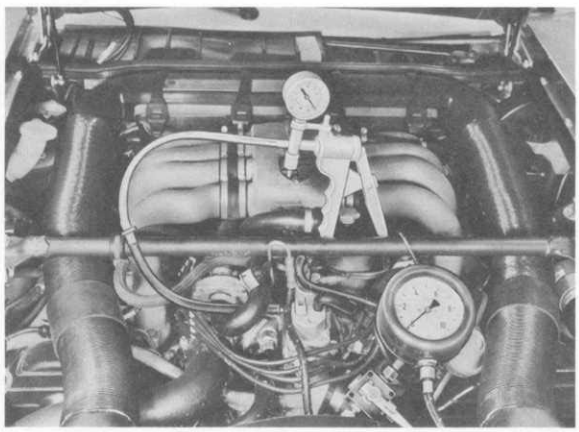
Engine must be cold for this test, which is absolutely essential for cars experiencing starting and/or warming-up problems. Do not use car for several hours, at best overnight.

If the control pressure regulator is vacuum controlled, the charts will only show values for the vacuum test method.

1. Connect and bleed pressure tester P 378. Set switching valve at position 2.

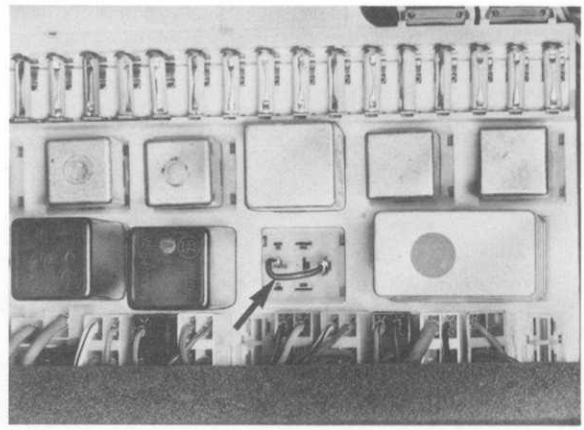


2. Pull vacuum hose off of control pressure regulator and connect extra hose and hand vacuum pump US 8026 to connection of control pressure regulator.



3. Pull wire plugs off of control pressure regulator to prevent overheating.

4. Bridge fuel pump relay socket terminals 30 and 87.

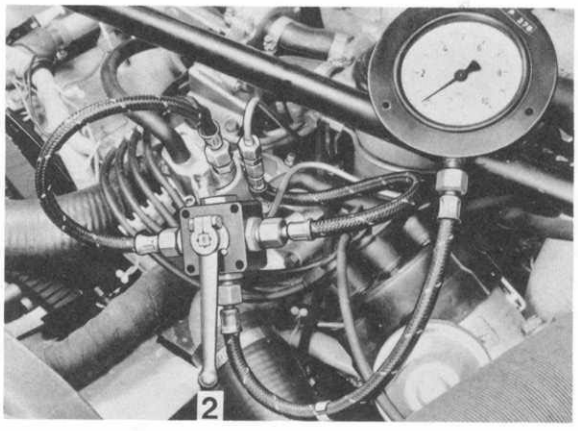


5. Produce specified vacuum with the hand vacuum pump, or adjust (see Testing and Adjusting Specifications).

6. Refer to diagram underneath Testing and Adjusting Specifications for nominal pressure agreeing with actual ambient temperature.

CHECKING FUNCTION OF HOT START VALVE (CIS)
(to Reduce Control Pressure for Warm Start)

Test Requirement:
Engine warm, coolant temperature about + 60 °C/ 140 °F or warmer.



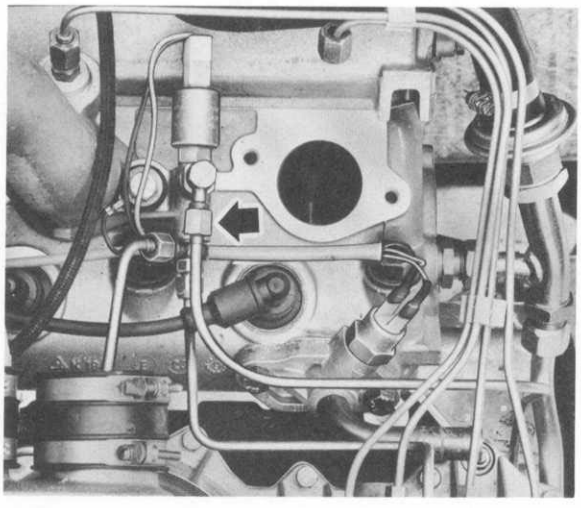
1. Connect pressure tester and switch to position 2.

2. Operate starter. This opens the hot start valve and drops the control pressure.
   Specification: 0.5 – 0.8 bar (note brief delayed action time).

3. If applicable, replace hot start valve or check temperature switch, i. e. temperature switch must have switched to through flow (ground).

CHECKING HOT START VALVE FOR LEAKS (CIS)

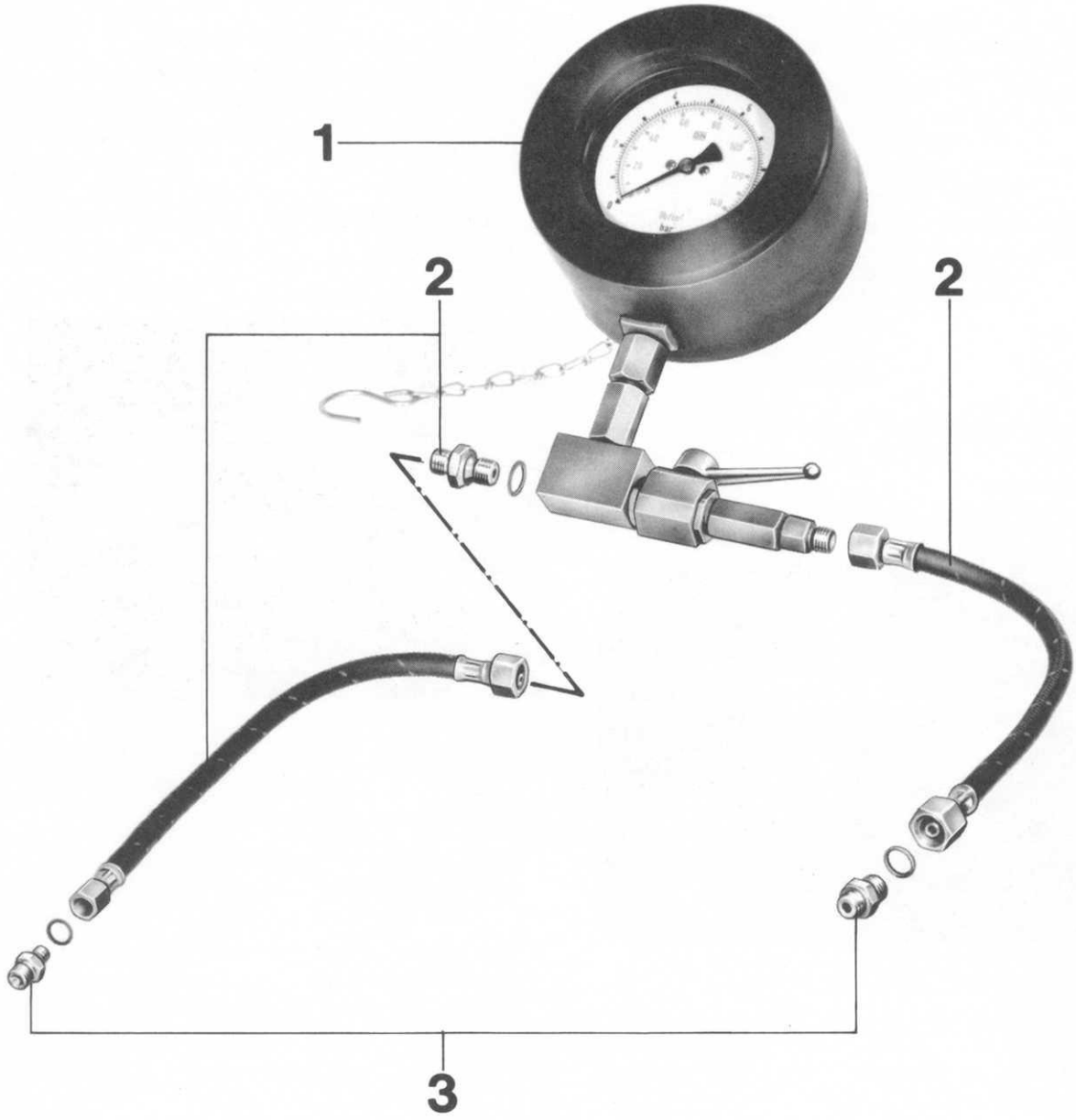
1. Detach and plug fuel return line.



2. Bridge fuel pump relay.

3. Hot start valve must be absolutely tight, i. e. fuel must not escape on fuel return connection.

TOOLS



No.	Description	Special Tool	Remarks
1	Pressure tester	VW 1318	
2	Connectors	P 378 c	
3	Adapter	9114/1	

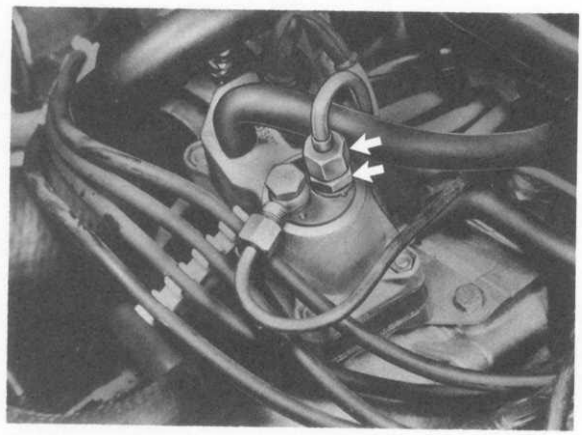
CONNECTING AND BLEEDING PRESSURE TESTER VW 1318

Connecting

Note:

Unscrew tank cap to let pressure escape from fuel tank prior to disconnecting fuel lines.

1. Unscrew control pressure line and standard adapters (M 10 x 1 / M 8 x 1) on control pressure regulator.

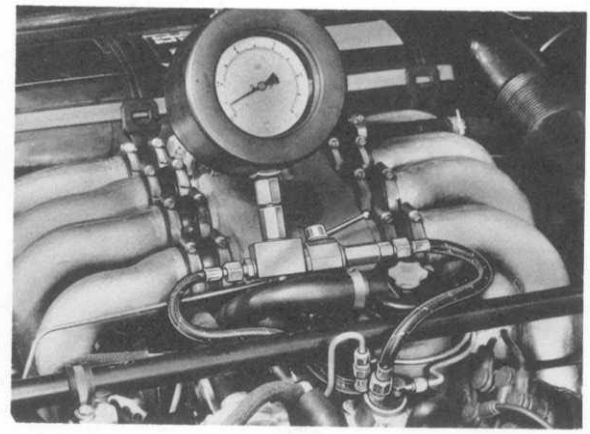


2. Remove original hose on pressure tester VW 1318 (it is not needed).

3. Screw in adapter of 9114/1 (M 10 x 1 / M 12 x 1.5) with seal on control pressure regulator and connect right test line of P 378 c.

4. Connect adapter of 9114/1 (M 8 x 1 / M 10 x 1) between disconnected control pressure line and left test line of P 378 c.

5. Connect adapter (M 12 x 1.5) and test line on pressure tester.

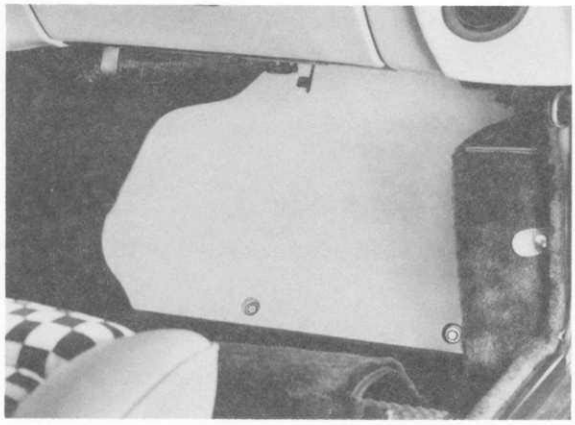


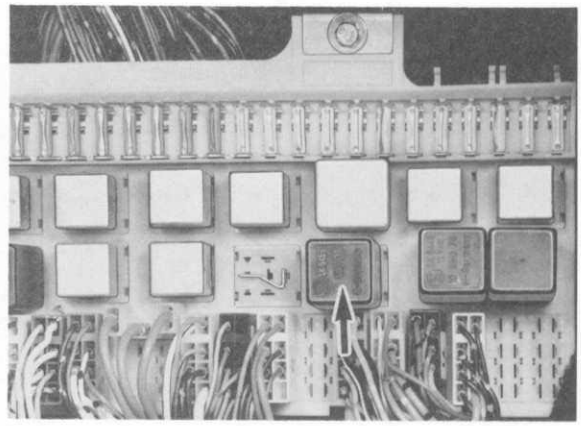
Bleeding

1. Pull off electric wire plugs on control pressure regulator and auxiliary air regulator to prevent heating of parts for the following tests.

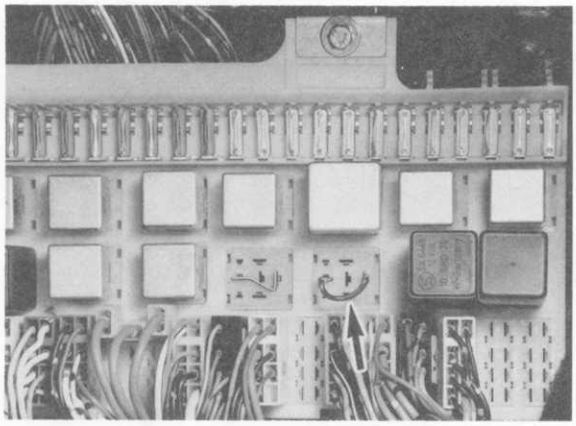
2. Bridge electric safety circuit.

   a) Unscrew and fold up cover in footwell on passenger's side.



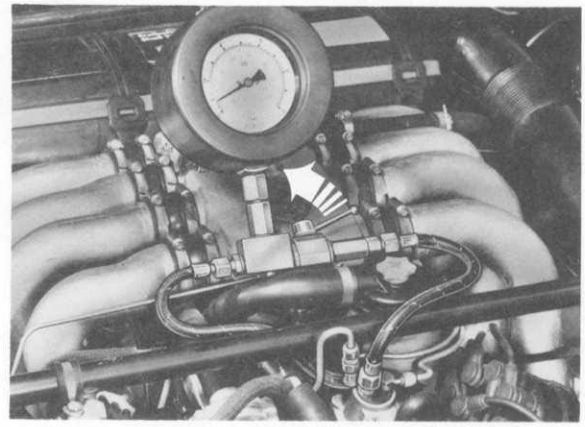


b) Pull off fuel pump relay.



c) Bridge plug connections 30 and 87 with a piece of wire. Fuel pump or fuel pumps should now run.

3. Bleed pressure tester. Let pressure gauge hang down. Move lever for switching-over valve between valve opened and valve closed positions in 10 second intervals.

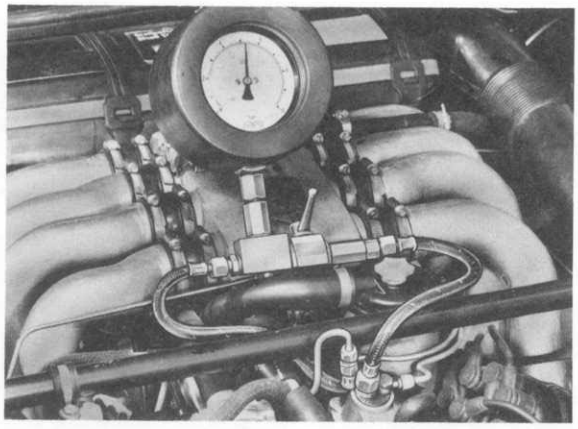


CHECKING SYSTEM PRESSURE

1. Connect and bleed pressure tester VW 1318.

2. Bridge safety circuit.

3. Set lever to closed valve position.



4. System pressure should now agree with specifications.

CHECKING CONTROL PRESSURE "WARM"

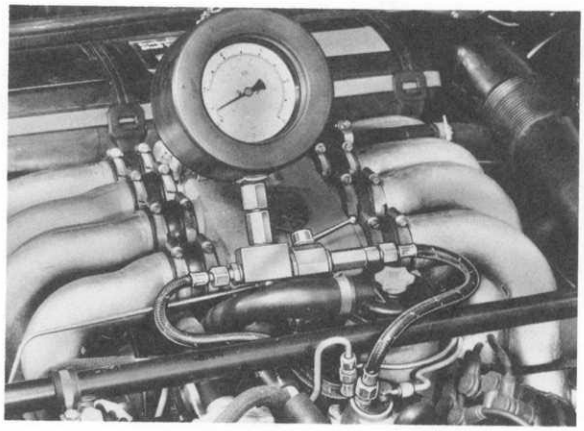
Engine could be cold or warm for this test.

1. Connect and bleed pressure tester VW 1318.

2. Electric wire plug remains connected on control pressure regulator.

3. Bridge safety circuit.

4. Set lever to opened valve position. Control pressure will now rise slowly and reach the specified value when control pressure regulator has been operated. Operating time will vary depending on ambient temperature.



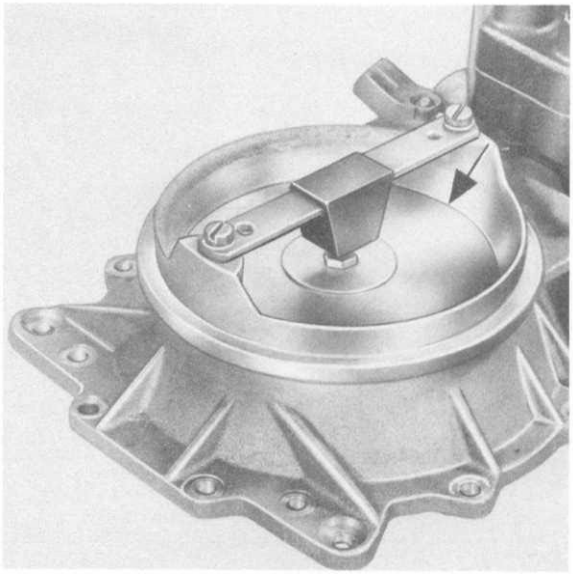
CHECKING AND ADJUSTING REST POSITION OF AIR FLOW SENSOR PLATE

Checking

1. Pull off high tension wire 4 from distributor and operate starter approx. 10 seconds.

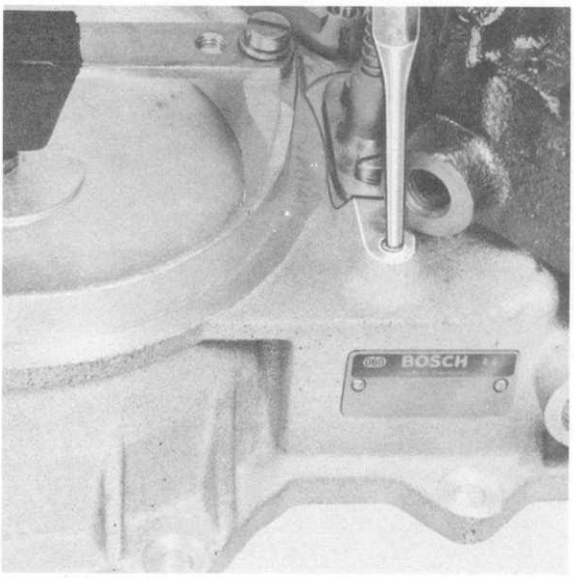
2. Upper edge of air flow sensor plate must be flush with beginning of venturi cone or at most a max. of 0.5 mm higher (strive for lowest position).

3. Air flow sensor plate must be horizontal and centered in venturi.



Adjusting

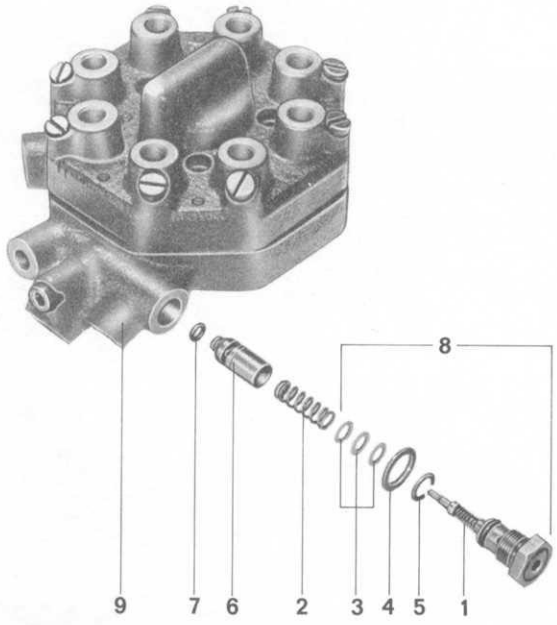
An excessively high air flow sensor plate setting can be corrected by driving down the stop spring guide pin with a drift and light hammer.



Note

Adjust very carefully, so that guide pin is not driven in too deep.
Avoid repeated adjustments in both directions, since this would loosen press fit of pin.

REPLACING PRESSURE RELIEF AND RESIDUAL PRESSURE VALVES



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Adapter with residual pressure valve (assembled unit)	1		Torque 1.3 - 1.5 mkg (9.4 - 10.8 ft lb)	
2	Spring	1			
3	Shim (as req.; 0.1, 0.15, 0.3, 0.4, 0.5 mm thick)	3		Install same as removed (always 3)	Check system pressure
4	Flat seal	1		Replace	
5	O-ring	1		Replace	
6	Pressure relief valve piston	1	Use tapered wooden peg, if necessary	Check, replace fuel distributor if damaged	
7	O-ring	1		Check, replace if necessary	
8	Part set	1			
9	Fuel distributor	1			disassemble

REMOVING AND INSTALLING MIXTURE CONTROL UNIT

Removing

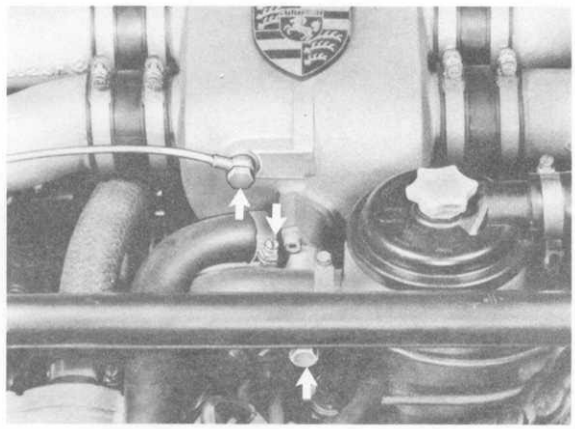
1. Disconnect battery ground wire from spare wheel well.

2. Remove air cleaner assembly.

3. Remove vacuum hose between intake branch and brake booster.

4. Detach and remove all fuel injection lines, counterholding on fuel injectors.

5. Detach and remove hose between auxiliary air regulator and air distributor, fuel supply line on cold start valve and, on cars with an automatic transmission, vacuum line.

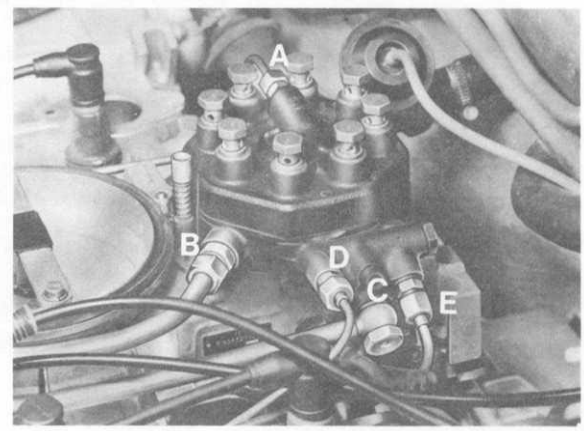


6. Loosen upper hose clamp on connector between air distributor and throttle housing.

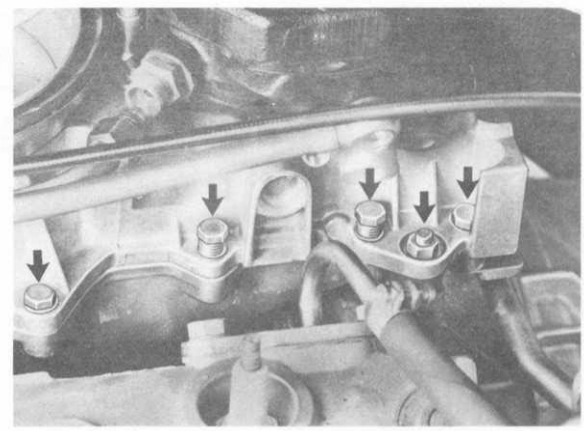
7. Detach intake pipes at bottom and remove together with air distributor.

8. Detach fuel lines:

   A - Control pressure line to control pressure regulator
   B - Fuel feed
   C - Fuel return
   D - Fuel feed/cold start valve
   E - Fuel return/control pressure regulator



9. Unscrew hexagon head bolts and nuts between air flow sensor and air guide housing, and remove mixture control unit from above.

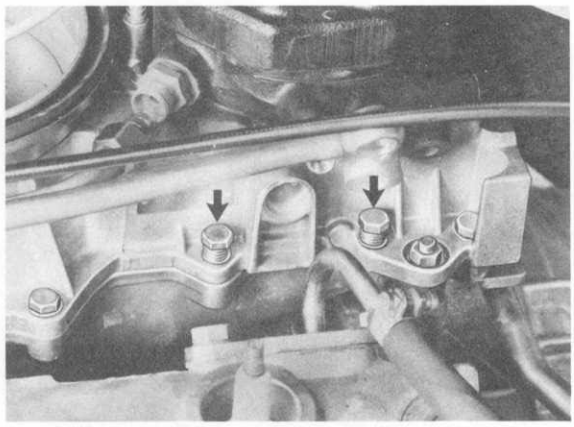


Installing

1. Always use new seals and gaskets.

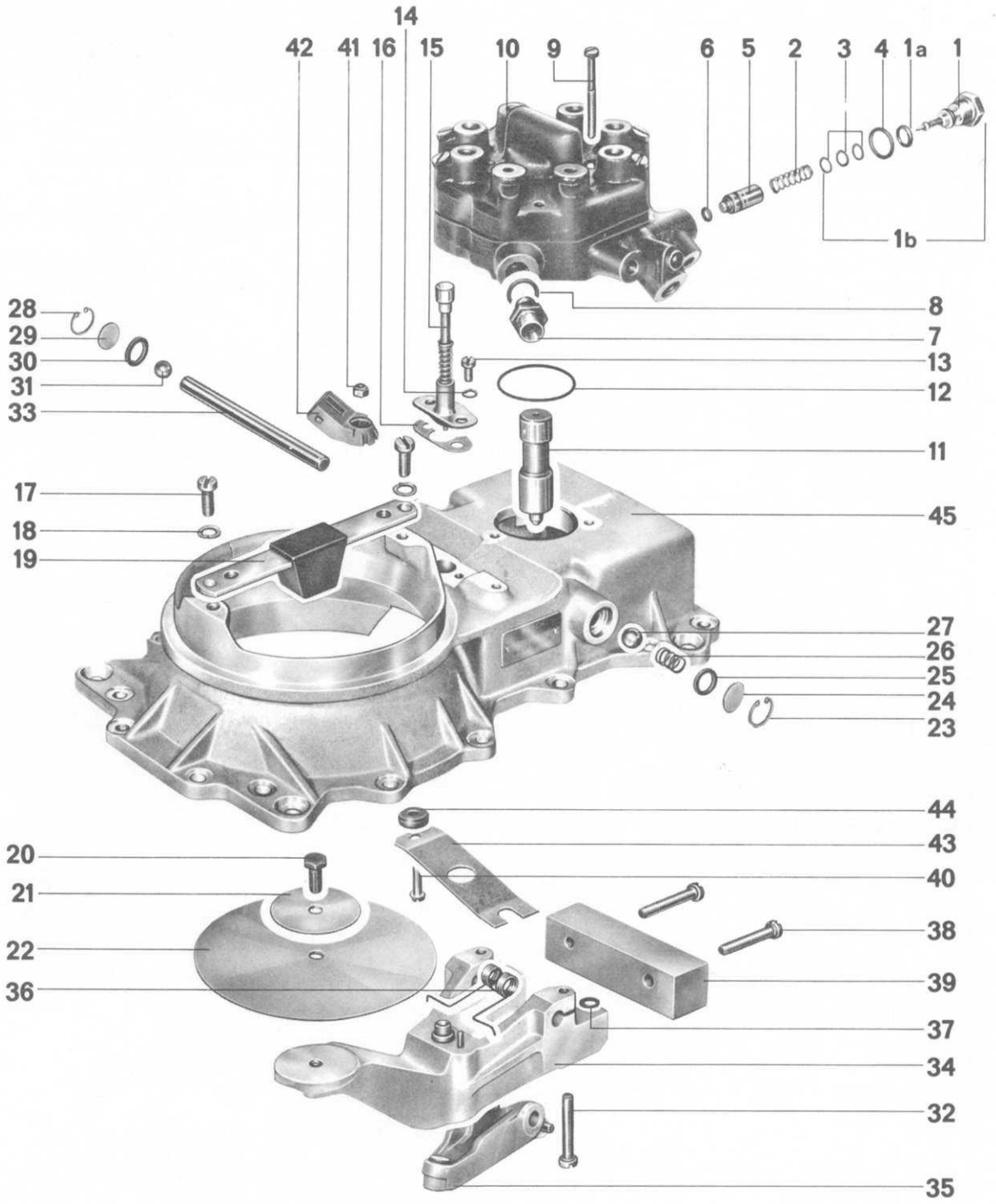
2. Tighten hex. head bolts on mixture control unit crosswise to 1,0 mkg (7 ft lb).

3. Tighten hex. head bolts with spring (in area of sensor plate lever bearings) to compressed length of spring and then loosen by one turn.



4. Tighten fuel lines and intake pipes to specified torque.

DISASSEMBLING AND ASSEMBLING MIXTURE CONTROL UNIT



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Adapter with residual pressure valve (assembled unit)	1		Torque 1.3 - 1.5 mkg (9.4 - 10.8 ft lb)	
1a	O-ring	1		Replace	
1b	Set of parts	1			
2	Spring	1			
3	Shim(s) as req. (0.1, 0.15, 0.3, 0.4, 0.5 mm thick)	3		Install same shims as removed (always 3)	Check system pressure
4	Flat seal	1		Replace	
5	Pressure relief valve piston	1	Pull out with tapered wooden peg	Check, replace fuel distributor if damaged (close tolerance part)	
6	O-ring	1		Check, replace if necessary	
7	Adapter	1			
8	Seal	1		Replace	
9	Fillister head cap-screw	3		Torque 0.32 - 0.38 mkg (2.3 - 2.7 ft lb)	
10	Fuel distributor	1			
11	Control piston	1	Do not let control piston fall out		
12	Seal	1		Replace	
13	Fillister head cap-screw	2			
14	Copper washers (standard part)	2			
15	Allen key for mixture adjustments	1		Curved side of flange faces fuel distributor	

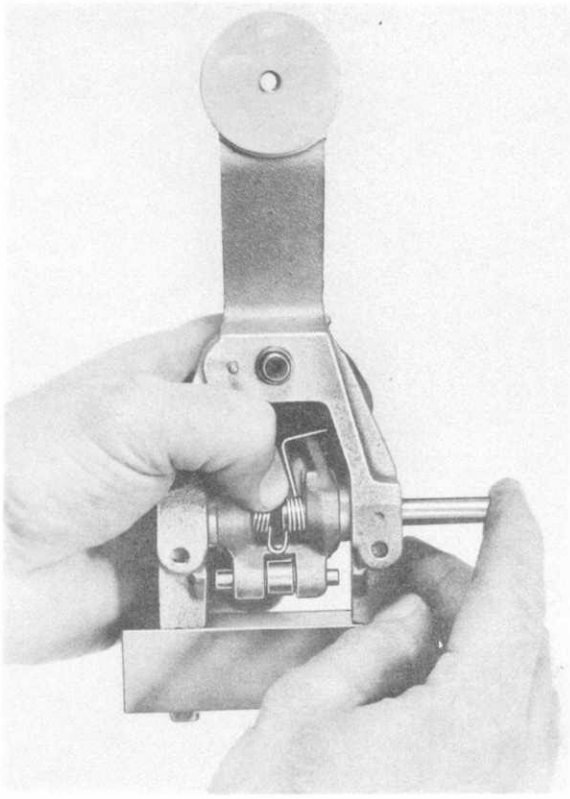
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
16	Gasket	1		Check, replace if necessary	
17	Fillister head capscrew	2			
18	Lockwasher	2			
19	Stop	1			Shown with 90° offset in fig.
20	Hex. head bolt	1		Torque 0.50 - 0.55 mkg (3.4 - 4 ft lb)	
21	Support disc	1			
22	Sensor plate	1		Check, replace if necessary Stamped edge of sensor plate or stamped code (--) faces up	
23	Circlip	1	First take off this circlip	Sharp edge side faces out	
24	End plate	1			
25	Seal	1			
26	Spring	1			
27	Ball	1		Lubricate with silicone grease	
28	Circlip	1		Sharp edge side faces out	
29	End plate	1			
30	Seal	1			
31	Ball	1		Lubricate with silicone grease	
32	Fillister head capscrew	2		Torque 0.47 - 0.53 mkg (3.4 - 3.8 ft lb)	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
33	Cylindrical pin	1			
34	Adjusting lever	1		Check	
35	Fork lever	1			
36	Spring	1			
37	Spacer	2			
38	Fillister head capscrew	2		Torque 0.47 - 0.53 mkg (3.4 - 3.8 ft lb)	
39	Counterweight	1		Position correctly	
40	Fillister head capscrew	1			
41	Locknut	1			
42	Plug, safety switch	1		Turned toward air venturi by approx. 15°	No electrical function
43	Stop leaf spring	1		Position correctly	
44	Insulator	1			
45	Air flow sensor housing	1		Lubricate bearing bores with silicone grease	

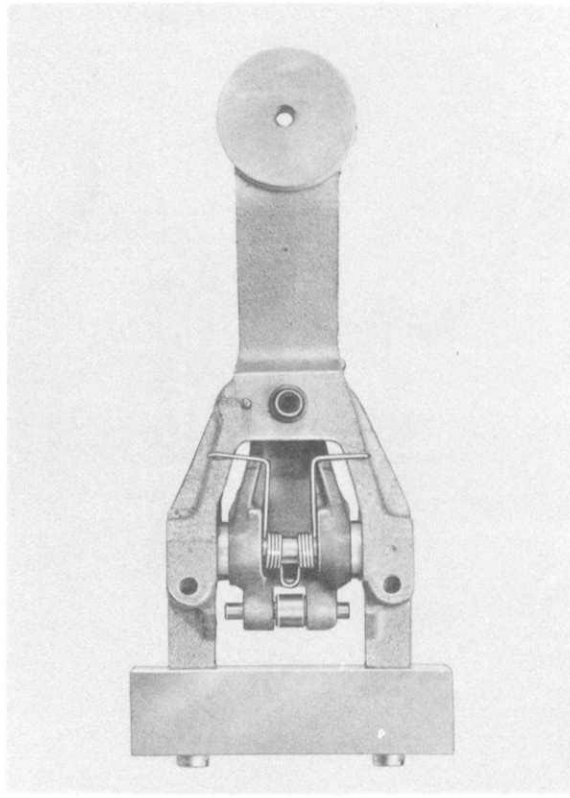
DISASSEMBLING AND ASSEMBLING MIXTURE CONTROL UNIT

1. Pre-assemble adjusting lever, spring and fork lever prior to installation in air flow sensor housing.

2. This requires a suitable cylindrical pin, e.g. pin from adjusting lever of 911 mixture control unit or a standard 8 h 8 x 60 DIN 7 cylindrical pin.
Both ends must be chamfered.

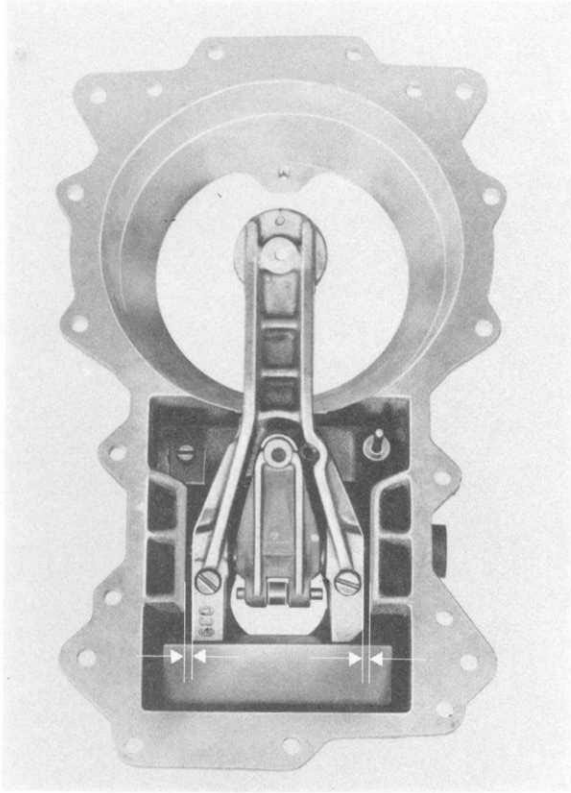


3. Make sure that springs fit properly.

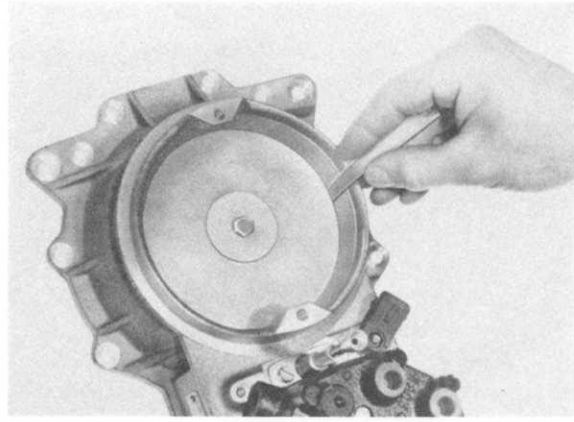


4. Guide preassembled parts into air flow sensor housing and carefully push out pin used for assembling with the original pin.

5. Center adjusting lever in air flow sensor housing and tighten mounting bolts.



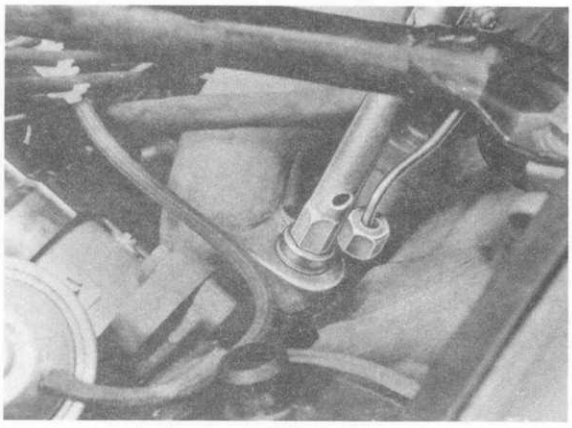
6. Center gap between sensor plate and venturi. The gap must be uniform, and can be checked with a 0.10 mm feeler gauge blade. This requires that the sensor plate be adjusted to correct height (rest position).



REMOVING AND INSTALLING FUEL INJECTORS

1. Unscrew coupling nut of fuel injection line, counterholding on fuel injector.

2. Unscrew fuel injector with a deep socket.

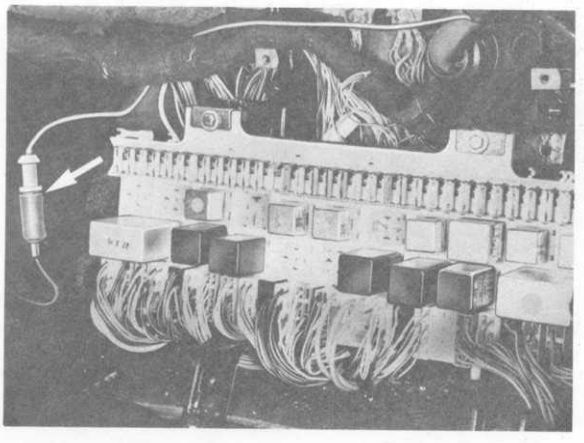


REMOVING AND INSTALLING OXYGEN SENSOR

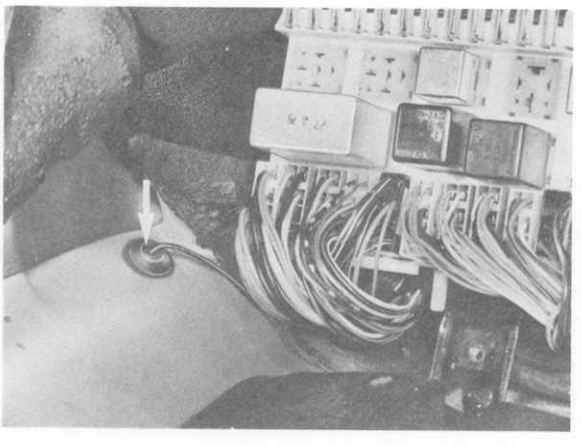
Removing

1. Remove lower section of foot support on passenger's side.

2. Disconnect oxygen sensor plug.



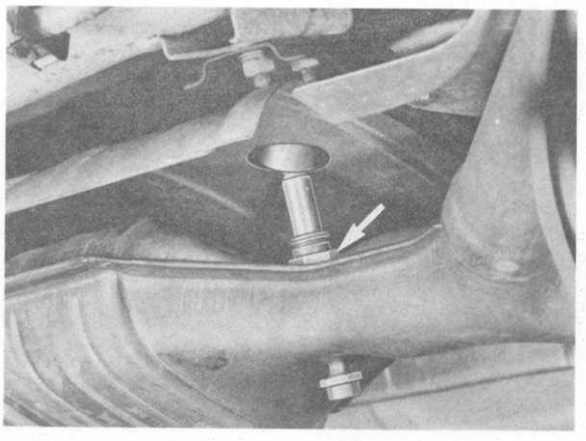
3. Push wire grommet and plug down through the floor board.



4. Lift car.

5. Pull off safety plug on oxygen sensor.

6. Unscrew oxygen sensor.



Installing

1. Coat threads of oxygen sensor with Bosch Paste VS 140 16 Ft or Optimoly HT.

Note

Be careful to keep paste out of slots in sensor.

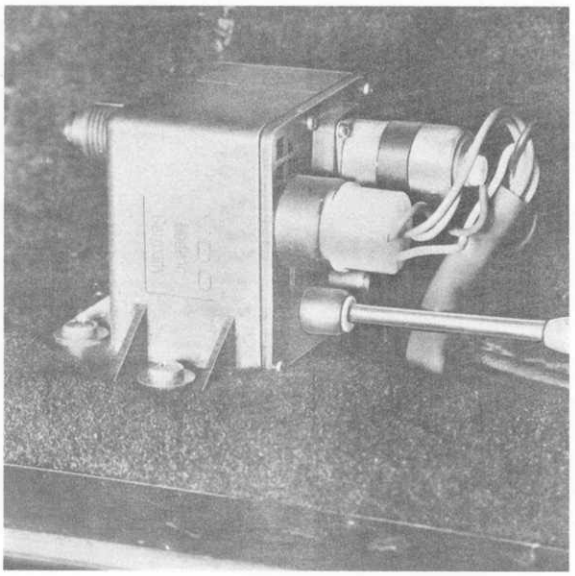
2. Tighten sensor to specified torque.
   Reference value: 50 - 60 Nm (36 - 43 ft lb)

RESETTING ELAPSED MILEAGE SWITCH

An elapsed mileage switch is mounted to the right of the passenger's seat to monitor the time of operation. It will turn on an indicator lamp for the oxygen sensor after the car has been driven 30,000 miles. The elapsed mileage switch must be reset to zero each time the oxygen sensor is replaced.

1. Loosen knurled head screw and remove cover for elapsed mileage switch.

2. Push in reset button on elapsed mileage switch against stop with a suitable tool. The elapsed mileage switch will return to zero and the oxygen sensor indicator light will again operate normally.

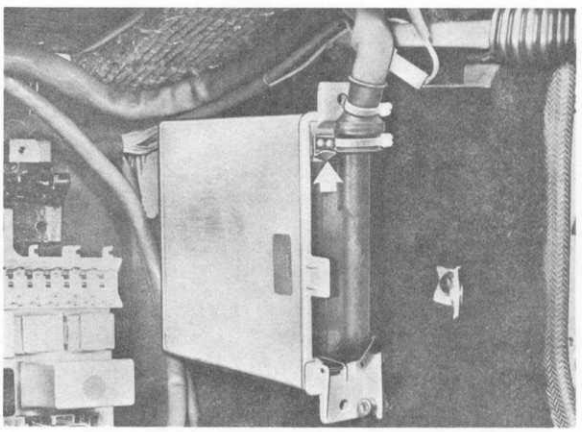


REMOVING AND INSTALLING CONTROL UNIT FOR AFC FUEL INJECTION AND OXYGEN SENSOR

This control unit is mounted on right wheel housing in passenger's footwell.

Removing

1. Push up plug clip to unlock the plug.



2. Loosen three mounting screws and remove control unit.

Installing

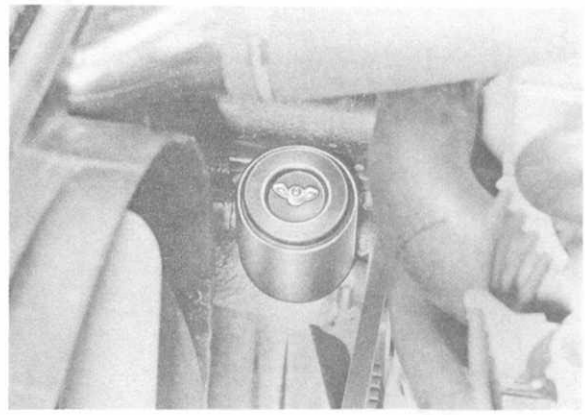
Make sure plug fits properly and can be felt to engage.

REPLACING FILTER ELEMENT OF AIR PUMP

Note

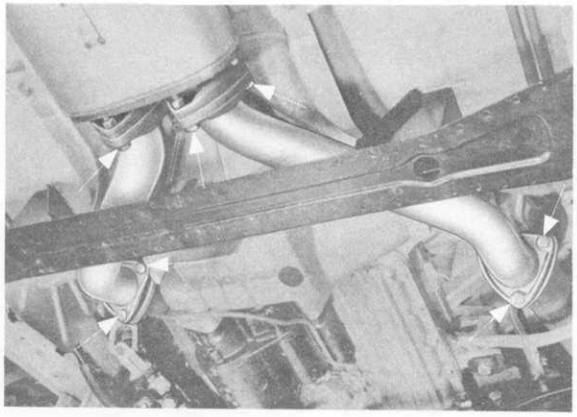
Filter housing is mounted on wheel housing in front righthand side of engine compartment.

Loosen winged nut, remove filter cover and take out filter element.

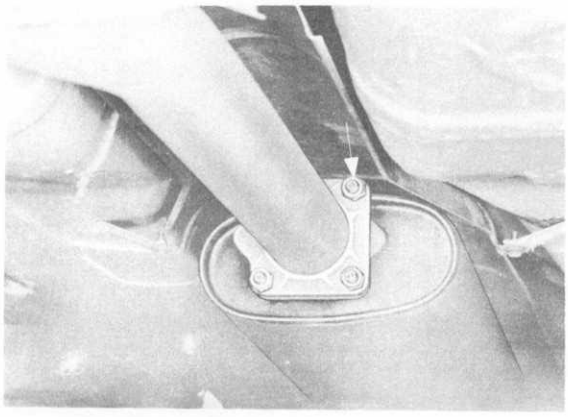


CHECKING TIGHTNESS OF EXHAUST FLANGES

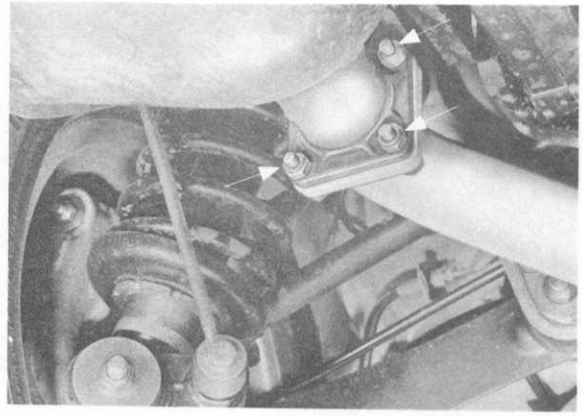
1. Check bolts between exhaust manifold pipes and catalytic converter.



2. Check bolts at intermediate muffler outlet.



3. Check bolts at main muffler inlet.



Tightening torque for bolts and nuts:

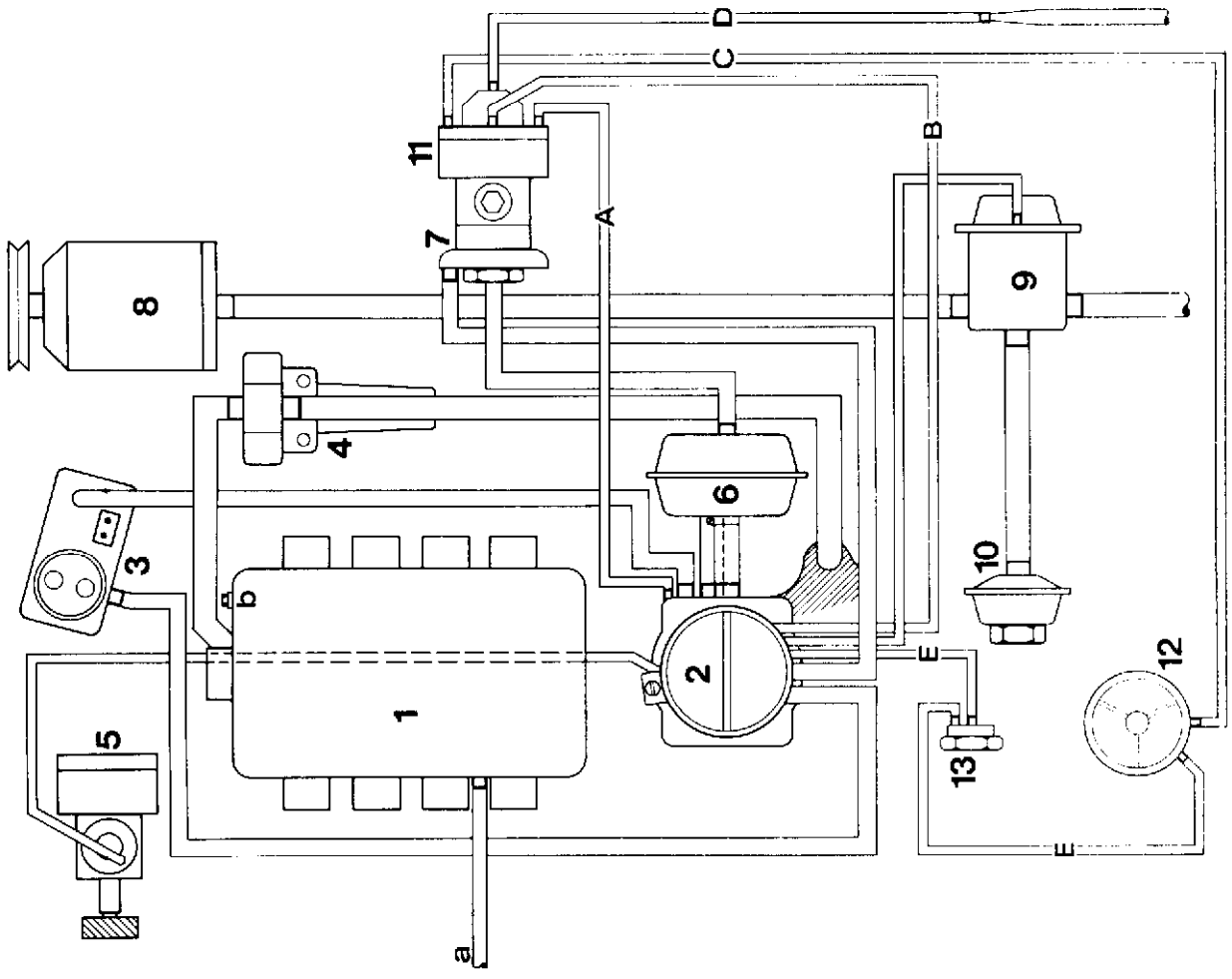
M 8	2,0 + 0,2 mkg (14 + 1,4 ft lb)
M 10	4,0 + 0,5 mkg (29 + 3,6 ft lb)

1 - Air distributor
a - Vacuum source for brake booster
b - Vacuum source for automatic transmission
2 - Throttle valve housing
3 - Control pressure regulator
4 - Auxiliary air regulator
5 - Ignition distributor
6 - Deceleration valve
7 - Barometric cell
8 - Air pump
9 - Diverter valve
10 - Check valve
11 - Pressure transducer
12 - EGR valve
13 - Thermo valve

Hose Colors:

A - white
B - blue
C - light brown
D - orange
E - red

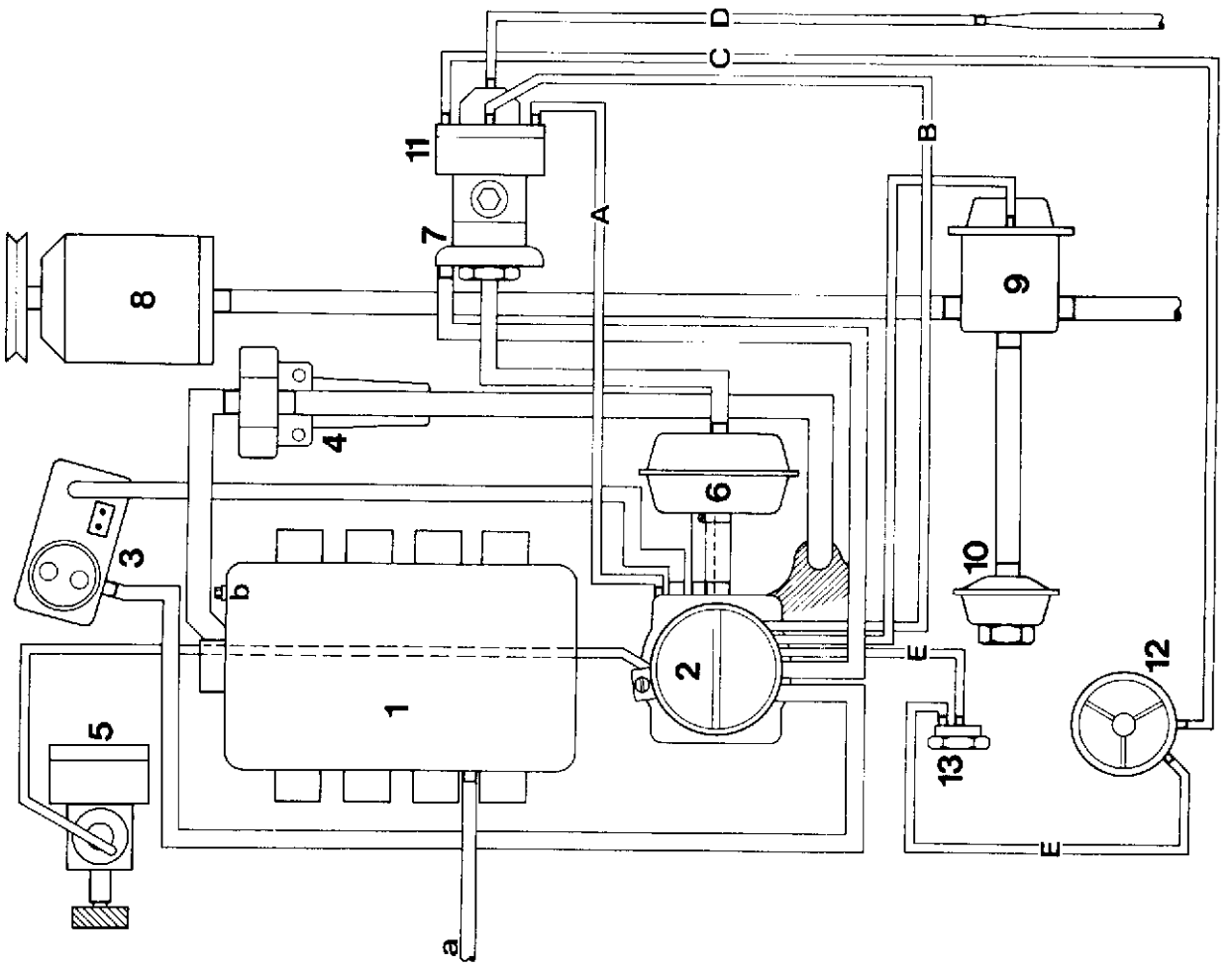
HOSE LAYOUT



HOSE CONNECTION PLAN - USA + JAPAN

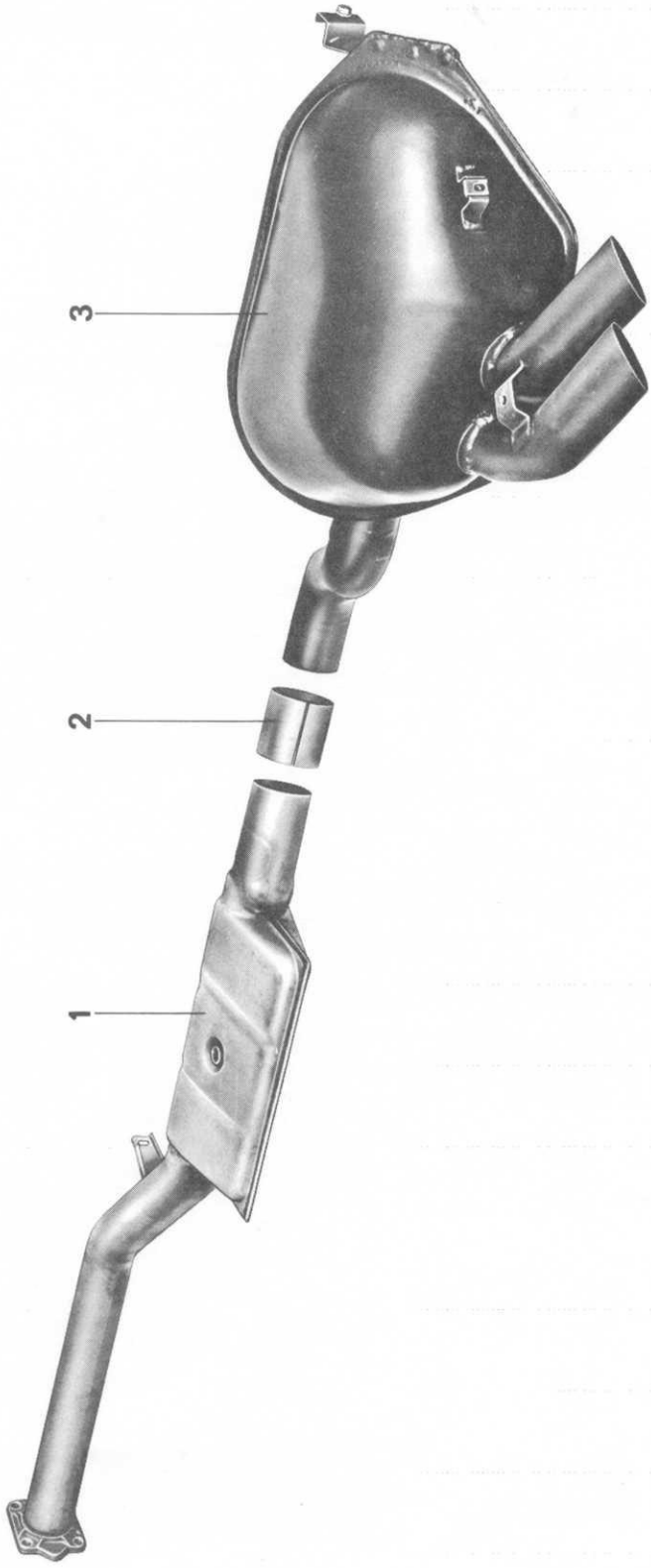
1 - Intake branch
a - Vacuum source for brake booster
b - Vacuum source for automatic transmission
2 - Throttle housing
3 - Warm-up control
4 - Throttle bypass valve
5 - Distributor
6 - Vacuum control
7 - Vacuum box
8 - Air pump
9 - Blowoff switching valve
10 - Check valve
11 - Pressure converter
12 - EGR valve
13 - Thermo valve

Hose Line Colors:
A - white
B - blue
C - light brown
D - orange
E - red



REPLACING INTERMEDIATE AND/OR FINAL MUFFLERS

Single Pipe System

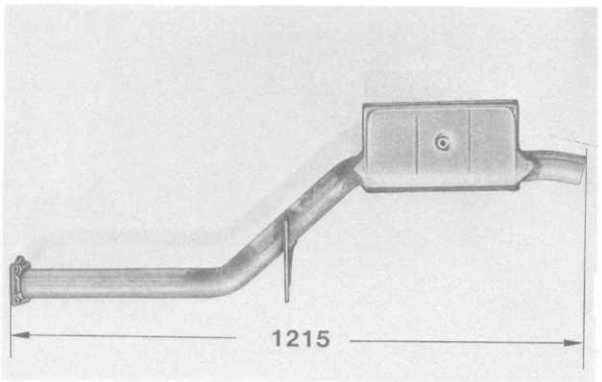


Printed in Germany

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Intermediate muffler	1			
2	Sleeve	1			
3	Final muffler	1			

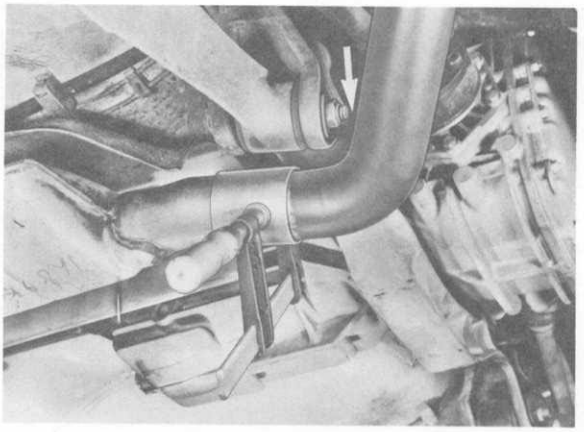
PROCEDURES

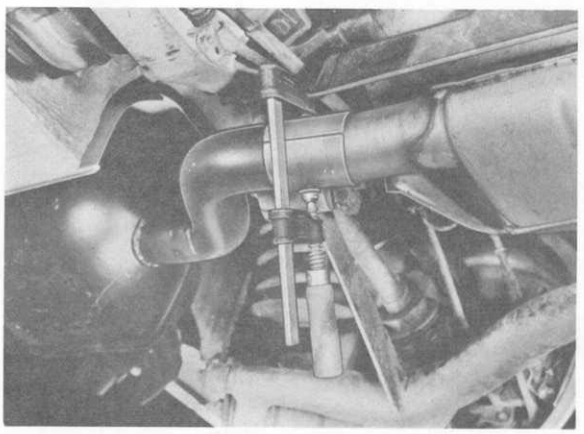
1. Unscrew bolts at flange of primary/intermediate mufflers and at rear. Remove exhaust assembly. Mark mating points and saw off exhaust pipe (see figure).
   Dimensions in mm.



2. Install new parts on car, using old mounting parts when possible.

3. Align exhaust assembly with the connecting sleeve to remove stress, whereby distance between bolt on rear axle beam and exhaust pipe must be about 15 mm. Clamp sleeve at several points to keep in correct position.





4. Remove assembly and weld sleeve all around. Inert gas welding should be preferred.

5. Use new mounting nuts for final installation.

REPLACING CENTER AND/OR FINAL MUFFLERS

Twin Pipe System - Type 928 S



Printed in Germany

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Intermediate muffler	1			
2	Final muffler	1			

PROCEDURES

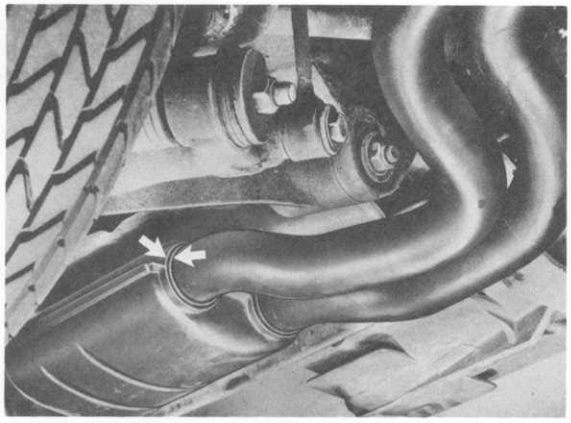
Replacing Intermediate Muffler and Final Muffler Together

1. Remove final muffler with intermediate muffler, heating front connecting pipe with a welder if necessary.

2. Mark off distance of about 10 mm on end of final muffler pipe to have minimum insertion depth of 10 mm.

   Install final and intermediate mufflers, and align to remove stress. Tack weld connecting pipe at several points to hold in installed position.

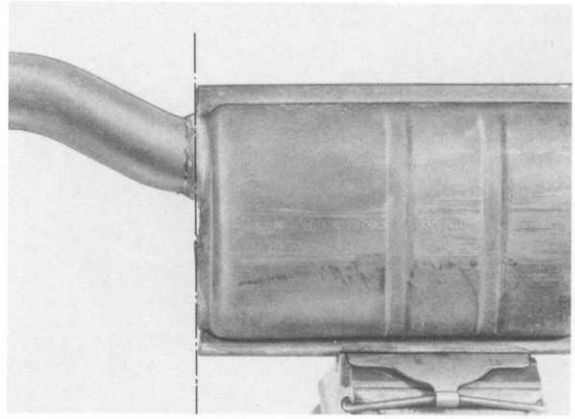
3. Remove assembly and weld connecting pipe as well as intermediate muffler sleeve all around. Inert gas welding should be preferred.



Replacing Final Muffler

1. Remove final muffler with intermediate muffler, heating front connecting pipe with a welder if necessary.

2. Cut through center of welding seam between final muffler and intermediate muffler with a saw or similar tool.



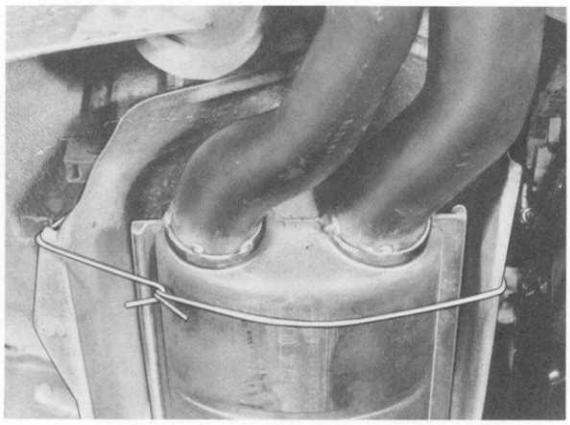
3. Remove remaining pieces of pipe from the intermediate muffler, grinding and/or filing off mating surfaces until pieces of pipe can be removed. Then remove rest of welding seam on inside.



4. Remove protective paint on ends of pipes on new final muffler in area of welding.

5. Mark off distance of about 10 mm on end of final muffler pipe to have minimum insertion depth of 10 mm.

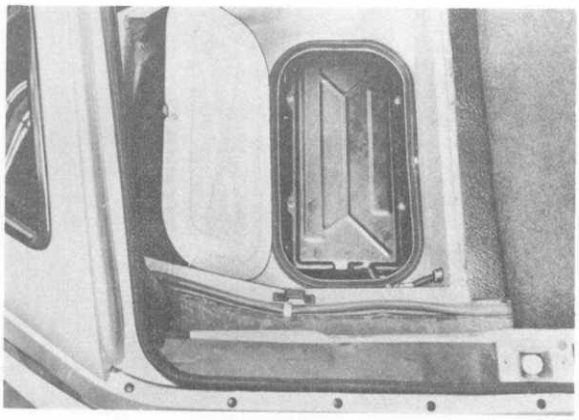
   Install final and intermediate mufflers, and align to remove stress. Tack weld connecting pipe at several points to hold in installed position.



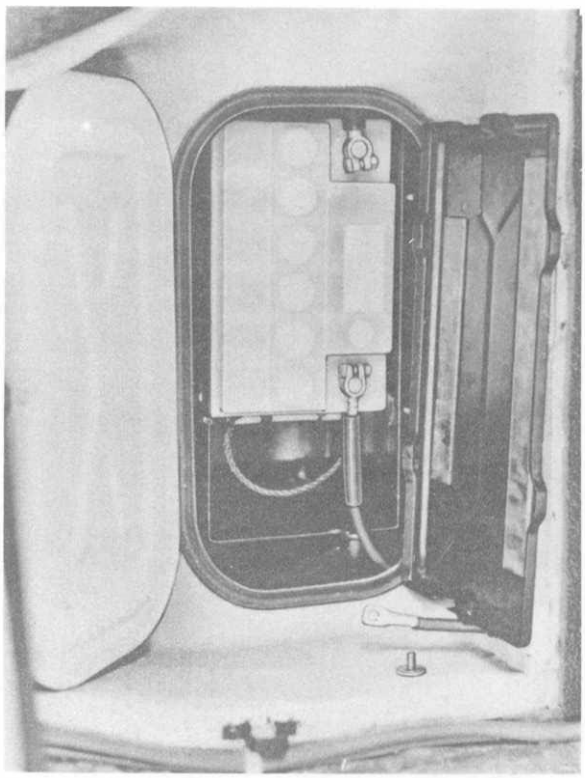
6. Remove assembly and weld connecting pipe as well as intermediate muffler sleeve all around. Inert gas welding should be preferred.

CHECKING BATTERY

1. Lift luggage compartment trim on left-hand side, remove cover plate, take out spare wheel and open battery box lid.



2. Disconnect battery ground wire at body. Unscrew and remove battery cover.



3. Measure specific gravity of each cell.

Specific Gravity	Battery Condition	Remarks
approx. 1.28	Fully charged	
approx. 1.20	Half charged	Recharge, if 1. car ist not used for a long time, 2. temperatures are below + 10° C/50° F or 3. specific gravity will not rise in spite of driving long distances (check alternator, regulator, belts).
approx. 1.10	Weak	Recharge immediately

4. Checking the specific gravity will not only supply information on charge condition of battery, but also any possible defects.

   a - Specific Gravity of one cell much lower than that of other cells: short circuit in weak cell, battery defective.

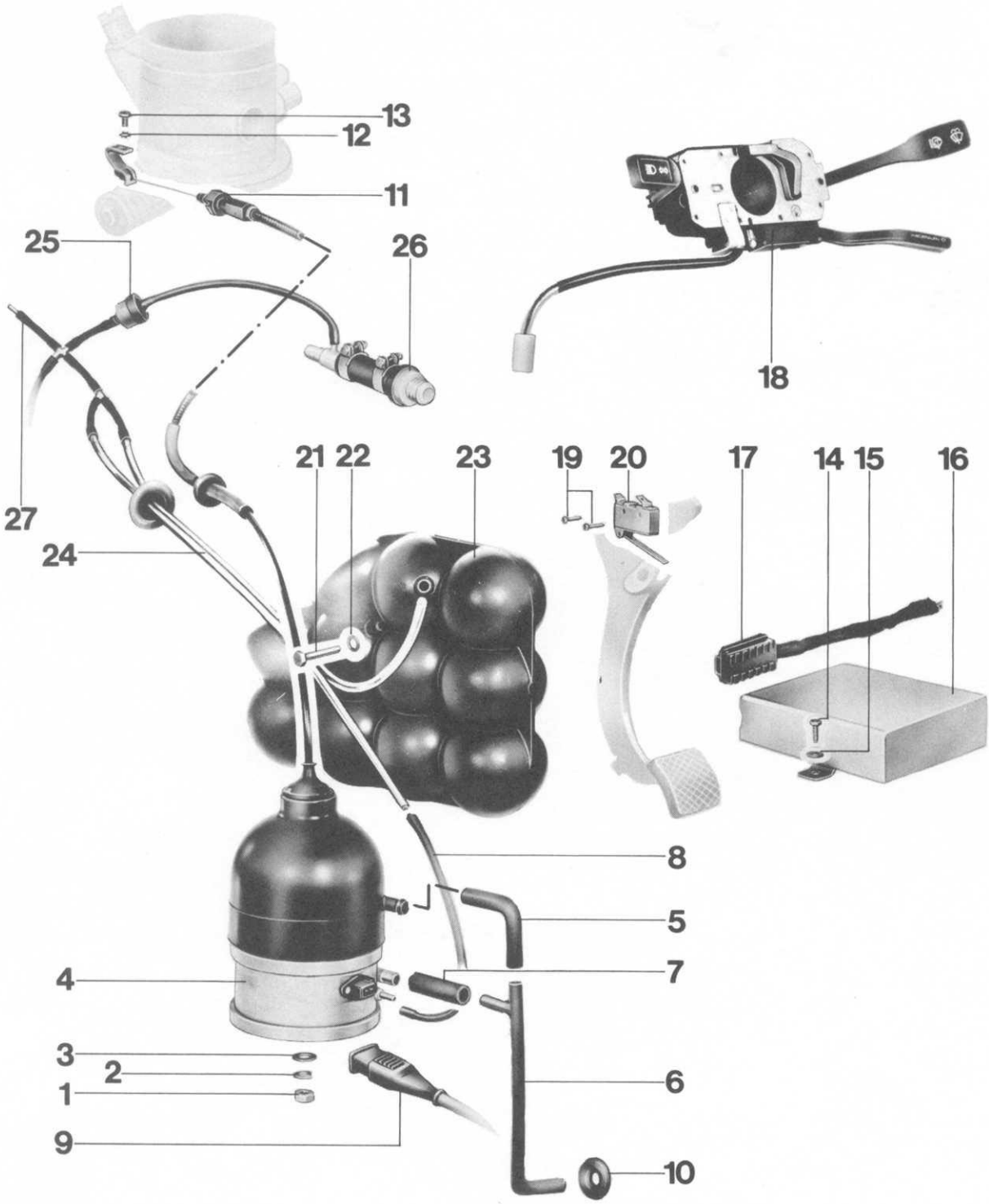
   b - Specific Gravity of two neighboring cells much lower than that of other cells: leak between both weak cells, battery defective.

   c - Specific Gravity correct in all cells, but battery voltage drops excessively under load: poor soldered connection between cells, battery defective.

5. If necessary, add distilled water to correct level.

AUTOMATIC CRUISE CONTROL (TEMPOSTAT)

AUTOMATIC CRUISE CONTROL
(TEMPOSTAT)



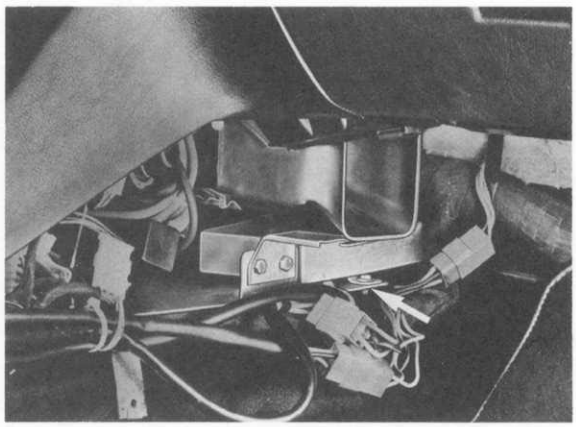
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Nut	1			
2	Lock washer	1			
3	Washer	1			
4	Vacuum servo	1			
5	Shaped hose	1			
6	Pipe	1			
7	Hose	1			
8	Vacuum hose	1			
9	Plug	1			
10	Grommet	1			
11	Cable	1			
12	Lock washer	2			
13	Bolt	2			
14	Bolt	2			
15	Washer	2			
16	Tempostat control	1			
17	Plug	1			
18	Steering column switch	1			
19	Screw	2			
20	Clutch pedal switch	1			
21	Bolt	1			
22	Washer	1			
23	Vacuum reservoir	1			
24	Vacuum line	2			
25	Check valve	1			
26	Brake booster conn.	1			
27	Testing connection	1			

REMOVING AND INSTALLING TEMPOSTAT CONTROL

1. Remove tray underneath glove box.

2. Unscrew side trim panels on center console.

3. Unscrew control mounting bolts. Remove control on side of passenger's footwell and pull off multiple pin plug.



REMOVING AND INSTALLING TEMPOSTAT SWITCH (STEERING COLUMN SWITCH)

Removal and installation are described on page 94 - 4 of this repair manual.

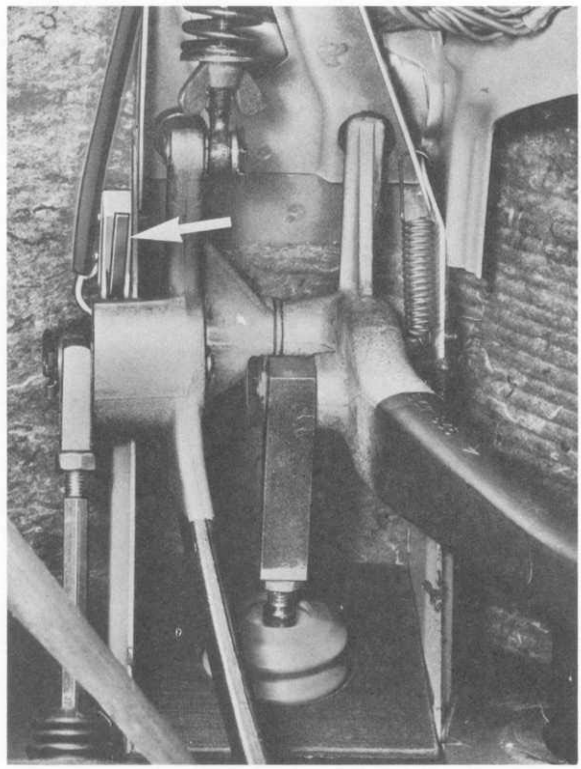
REMOVING AND INSTALLING CLUTCH PEDAL SWITCH

Note

Cars with an automatic transmission will have bridged wires instead of the switch.

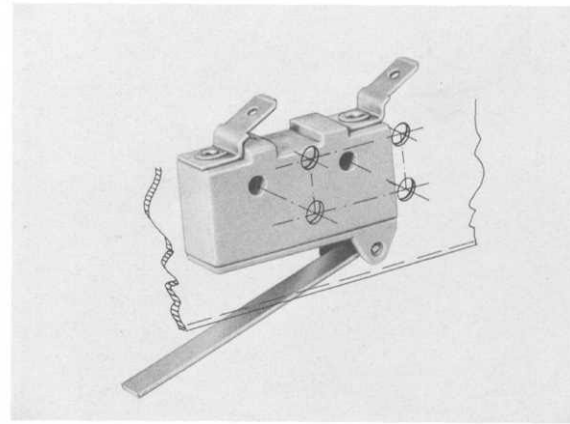
1. Unscrew mounting bolts.

2. Pull off wire plugs.



Note

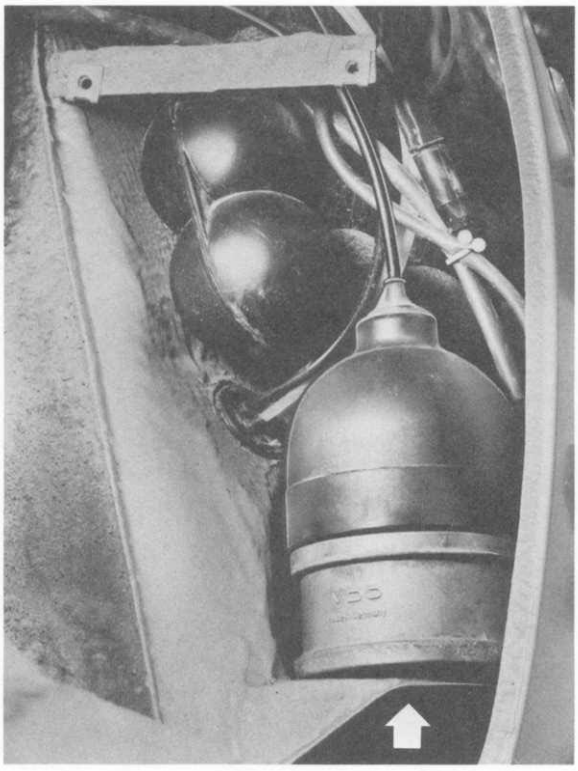
Two mounting planes are provided to adjust the switch. The switch must have switched completely (contacts made) when clutch pedal is in off position.



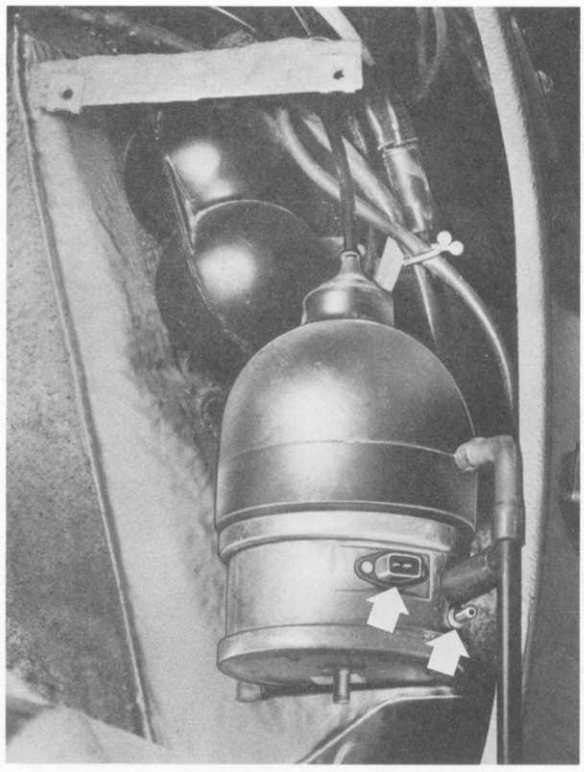
REMOVING AND INSTALLING VACUUM SERVO

1. Unscrew trim at rear in left front wheel house.

2. Unscrew mounting nut underneath the vacuum servo holder.

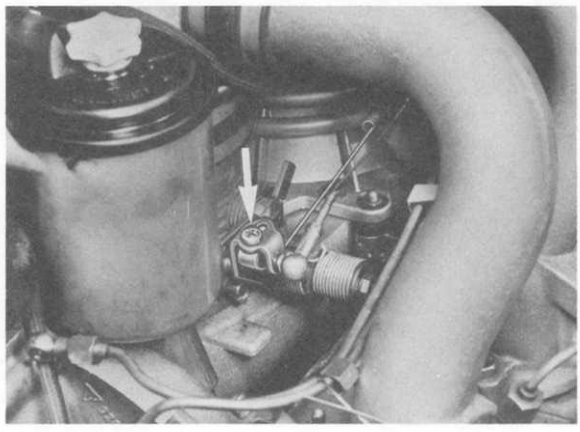


3. Pull vent tube underneath the vacuum servo out of the grommet. Turn vacuum servo so that connections face forward and pull off lines.

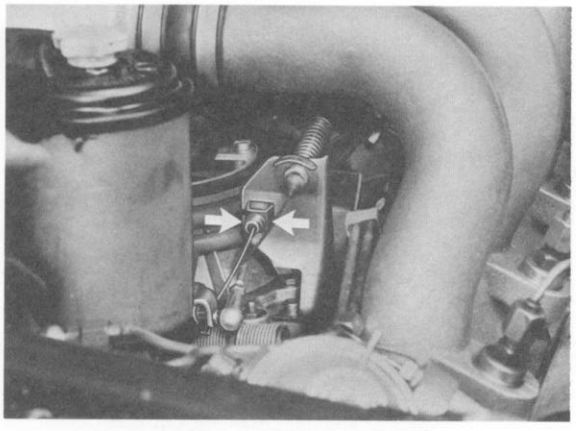


4. Remove entire air cleaner.

5. Unscrew cable on throttle.



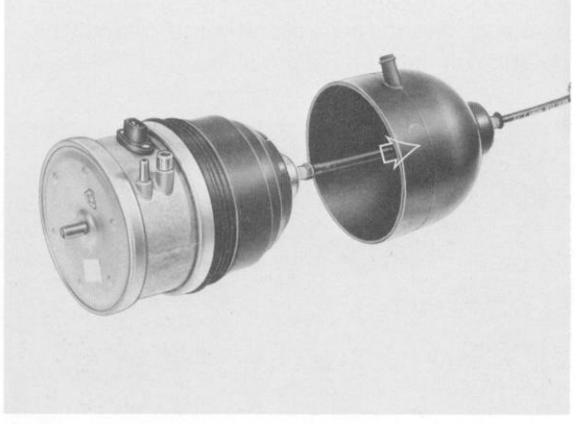
6. Compress catches on adjusting screw and push out of holder.



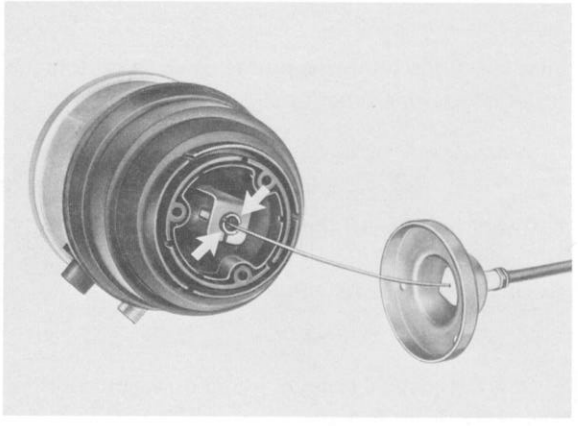
7. Pull cable with grommet into left wheel house.

REMOVING AND INSTALLING CABLE ON VACUUM SERVO

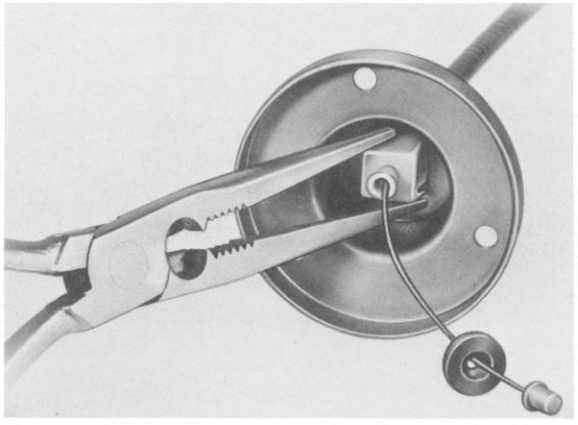
1. Pry cover off of vacuum servo.



2. Unscrew cap. Compress clip, push in and disconnect cable.



3. Press clip out of cap and take cap off of cable.



Note

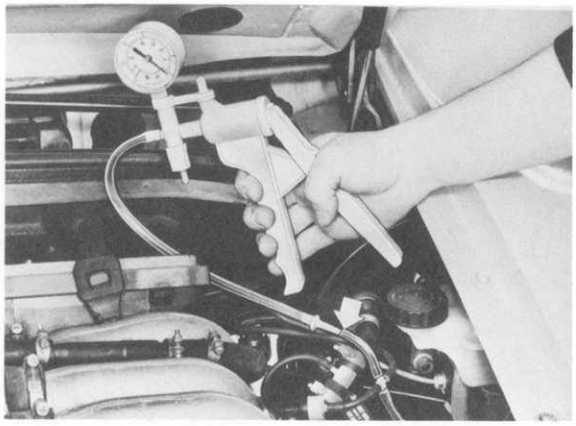
Make sure cable is installed without sharp bends. Cable should have approx. 1 mm play on throttle mounting point. Under no circumstances should the cable be tight when the engine is stopped.

TROUBLESHOOTING AUTOMATIC CRUISE CONTROL (TEMPOSTAT)

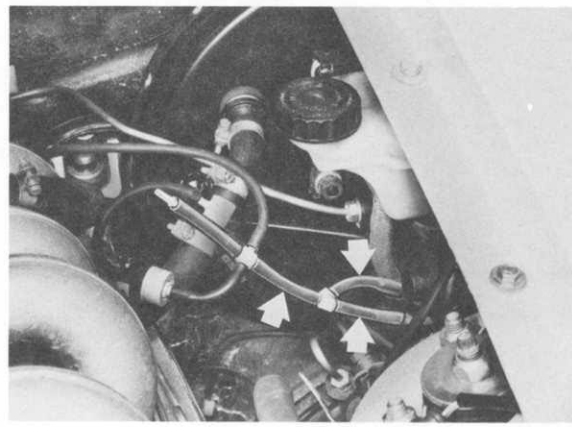
First check the following points when the automatic cruise control malfunctions.

1. Check fuse no. 10 (no. 7 beginning with 1981 models).
   This fuse is also for the stop lights.

2. Connect manual vacuum pump on vacuum system and check for leaks.



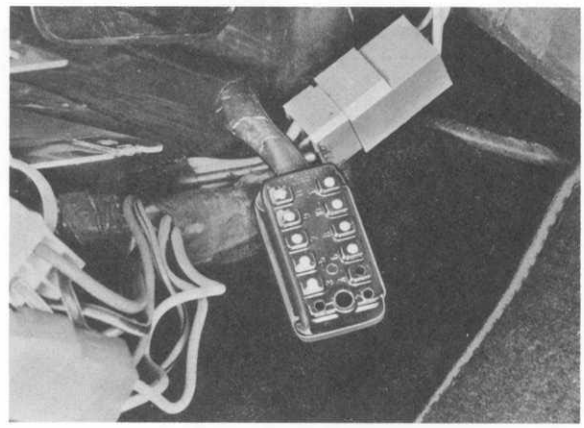
3. Visually inspect vacuum hoses for bends or twisting.



4. Check that electric connection on vacuum servo fits tight.

5. Check function of microswitch on clutch pedal. Switch must have switched fully, i. e. contact made, when clutch pedal is in o f f position (switching heard when operating clutch).

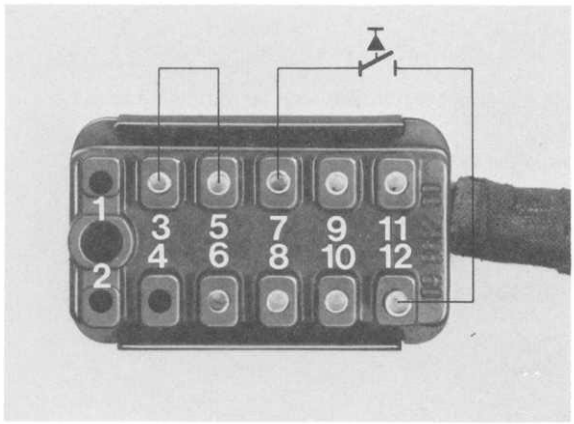
If no defect is found while checking all of these points, remove the control and continue trouble-shooting on the multiple pin plug.



CHECKING VACUUM SERVO

1. Bridge term. 3 and term. 5 on multiple pin plug of removed control.

2. Connect any push button switch on terminals 7 and 12.

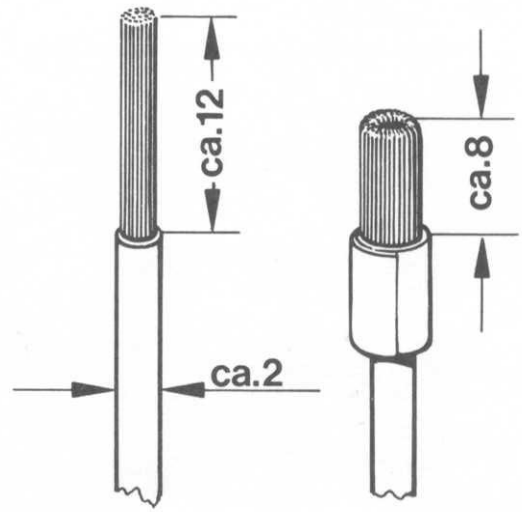


3. Turn on ignition and press push button switch with engine stopped. The vacuum servo should move the throttle uniformly to full load position.
This requires vacuum.

N o t e

To avoid damaging the female plugs in the multiple pin plug, suitable plugs or the wires described below must be used.

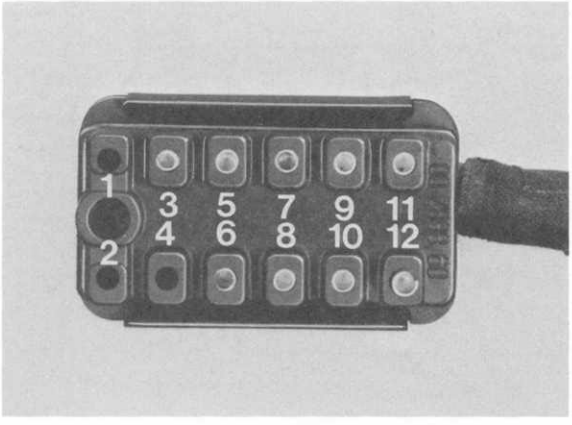
Remove insulation on wires with an insulating diameter of approx. 2 mm, bend back separate wires all around and wrap insulating tape around ends of wires.



The length of the wires for the push button switch should be about 2 meters, in order to be able to watch the throttle while operating the switch.

CHECKING MULTIPLE PIN PLUG OF CONTROL WITH A VOLTMETER OR TEST LAMP

1. Turn on ignition.
   Connect tester between terminals 5 and 12 (ground).



   There should be battery voltage at terminal 5.

2. Connect tester between terminals 6 and 12.
   There should be battery voltage when operating the brake.

3. Connect tester between terminals 8 and 12.

   Display = battery voltage.

   Pull back lever on tempostat switch (cancel).

   Display = 0 volt.

4. Connect tester between terminals 9 and 12.

   Display = 0 volt.

   Push lever on tempostat switch forward (set).

   Display = battery voltage.

5. Connect tester between terminals 10 and 12.

   Display = 0 volt.

   Push down lever on tempostat switch (repeat).

   Display = battery voltage.

CHECKING MULTIPLE PIN PLUG OF CONTROL WITH AN OHMMETER AND IGNITION TURNED OFF

1. Check ground on plug.
   Display between terminal 12 and car ground should be 0 ohm.

2. Connect ohmmeter between terminals 3 and 7.
   Display = approx. 14 ohms (resistance value of vacuum servo).
   Display should move to infinite ohms (switch interrupted).

3. Connect ohmmeter between terminals 11 and 12 (speed sensor).
   Push car slowly or turn one rear wheel and hold the other rear wheel. Display of meter should alternate between 0 and infinite ohms.

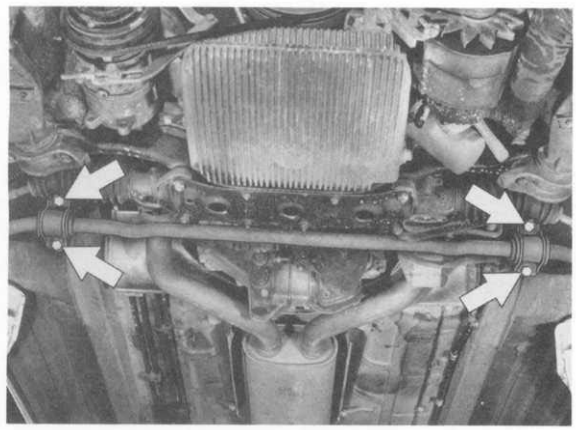
Replace the control, if no defects are found in the tests.

REMOVING AND INSTALLING STARTER

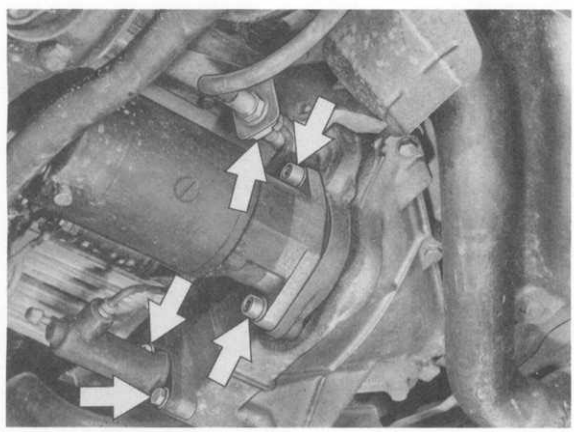
1.Disconnect battery.

2.Disconnect all cables to starter.

3.Detach stabilizer.



4.Remove clip from clutch-hose bracket.



5.Unbolt clutch actuating cylinder.

6.Remove mounting bolts.

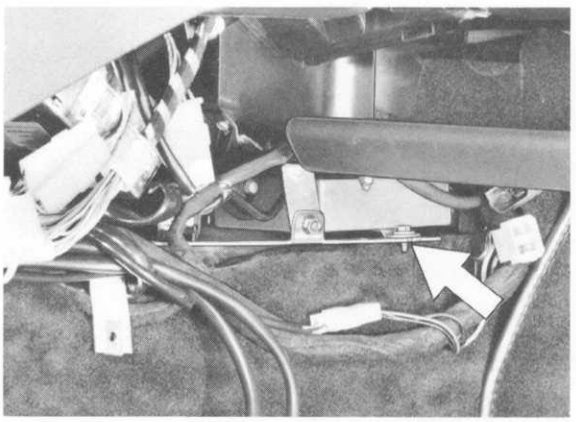
ELECTRICALLY CONTROLLED TEMPOSTAT, '88 MODELS ONWARD

As of model year '88, the 928 models are fitted with an electrically controlled tempostat.

REMOVING AND INSTALLING TEMPOSTAT CONTROL UNIT

1. Detach right-hand side panel from center console.

2. Remove mounting bolt.



3. Remove control unit.

4. Disconnect plug.

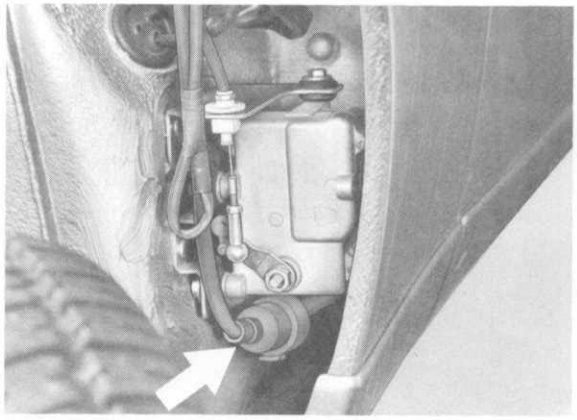
REMOVING AND INSTALLING STEERING COLUMN SWITCH

Removal and installation are described on page 94 - 4 of the Repair Manual.

REMOVING AND INSTALLING ACTUATOR

1. Remove front left-hand wheel-arch inner panel.

2. Open multi-pin plug holder and disconnect plug.

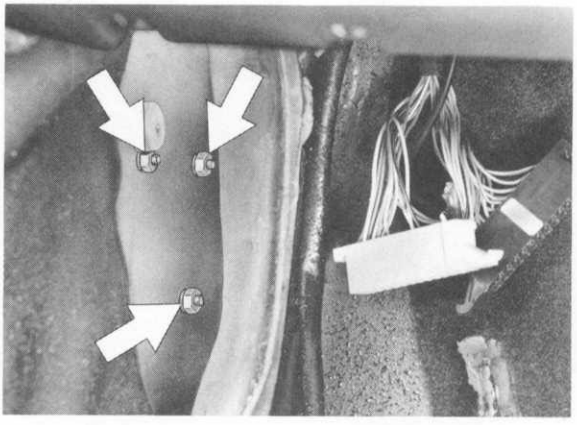


3. Disengage cable.

4. Press retainers together and push Bowden cable up out of holder.

5. Remove footrest in driver's side footwell.

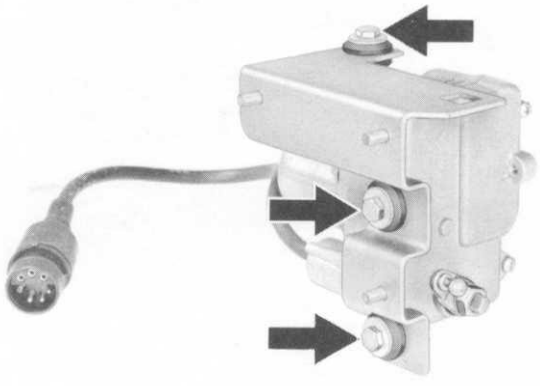
6. Remove carpet and insulator from wheel-arch sidewall far enough to gain access to 3 mounting nuts.



7.Remove mounting nuts.

8.Remove actuator complete with holder.

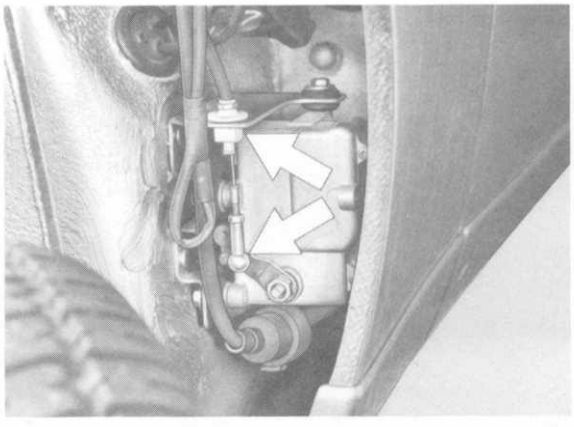
9.Unscrew attachment bolts.



REMOVING AND INSTALLING BOWDEN CABLE

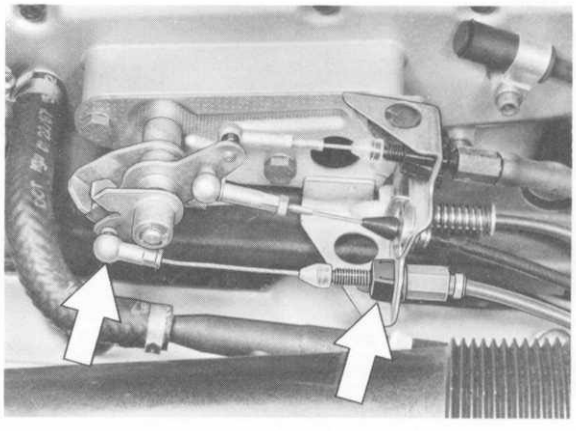
1.Remove front left-hand wheel-arch inner panel.

2.Disengage cable.



3.Press retainers together and push Bowden cable up out of holder.

4.Disengage Bowden cable from reversing lever.



5. Press retainers of setscrew together and push back out of holder.

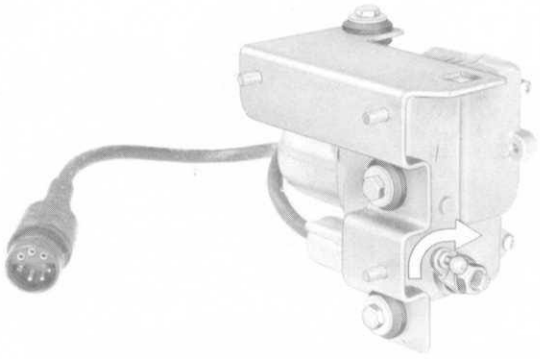
6. Push Bowden cable and rubber grommet through wheel-arch wall.

Note:

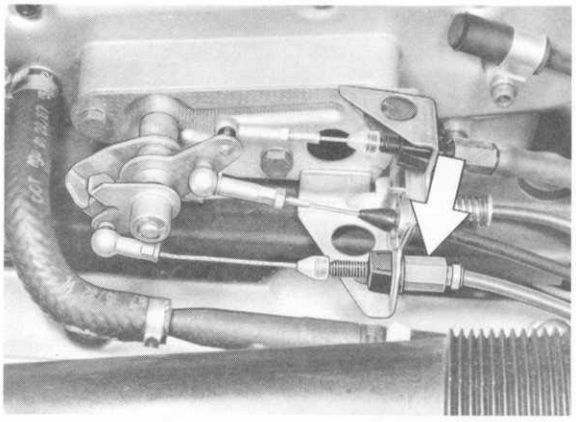
When installing the Bowden cable, check to ensure that it is routed free of kinks.

Adjusting Bowden Cable

1. Turn adjusting lever on actuator clockwise as far as it will go.



2. Turn setscrew to adjust Bowden cable so that there is play of 1 - 2 mm at reversing lever.



REMOVING AND INSTALLING CLUTCH PEDAL SWITCH

See page 27 - 7.

TROUBLESHOOTING, TEMPOSTAT

If faults arise in the automatic speed control system, begin by checking the following points.

1. Check cable for damage and maladjustment.

2. Fuse no.4 on the central electrics unit.

3. Operation of stoplights.

4. Operation of clutch pedal switch. In its normal position, the switch must be closed. A jumper must be installed in place of the clutch pedal switch in cars with automatic transmission.

If these checks do not reveal any fault, continue by testing the multi-pin plug of the control unit.

TEMPOSTAT CONTROL UNIT PIN ASSIGNMENT

1 - Ter.X

2 - Not occupied

3 - Switch "off"

4 - Switch "set/accelerate"

5 - Clutch actuator

6 - Switch "resume"

7 - Actuator, engine plus

8 - Stoplight/clutch actuator

9 - Clutch, potentiometer plus

10 - Actuator, engine minus

11 - Engine-speed signal

12 - Ter.31/actuator potentiometer minus

13 - Actuator potentiometer sliding contact

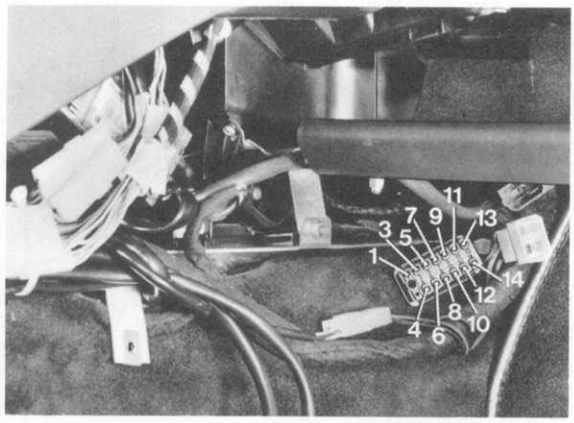
14 - Clutch pedal switch, jumper to ter.31 if car has automatic transmission

---

TESTING MULTI-PIN PLUG OF TEMPOSTAT CONTROL UNIT

Note:

Use a voltmeter or ohmmeter to carry out tests on disconnected plug receptacle.



1. Turn ignition key to position X.

2. Connect voltmeter to ter.1 (plus) and ter.12 (minus).
   Reading: battery voltage

3. Connect voltmeter to ter.3 and ter.12
   Reading: battery voltage
   Push operating switch toward "off".
   Reading: 0 volts

4. Connect voltmeter to ter.4 and ter.12
   Reading: 0 volts
   Press operating switch toward "set/accelerate".
   Reading: battery voltage

5. Connect voltmeter to ter.6 and ter.12
   Reading: 0 volts
   Press operating switch toward "resume".
   Reading: battery voltage

6. Connect voltmeter to ter.8 and ter.12
   Reading: 0 volts
   Press brake pedal.
   Reading: battery voltage

7. Connect voltmeter to ter.1 and ter.14
   Reading: battery voltage
   Press clutch.
   Reading: 0 volts

8. Connect ohmmeter to ter.11 and ter.12
   Push car slowly.
   The reading on the gage must alternate between 0 ohm and ∞ ohm.

9. Connect ohmmeter to ter.5 and ter.8
   Reading: approx. 30 - 40 ohm

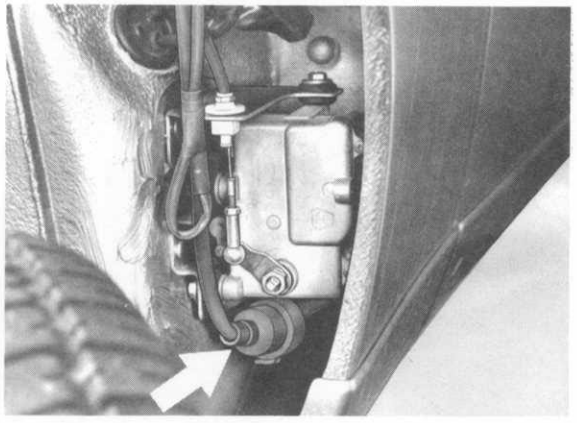
10. Connect ohmmeter to ter.7 and ter.10
    Reading: approx 2 - 6 ohm

11. Connect ohmmeter to ter.9 and ter.12
    Reading: 2 - 4 kohm

12. Connect ohmmeter to ter.12 and ter.13
    Reading: 2 - 4 kohm

Note:

If the readings stated in steps 9 through 12 are not reached, test the actuator half of the plug in the same way.



13. Connect ohmmeter to ter.1 and ter.7
    Reading: 2 - 6 ohm

14. Connect ohmmeter to ter.5 and ter.6
    Reading: 30 - 40 ohm

15. Connect ohmmeter to ter.2 and ter.4
    Reading: 2 - 4 kohm

16. Connect ohmmeter to ter.2 and ter.3
    Reading: 2 - 4 kohm

If these tests do not reveal a fault, replace the control unit.

Alternator, removing and installing as from Model 85

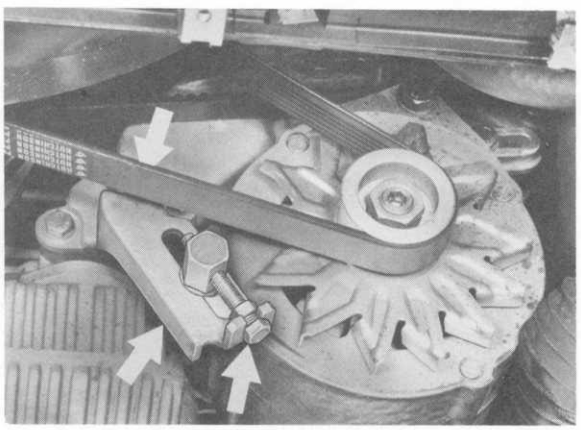
Removing

1. Disconnect the battery ground connection behind the tool panel.

2. Lift the vehicle and remove the sump guard.

3. Pull off the ventilation hose for the alternator.

4. Undo both nuts and the alternator adjustment screw. Loosen the bracket on the console, swivel the alternator inwards and remove the poly-rib drive belt.



11571

5. Disconnect the electrical connectors from the oil pressure sensor.

6. Undo the alternator's fastening screw and pull out forwards. Remove the alternator downwards.

7. Remove the air box and detach electrical connections.

Installing

Check and adjust the poly-rib drive tension for the alternator, see Page 13 - 18 b.
Tightening torque of the fastening screws
M 10 = 45 Nm.

IGNITION COMPONENTS

Ignition Coil

Type/Model	Version	Remarks
928	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors (0.4 and 0.6 ohms)

Distributor

Type/Model	Version	Remarks
928	928 602 032 01 Bosch No. 0 237 401 006	Centrifugal advance and vacuum retard control See note on next page!

Spark Plugs

Type/Model	Version	Remarks
928	Bosch W 145 T 30 Beru 145/14/3 A	0.7 + 0.1 mm plug gap

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. 0 227 100 008	Transistor ignition

Note

The fuel pump relay is designed to turn off the fuel pumps when engine reaches a speed of approx. 6300 rpm. This type of speed control is required, since ignition failure could destroy the catalytic converter required for emission control.

CAUTIONS WHEN REPAIRING ELECTRONIC IGNITION SYSTEMS

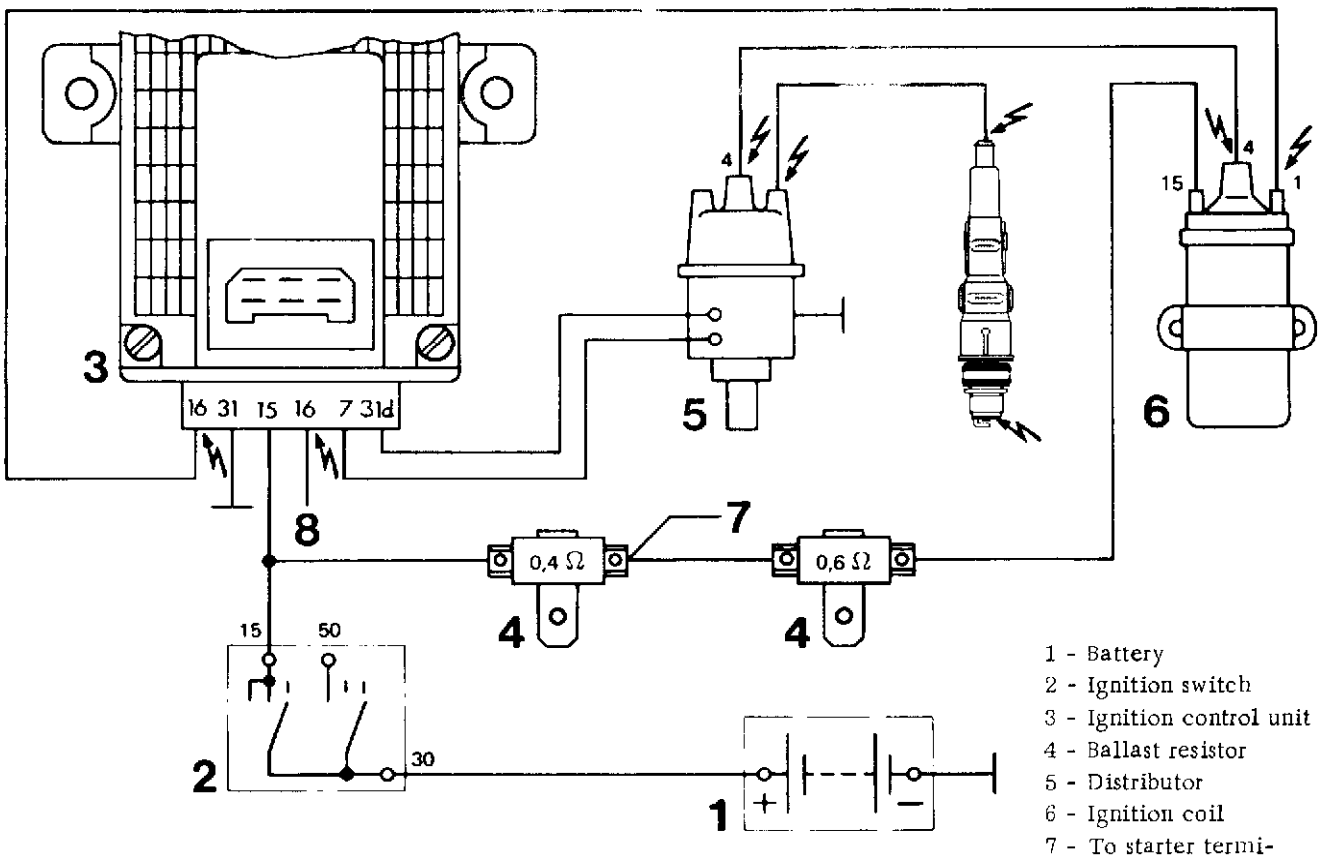
The 928 is equipped with an electronic ignition system. The ignition output of this transistorized ignition coil ignition system is so high, that with the engine running there could be dangerous current in the system. Consequently, any work on the ignition system requires that the ignition be turned off or battery ground cable disconnected. Such jobs would include the following.

1. Connecting engine testing equipment (timing light, tachometer, ignition oscilloscope etc.).

2. Replacement of ignition system parts (spark plugs, ignition coil, distributor, ignition cables etc.).

If testing the ignition system or making engine adjustments requires turning on the ignition, dangerous voltage will be on the primary and secondary side of the entire system. Thus the danger is not only present at the individual parts of the ignition system (for example, distributor, ignition coil, ignition control unit, ignition cables etc.), but even on the line leading from the ignition control unit to the tachometer, the plug connections and any testing equipment connected.

The dangerous points are marked with high tension arrows in the layout plan below.

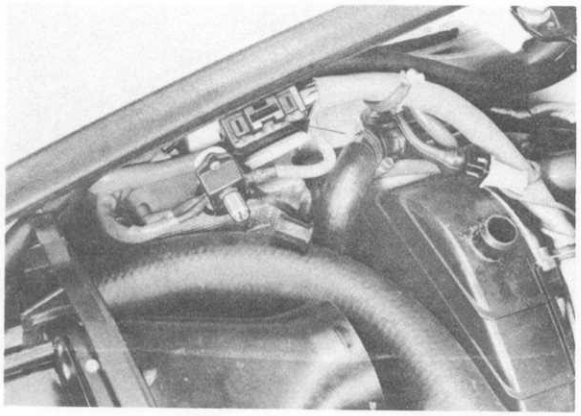


1 - Battery
2 - Ignition switch
3 - Ignition control unit
4 - Ballast resistor
5 - Distributor
6 - Ignition coil
7 - To starter terminal 16
8 - To tachometer

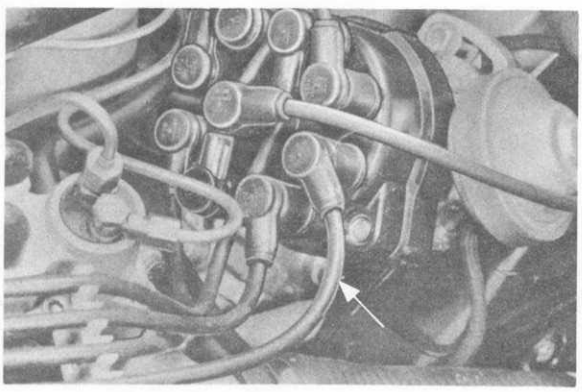
ADJUSTING IGNITION TIMING

1. Run engine to operating temperature (oil temperature about 80 to 90° C/176 to 194° F).

2. Connect engine tester or timing light and tachometer. A positive terminal for connection of testing equipment is located above ignition control unit in engine compartment.



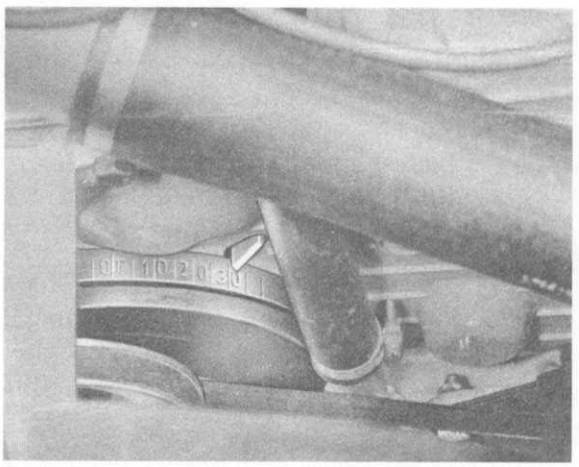
Timing light is connected to ignition cable of cylinder number 1.



Unlike capacitor discharge ignition systems, testing equipment (e.g. tachometer) can be connected to ignition coil terminals 1 and 15 of transistorized ignition coil systems.

3. Detach both vacuum hoses at distributor.

4. Adjust ignition timing to 31° before TDC at engine speed of 3000 rpm. Loosen and turn distributor to change ignition timing.



5. Run engine at 5000 rpm, at which speed ignition timing must not exceed 36°.

6. Attach vacuum hoses. Ignition timing must be $0 \pm 4^{\circ}$ when engine runs at idle speed 800 ± 50 rpm).

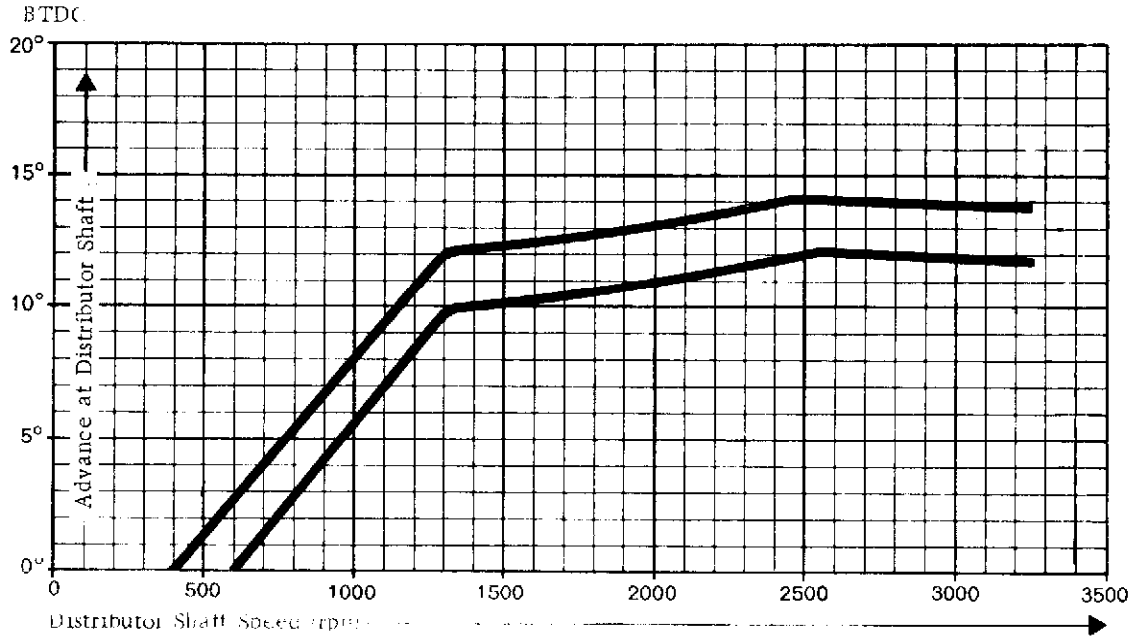
Remove distributor and check it in a distributor test bench, if specifications in points 5 and 6 cannot be held.

Note

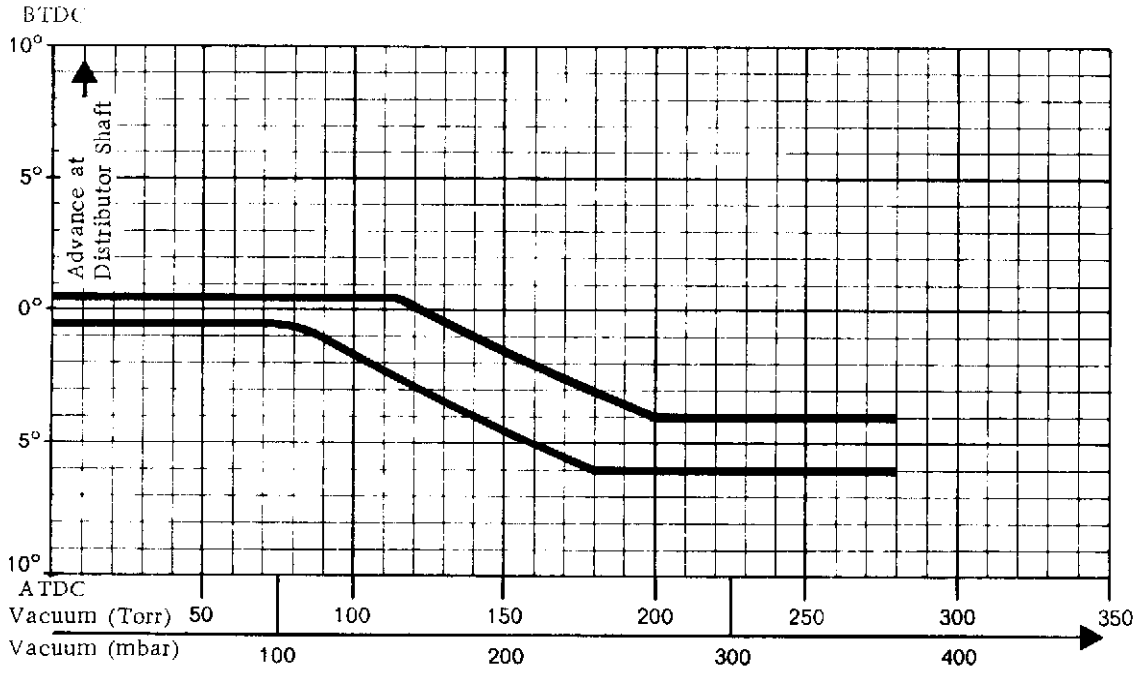
1. Ignition must be off when connecting tester to ignition coil.

2. The dwell angle is not adjustable and does not need to be checked.

CENTRIFUGAL ADVANCE CURVE FOR DISTRIBUTOR



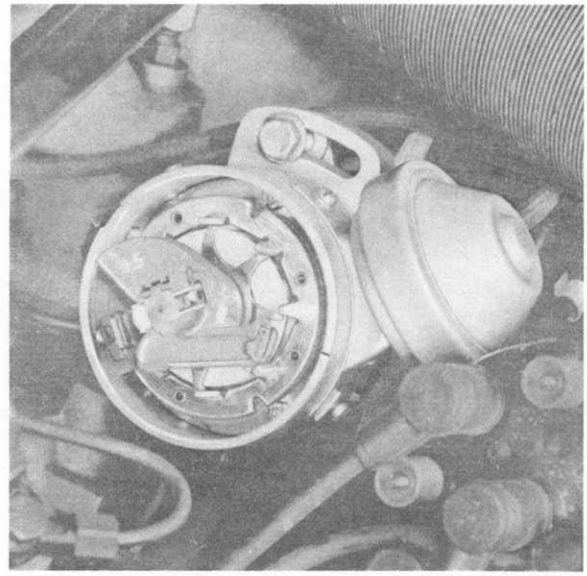
VACUUM RETARD CURVE FOR DISTRIBUTOR



REMOVING AND INSTALLING DISTRIBUTOR

1. Set cylinder 1 at TDC.





2. Remove distributor cap, rotor and dust cap. Detach vacuum hoses and wires.

3. Unscrew mounting bolt and remove distributor.

4. When installing the distributor rotor make sure that it faces the cylinder 1 mark on distributor housing.

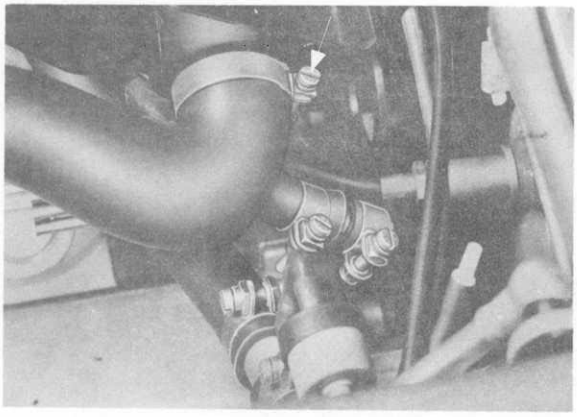
5. Adjust ignition timing.

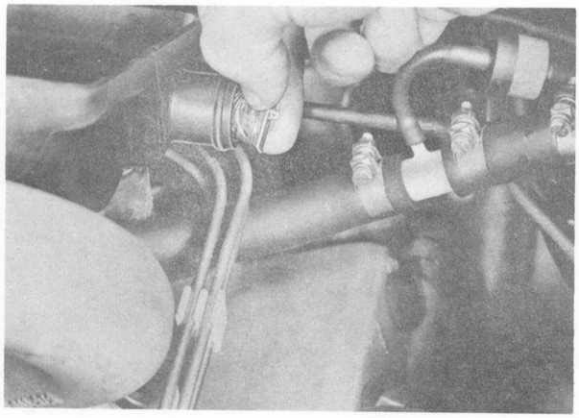
REPLACING SPARK PLUGS

1. Detach both air intake hoses.

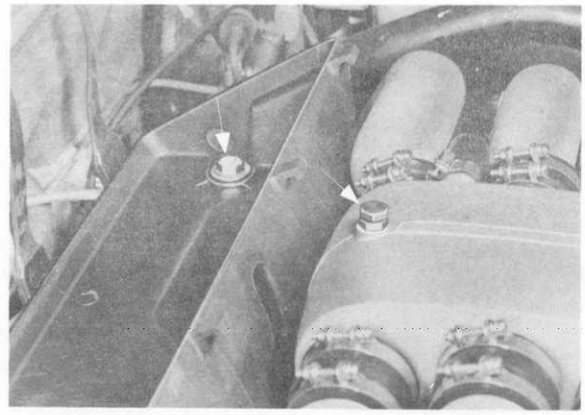
2. Disconnect rubber straps at air cleaner lower section and take out filter element.

3. Loosen and detach vent hose, and pull out flame trap.

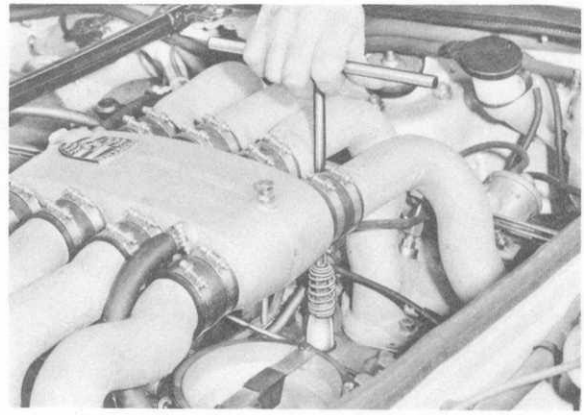




4. Loosen and pull out air cleaner lower section clamping bolt in intake branch. Loosen air cleaner lower section bolts and remove air cleaner lower section to the right.



5. Unscrew spark plugs with a standard socket.



Installation Instructions

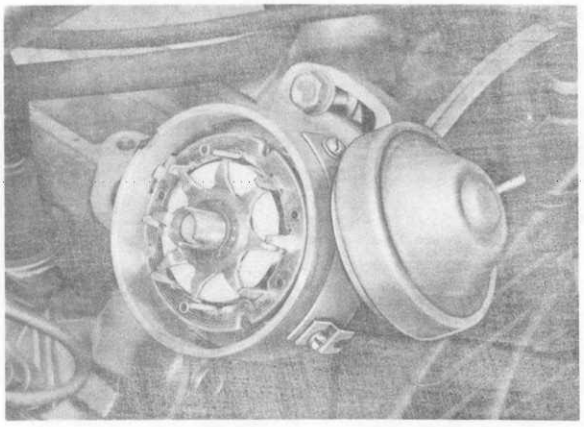
1. Apply a light coat of Molykote HTP white paste to plug threads.

2. Tightening torque: 25 to 30 Nm (18 to 22 ft lb)

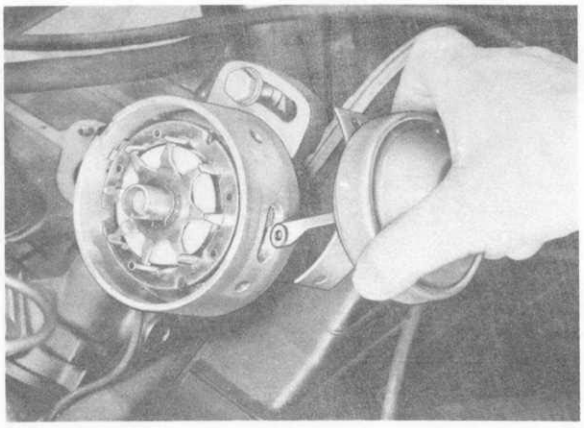
REMOVING AND INSTALLING VACUUM UNIT ON DISTRIBUTOR

1. Remove distributor cap, rotor and dust cover. Pull off hoses from vacuum unit.

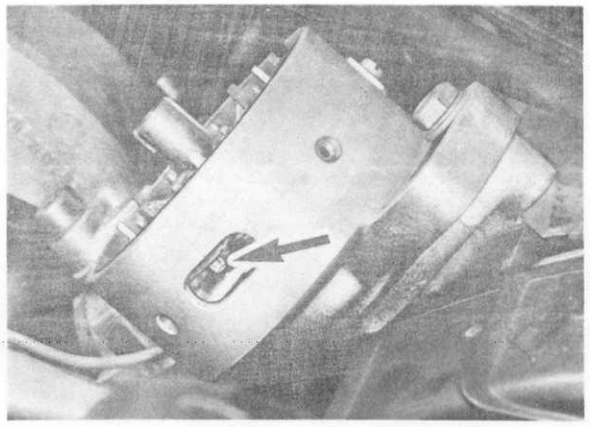
2. Unscrew screws.



3. Press up and remove vacuum unit.



4. When installing, engage hole of pull rod in pin on stator of transmitter.



This can be done more easily by turning stator against left stop and holding in this position.

Note

The soft iron teeth of the transmitter must not be bent, regardless of circumstances.

TROUBLESHOOTING ELECTRONIC IGNITION SYSTEM (BOSCH TRANSISTORIZED IGNITION SYSTEM)

Testing Prerequisites:

Battery fully charged, fuel in tank, engine or ambient temperature between 0 and + 40° C/ 32 and 104° F (temperature has considerable influence on test values).

Note especially information concerning dangers of electronic ignition systems (see page 28 - 3).

Starter turns, engine will not start or does not develop sufficient power.

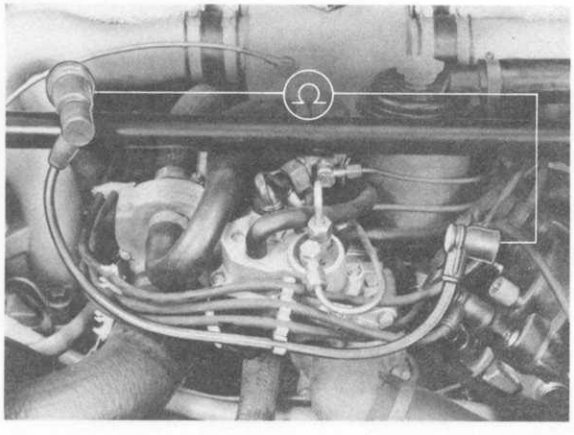
1. Connect spark gap tester to ignition coil terminal 4 and set length at 12 mm. Start engine.

   12 mm spark gap present?

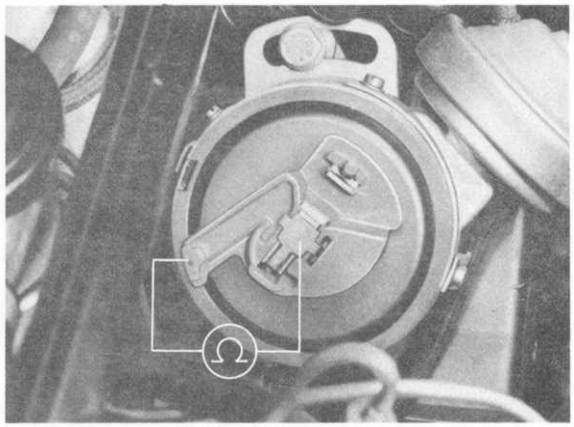
   yes

   no → go to point 7

2. Check distributor cap, distributor rotor, ignition cables and spark plugs.



Resistance of ignition line including plug: 2.5 k Ohms.



Resistance of distributor rotor: 5 k Ohms.

Spark at spark plug?

yes

no → repair secondary side

3. Check ignition timing.

Timing correct?

yes

no → adjust timing

4. Check fuel system.

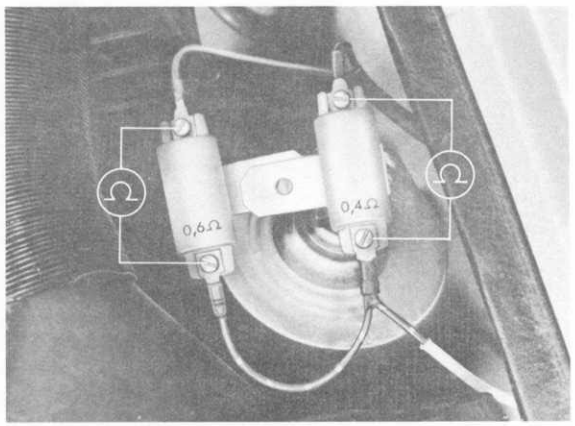
Engine receiving sufficient fuel?

yes

no → repair fuel system

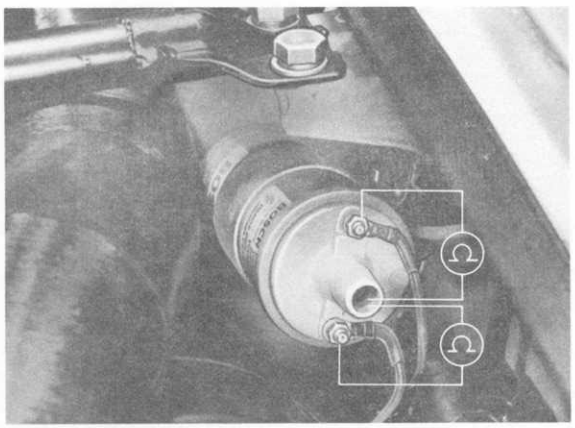
yes

5. Check resistors and ignition coil.



0.4 ohm resistor: 0.35 ... 0.45 ohm

0.6 ohm resistor: 0.55 ... 0.65 ohm



Ignition coil primary (term. 1 and 15):
0.33 ... 0.46 ohm

Ignition coil secondary (term. 1 and 4):
7 ... 12 k Ohms

Resistances value correct?

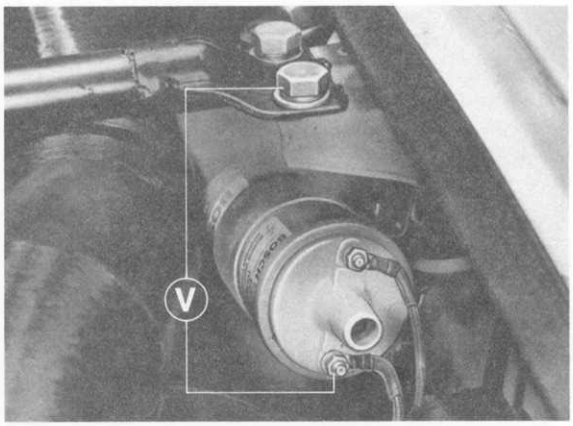
no → replace resistor or ignition coil

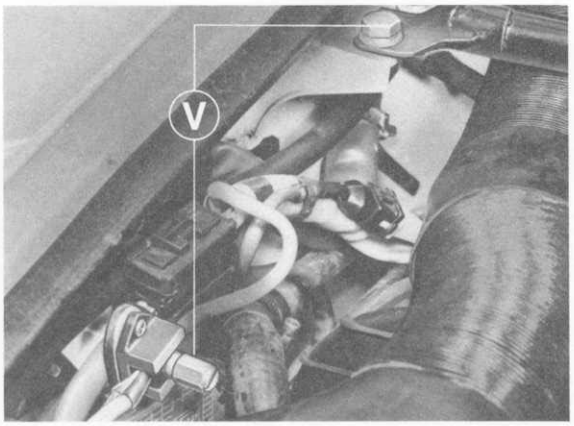
yes

yes

6. Measure voltage of ignition coil terminal 15 against ground.

Turn on ignition.





Voltage at term. 15: at least 3 V at battery voltage of at least 11 volts (measure at same time).

Voltage correct?

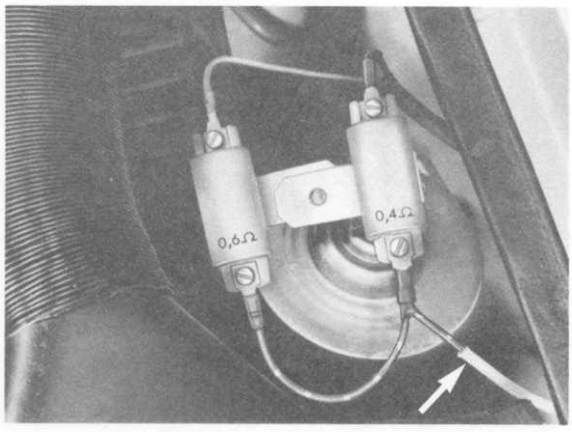
yes

go to point 11.

no

Check voltage drop at wires and connections on ignition switch, resistors, ignition coil and control unit, and eliminate voltage drop.

7. Check starting voltage.



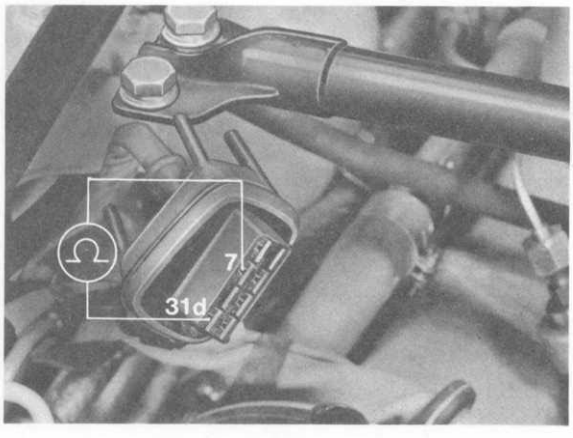
Disconnect line leading to starter term. 15a at 0.4 ohm resistor and connect voltmeter. Operate starter. Measured voltage must be same as battery voltage (measured at same time).

Starting voltage good?

yes

no → Eliminate break in supply line or contact 15a in starter relay.

8. Measure sensor resistance including sensor line at disconnected ignition control unit plug between terminals 7 and 31 d.



Measured value between 485 and 700 ohms?

no → Pull off sensor lines from distributor and repeat test on sensor system.

Resistance between 485 and 700 ohms?

yes → Replace sensor line.

no → Replace distributor.

yes

9. Check sensor coil with sensor line for ground, between terminal 7 and ground; and terminal 31 d and ground.

Infinite resistance?

no → Pull off sensor line from distributor and repeat test on sensor system.

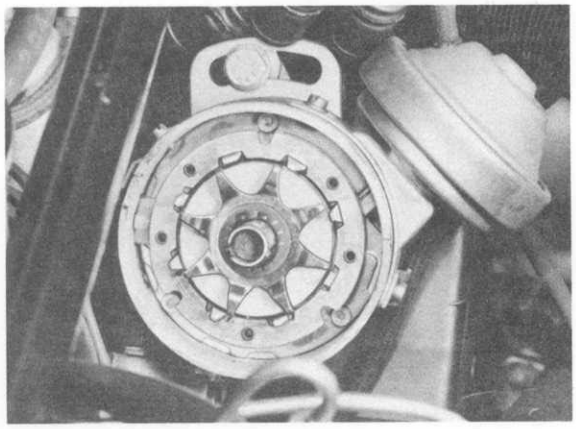
Infinite resistance?

yes → Replace sensor line.

no → Replace distributor.

yes

10. Check sensor system for mechanical damage. Visual inspection: gap between rotor and stator?



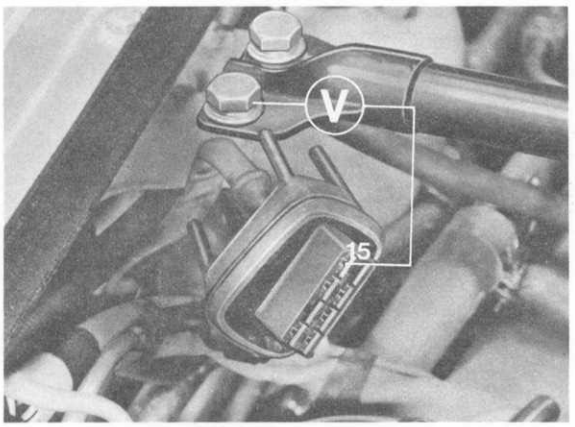
Sensor system good?

yes

go to point 5.

no → Replace distributor.

11. Check voltage at ignition control unit plug terminal 15 against ground. Voltage must be same as battery voltage.



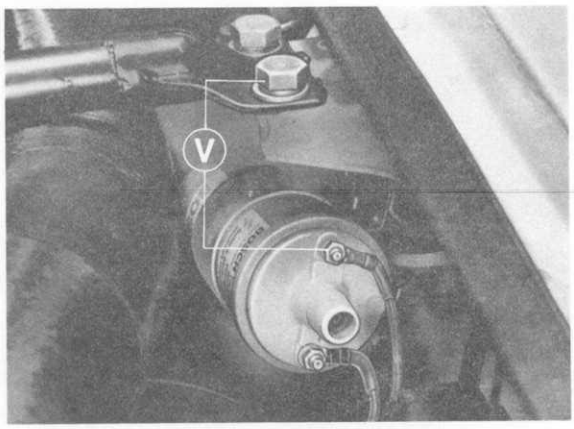
Voltage correct?

yes

no → Check voltage drop in line from ignition switch to control unit, and eliminate voltage drop.

yes

12. Check voltage at ignition coil terminal 1 against ground.
Voltage at term. 1: max. 2 V.

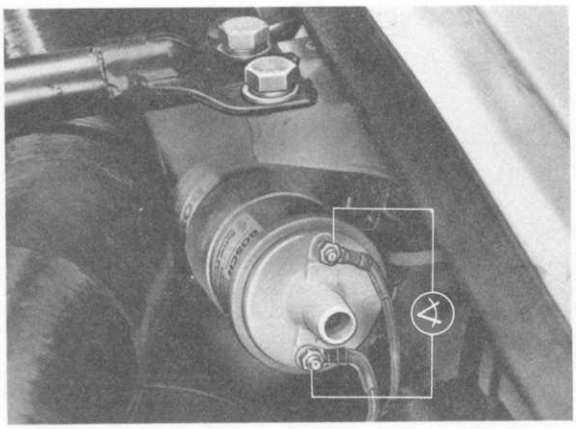


Voltage correct?

yes

no → Replace control unit.

13. Check dwell angle (short test on warm engine).



Dwell angle 25 ... 39° at 1500 ± 50 rpm
Dwell angle 33 ... 40° at 5000 ± 50 rpm

Dwell angle correct?

yes

no

no → Perform test steps 8, 9 and 10. Replace control unit when sensor system is good.

yes

Engine must start and/or engine power must be adequate. If not, there is a mechanical defect.

14. Ignition failure:
Disconnect tachometer (12-pin plug on instrument cluster, right, or plug G on central fuse/relay panel.

Ignition failure eliminated?

no → Replace control unit.

yes

Replace tachometer.

IGNITION COMPONENTS - 1980 Models

Ignition Coil

Type/Model	Version	Remarks
928	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928	928 602 032 03 Bosch No. 0 237 405 010	Centrifugal and vacuum advance and retard control Distributor rotor without rev. limiter.

Spark Plugs

Type/Model	Version	Remarks
928	Bosch WR 8 DS Beru RS 35	0.7 + 0.1 mm (0.028 + 0.004 in.)

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. A 227 010 123	Transistor coil ignition

Note

The vacuum control range of the distributor is changed from 140 - 240 mbar to 360 - 470 mbar beginning with 1981 models.
Part No. for distributor is 928.602.032.04 (Bosch No. 0237 405 020).

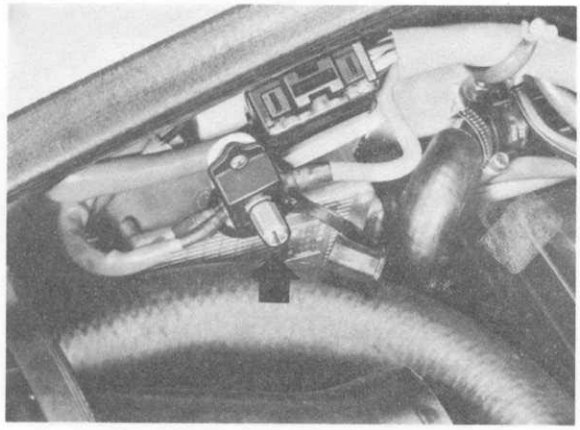
IGNITION ADJUSTING AND TESTING VALUES

Type	928 M 28/13/14
Ignition timing (without vacuum)	23° BTDC at 3000 rpm
Advance installed	yes
Retard installed	yes
Idle speed (rpm)	750 ± 50
Centrifugal advance (without vacuum)	8 to 10° BTDC at idle speed
	29 to 34° BTDC at 6000 rpm
Vacuum advance (at idle speed) degrees of "advance" adjustment	Vacuum hose of conn. 2 on conn. 1 8 to 12°
Speed increase	turned back below 1000 rpm
Vacuum retard degrees of retard adjustment (at idle speed)	Vacuum hose (connection 2) connected
"retard"	4 to 8°
	refer Porsche to their publication 4592. 21(928 Service Information) page 73. Ignition timing specs. do not agree!

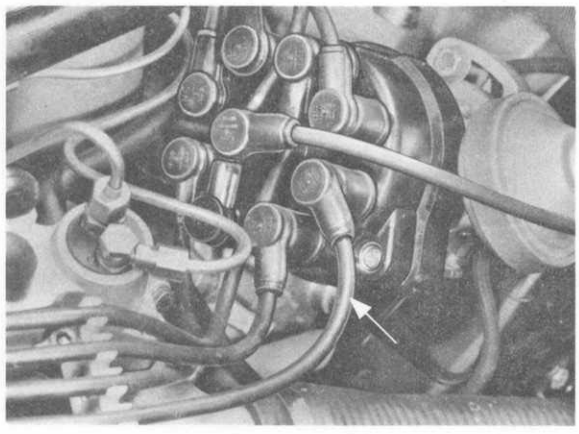
ADJUSTING IGNITION TIMING - From 1980 Models

1. Run engine to operating temperature (oil temperature about 80 to 90° C/176 to 194° F).

2. Connect engine tester. A positive terminal for connection of testing equipment is located in engine compartment.

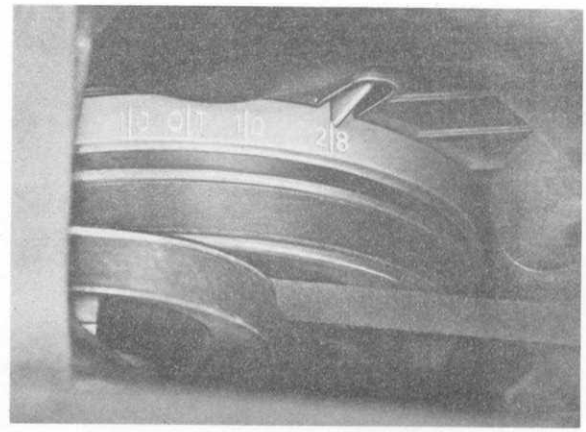


3. Connect timing light to ignition cable of cylinder 1.



4. Pull off both vacuum hoses at distributor.

5. Adjust ignition timing to 23° before TDC at an engine speed of 3000 RPM.



Loosen and turn distributor to change ignition timing.

6. Attach vacuum hoses again.

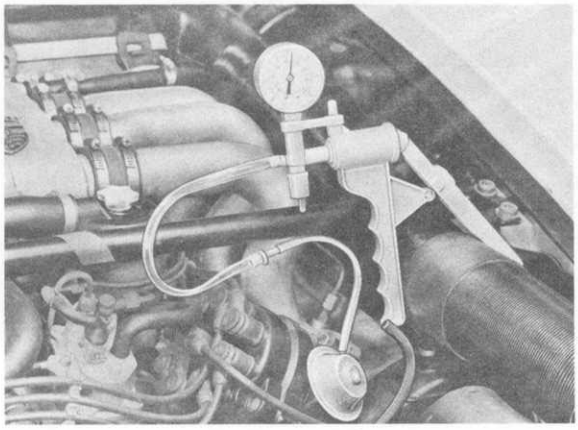
CHECKING IGNITION TIMING - From 1980 Models

Requirements:

Ignition timing adjustment is correct.

1. Check centrifugal advance (see table).

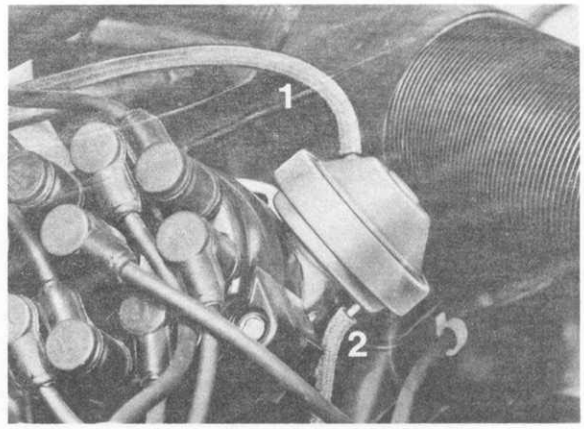
2. Check vacuum unit (see table)



Idle speed vacuum available at connection 2 can be used to check ignition advance.

This requires connecting the vacuum hose from retard unit to the advance unit.

Vacuum connections



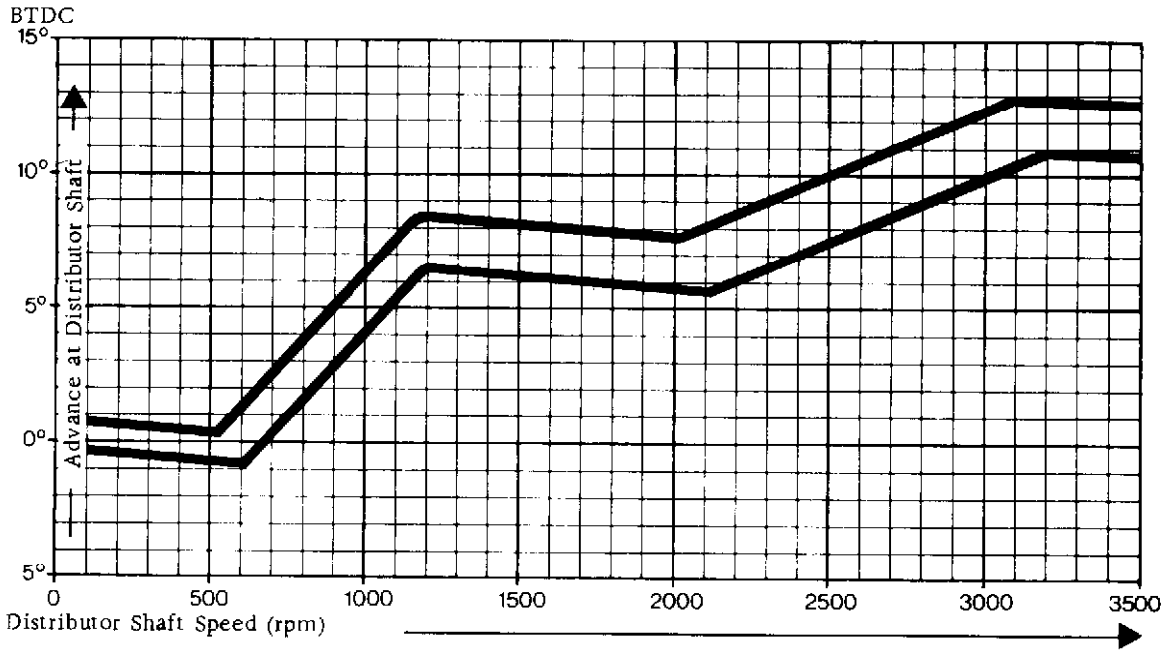
1 - Advance
2 - Retard

Note

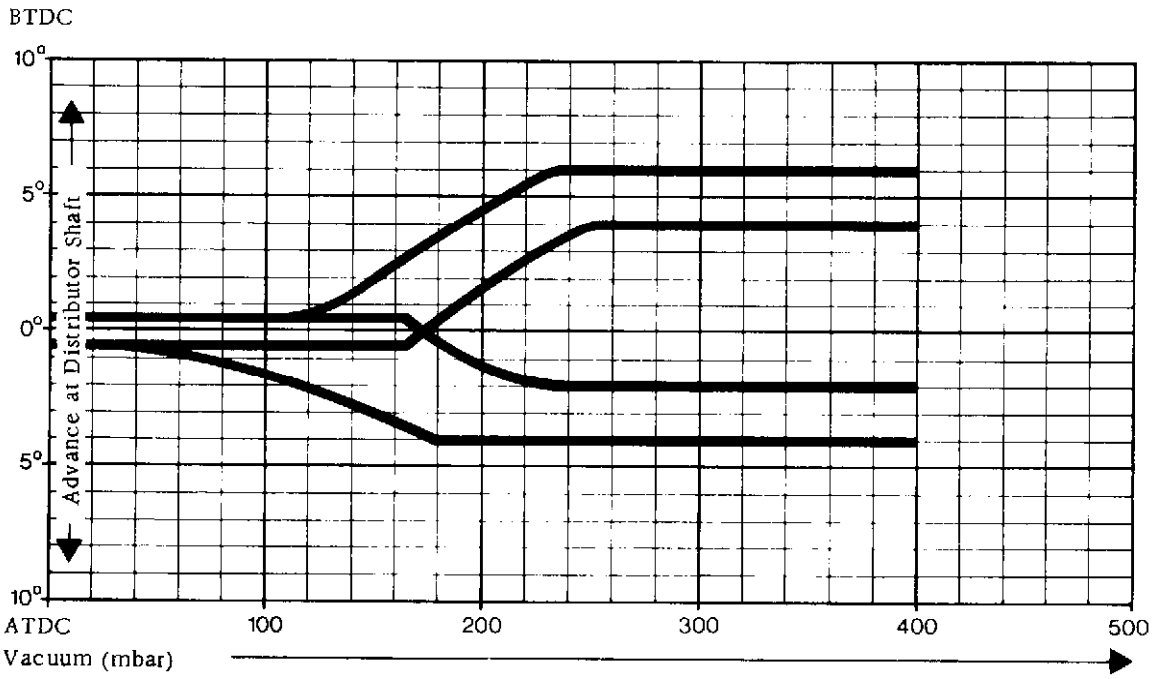
After completion of tests reconnect vacuum hoses.

If specified testing values can't be reached, remove distributor for inspection on a test bench.

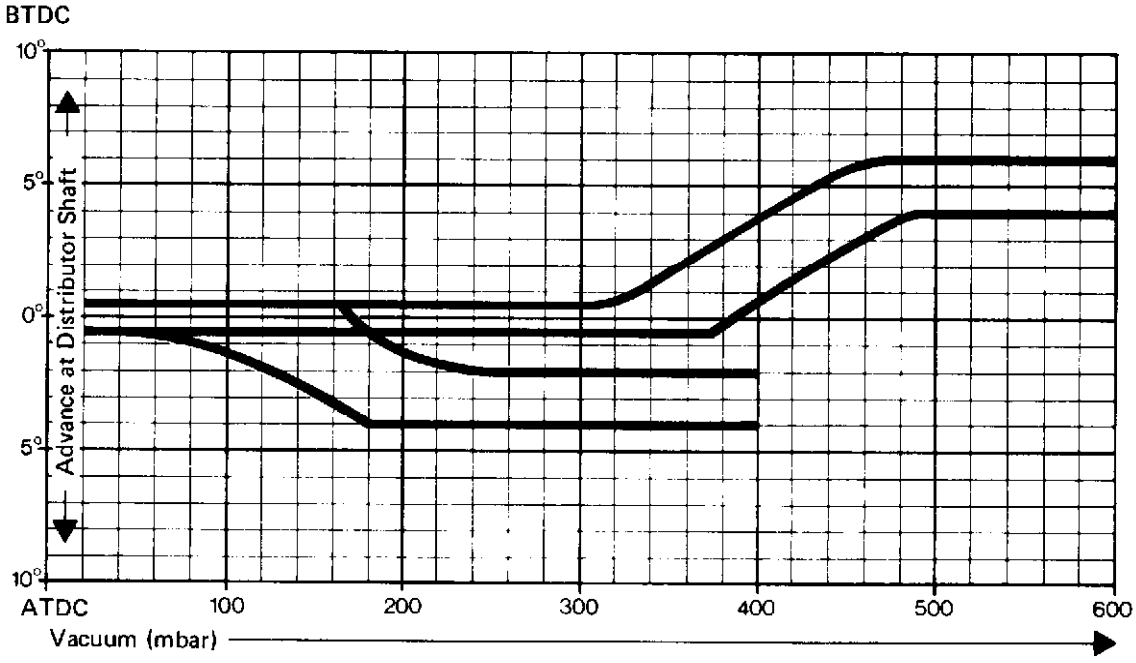
CENTRIFUGAL ADVANCE CURVE TYPE 928 - from 1980 Models



VACUUM ADVANCE CURVE TYPE 928 - from 1980 Models



VACUUM ADVANCE CURVE TYPE 928 - from 1981 Models



IGNITION COMPONENTS — 1983 Models

Ignition Coil

Type/Model	Version	Remarks
928 S	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928 S	928 602 032 06 Bosch No. 0 237 401 018	Centrifugal and vacuum advance control. Distributor rotor without speed governor.

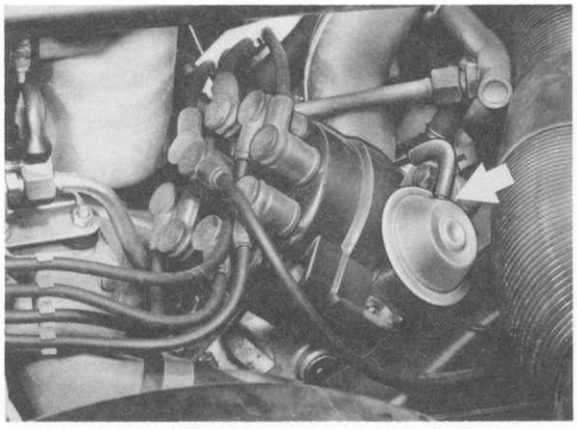
Spark Plugs

Type/Model	Version	Remarks
928 S	Bosch WR 8 DS Beru RS 35	0.7 + 0.1 mm

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. A 227 010 123	Transistor coil ignition

The distributor for USA/Canada models has a vacuum unit for advance control beginning with 1983 models.



IGNITION ADJUSTING AND TESTING VALUE
BEGINNING WITH 1983 MODELS

Ignition timing (without vacuum)	20° BTDC at 3000 rpm
Idle speed	650 ± 50 rpm
Centrifugal control (without vacuum)	4 to 8° BTDC at idle speed; 24 to 28° BTDC at 5000 rpm
Vacuum control (at idle speed) "Advance"	Produce approx. 400 mbar with manual vacuum pump 13 to 17°

THE USA PAGES 28 - 31 TO 28 - 34 HAVE BEEN LEFT BLANK.

IGNITION COMPONENTS – 1983 MODELS

Ignition Coil

Type/Model	Version	Remarks
928 S	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928 S	928 602 033 00 Bosch No. 0 237 404 013	Centrifugal and vacuum advance and retard control. Distributor rotor with speed governor for 6500 – 260 rpm
928 S USA/Japan	928 602 032 06 Bosch No. 0 237 401 018	Centrifugal and vacuum advance control. Distributor rotor without speed governor.

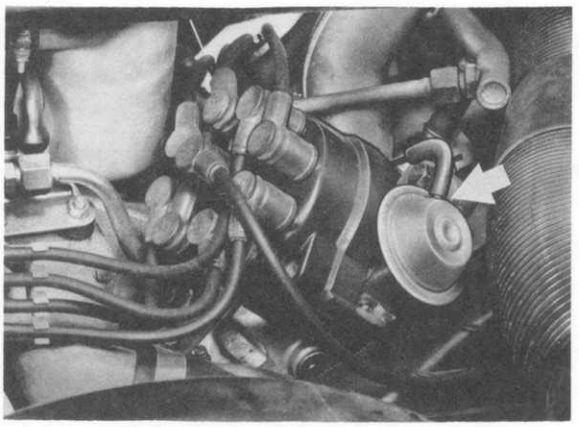
Spark Plugs

Type/Model	Version	Remarks
928 S	Bosch W 7 D (175 T 30) Beru 14 - 7 D (175/14/3A)	0.7 + 0.1 mm
928 S USA/Japan	Bosch WR 8 DS Beru RS 35	0.7 + 0.1 mm

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. A 227 010 123	Transistor coil ignition

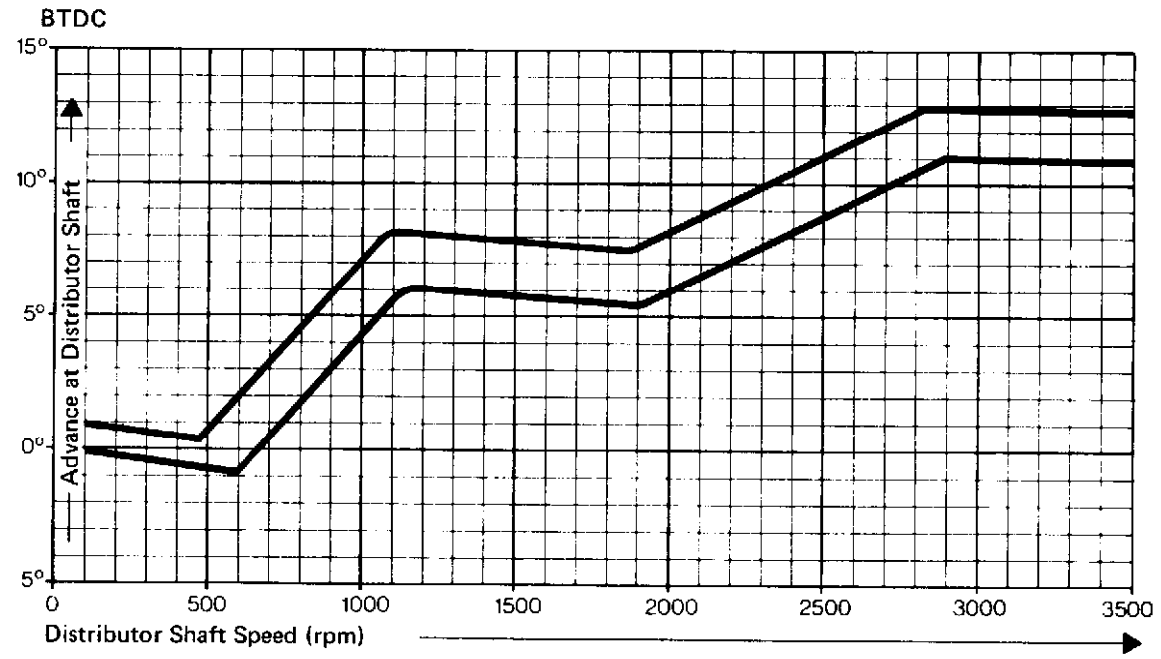
The distributor for USA/Canada/Japan models has a vacuum box for advance control beginning with 1983 model.



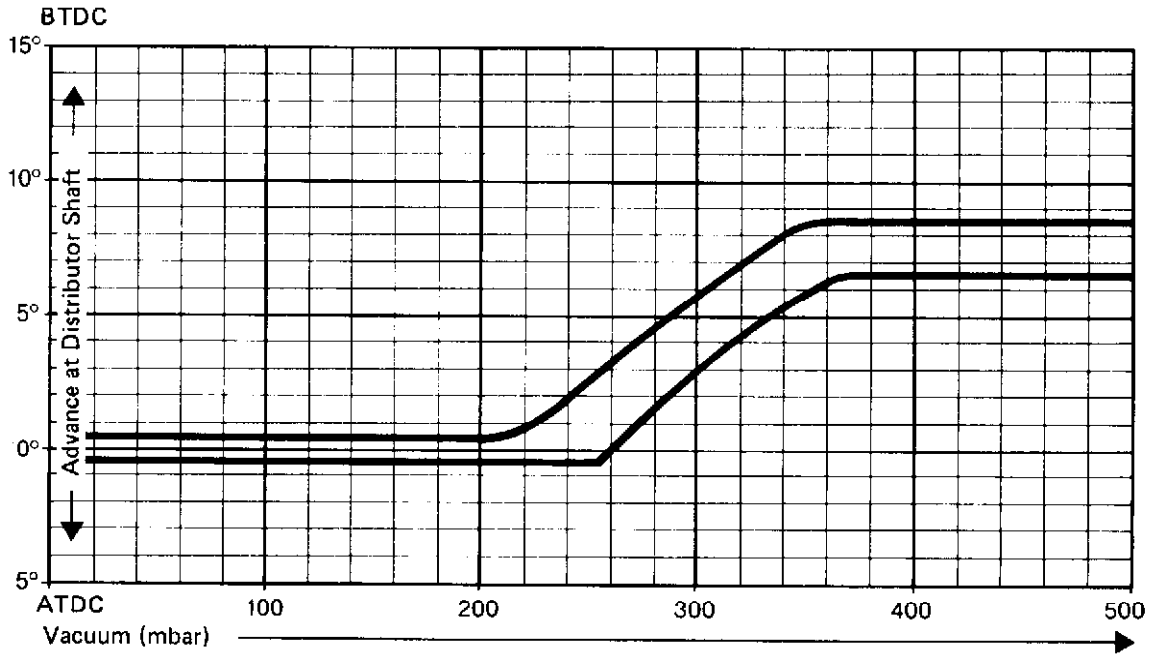
IGNITION ADJUSTING AND TESTING VALUE – USA/CANADA/JAPAN BEGINNING WITH 1983 MODELS

Ignition timing (without vacuum)	20° BTDC at 3000 rpm
Idle speed	650 ± 50 rpm
Centrifugal control (without vacuum)	4 to 8° BTDC at idle speed 24 to 28° BTDC at 5000 rpm
Vacuum control (at idle speed) "Advance"	Produce approx. 400 mbar with manual vacuum pump 13 to 17°

CENTRIFUGAL ADVANCE CURVE TYPE 928 S - from 1983 Models
(USA, Canada, Japan)



VACUUM ADVANCE CURVE TYPE 928 S - from 1983 Models
(USA, Canada, Japan)



EQUIPMENT TABLE – BEGINNING WITH 1984 MODELS

Ignition Coil

Type/Model	Version	Remarks
928 S	944 602 115 00 Bosch No. 0 221 118 322	Two ignition coils without ballast resistors
928 S USA/Japan	928 602 503 00 Bosch No. 0 221 122 001	With ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928 S	928 602 011 02	Double distributor (2 x 4 cylinders) with mutual drive shaft Only high voltage distribution
928 S USA/Japan	928 602 032 07 Bosch No. 0 237 401 019	Centrifugal and vacuum advance control Distributor rotor without speed governor

Spark Plugs

Type/Model	Version	Remarks
928 S	Bosch W 7 D Beru 14 - 7 DU	0.7 + 0.1 mm plug gap 0.7 mm plug gap
928 S USA/Japan	Bosch WR 8 DS Beru RS 35	0.7 mm plug gap

Steuergerät

Type/Modell	Version	Remarks
928 S FRG, R.o.W. Australia New Zealand Switzerland Sweden Hong Kong	928.618.123.00 spare part: 928.618.123.02	LH-Jetronic control unit
928 S FGR, R.o.W. Australia New Zealand Switzerland Sweden Hongkong	928.618.124.00 spare part: 928.618.124.03 928.618.124.02 spare part: 928.618.124.04	EZF-control unit
928 S USA Japan	928.618.106.04 928.618.106.01	L-Jetronic control unit

Printed in Germany – XXIX, 1992

Control unit (Final stage)

Type/Model	Version	Remarks
928 S	928.602.706.01	Transistor ignition (2 pieces)
928 S USA/Japan	928.602.702.02	Transistor ignition

Printed in Germany – XXIX, 1992

CAUTIONS WHEN REPAIRING ELECTRONIC IGNITION SYSTEMS

Modern engines requiring more from ignition systems and the objective of low (or no) maintenance have led to the application of electronic ignition systems in standard production some time ago. Normally the ignition output of an electronic system will be higher than that of a conventional system, whereby even greater ignition output is feasible. Consequently electronic ignition systems are in an output range, where touching current carrying parts or terminals on both primary and secondary sides could be dangerous.

In conjunction with this matter we must point out to you that there must be conformance with pertinent legislation of your country when repairing and testing ignition systems.

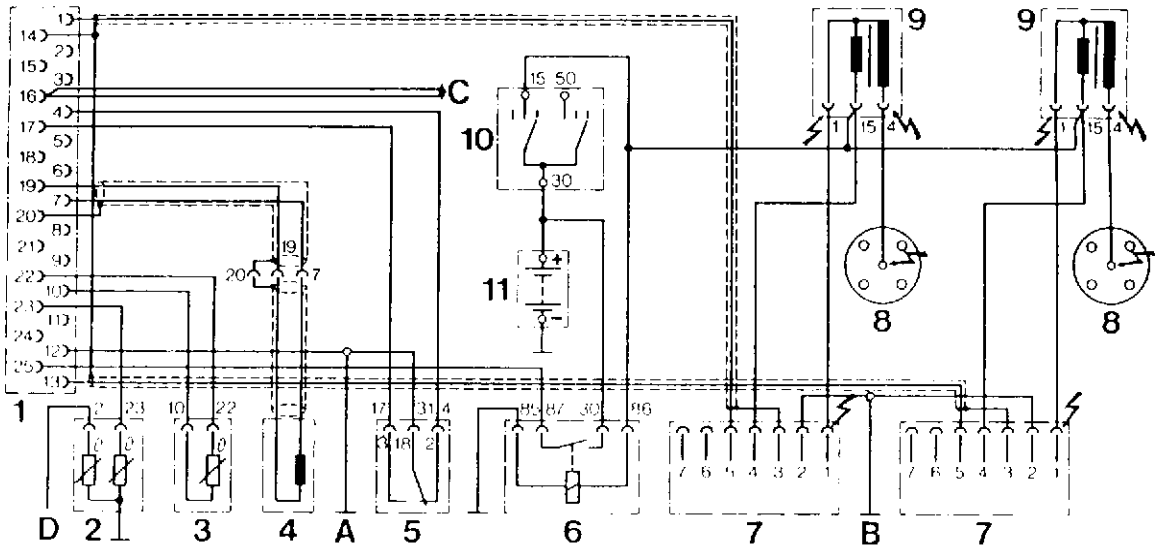
Always turn off the ignition or disconnect the battery when working on the ignition system. Such jobs include the following.

- Connecting engine testing equipment (timing light, dwell angle/speed tester, ignition oscilloscope, etc.)

- Replacement of ignition system parts (spark plugs, ignition coils, distributor, ignition cables, etc.)

If testing the ignition system or making engine adjustments requires turning on the ignition, the mentioned dangerous voltage will be in the entire system.

Thus the danger is not only present at the individual parts of the ignition system (for example, distributor, ignition coil, control unit, ignition cables, etc.), but even on the wire harness (as for example, tachometer connection, diagnosis plug), plug connections and any testing equipment connected.



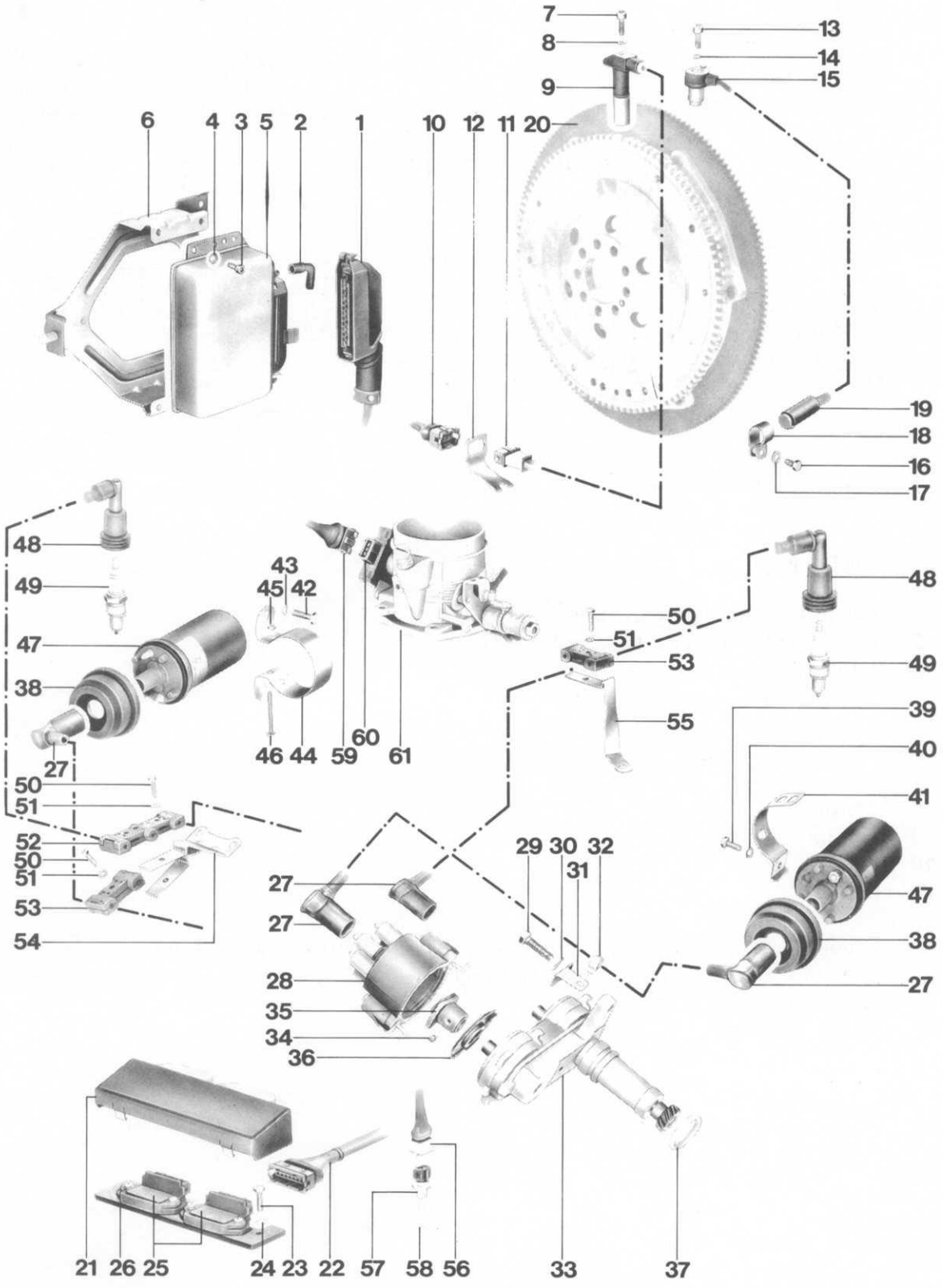
⚡ – **Dangerous voltage points** (400 V – 25 kV)

2. Wiring Diagram

1 – Electronic ignition control unit
2 – Engine temperature sensor (double NTC)
3 – Intake air temperature sensor
4 – Speed and reference mark sensors
5 – Throttle switch
6 – Power supply relay
7 – Final stages
8 – Distributor
9 – Ignition coils
10 – Ignition switch
11 – Battery

A – Ground – control unit (right valve cover below blowoff switching valve)
B – Ground – final stages (near right ignition coil – looking forward)
C – Activation – LH-Jetronic
D – To LH-Jetronic

ELECTRONIC PERFORMANCE CURVE CONTROLLED IGNITION SYSTEM



No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Plug for electronic ign. control unit	1			
2	Elbow hose	1			
3	Bolt	4			
4	Washer	4			
5	Control unit	1			
6	Bracket for control units	1			
7	Bolt	1			
8	Washer	1			
9	Speed/reference mark sensor	1			
10, 11	Plug for speed/ reference mark sensor	1			
12	Bracket	1			
13	Bolt	1			
14	Washer	1			
15	TDC sensor	1			
16	Bolt	1			
17	Washer	1			
18	Mounting clamp	1			
19	Test connection for TDC sensor	1			

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
20	Flywheel	1			
21	Cover	1			
22	Plug	2			
23	Bolt	2			
24	Washer	2			
25	Ignition control unit	2			
26	Cooling plate	1			
27	Plug — ignition cable	10			
28	Distributor cap	2			
29	Hex. head screw	1			
30	Washer	1			
31	Holder	1			
32	Cable holder	1			
33	Distributor	1			
34	Socket head screw	2			
35	Distributor rotor	2			
36	Dust cap	2			
37	Seal	1			

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
38	Protective cap	2			
39	Hex. head screw	1			
40	Washer	1			
41	Holder, left	1			
42	Hex. head screw	1			
43	Washer	1			
44	Holder, right	1			
45	Hexagon nut	1			
46	Bolt	1			
47	Ignition coil	2			
48	Spark plug connector	8			
49	Spark plug	8			
50	Hex. head screw	5			
51	Washer	5			
52 53	Holder for ignition cables	5			
54	Holder	1			
55	Holder	1			
56	Plug	1			
57	Temperature sensor II	1			
58	Seal	1			
59	Plug	1			
60	Throttle switch	1			
61	Throttle housing	1			

IMPORTANT CAR INFORMATION

Conformance with following safety measures is necessary to avoid damage on the electronic ignition system.

1. Never start engine without a firmly connected battery.

2. Mixing up power supply connections, e. g. wrong connection of battery, could lead to destruction of the control units.

3. Never disconnect battery while engine is running.

4. Never use a boost battery charger to start the engine. Only use a second 12 V battery for outside starting help.

5. Disconnect battery from car network before boost charging.

6. Only measure resistance values after turning off ignition or disconnecting battery.

7. Pull off both control unit plugs or make a firm connection between ignition coil term. 4 and ground with a piece of wire before checking the compression (dangerous high voltage, insulation damage on ignition coil, high voltage distributor, ignition cables, etc.). Piece of wire must be interference suppressed with a shielding sleeve of at least 2 k-ohms.

8. Never replace specified ignition coil with a different ignition coil.

9. Never connect a shielded capacitor on ignition coil terminals 1 and 15.

10. Ignition coil terminal 1 must not be used for ground connection when installing a burglar alarm system (ignition coil would be destroyed with the "ignition on").

11. Never connect battery positive (+) or a test lamp on ignition coil terminal 1.

12. Never disconnect ignition lead between ignition coil terminal 4 and high voltage distributor terminal 4 while engine is running.

13. To avoid destruction of the ignition control unit, secondary side of ignition system must be shielded with at least 4 k-ohms, whereby the original distributor rotor with a 1 k-ohm shielded resistor must be installed (do not use a 5 k-ohm distributor rotor even for radio and communication equipment suppression).

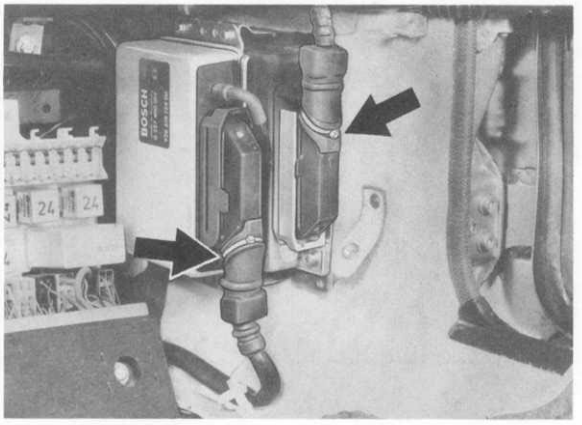
REMOVING AND INSTALLING ELECTRONIC IGNITION CONTROL UNIT

Removing

1. Turn off ignition.

2. Fold back mat in passenger's footwell and open cover for central electric board.

3. Disengage lock on control unit by pressing toward housing and pull off multiple-pin plug.
   Take off vacuum connection.

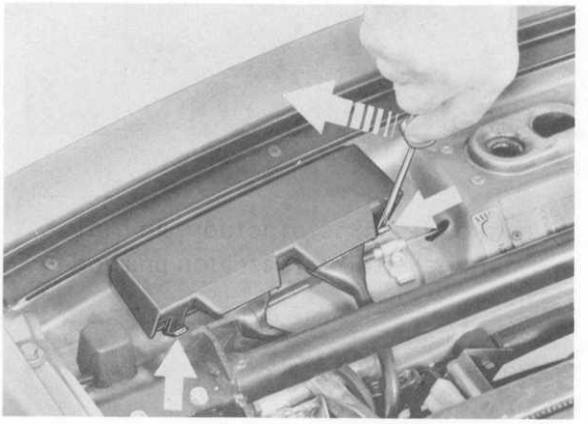


4. Unscrew mounting bolts.

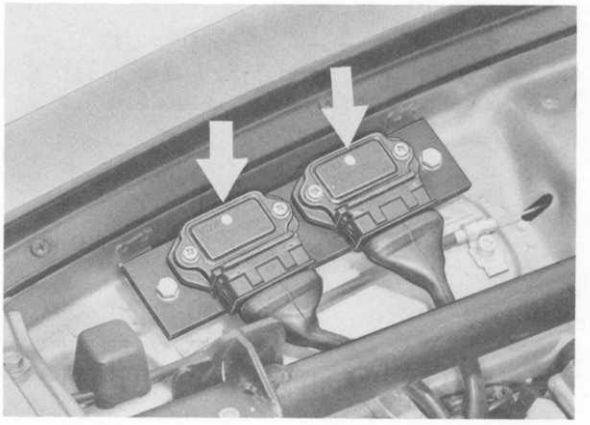
REMOVING AND INSTALLING TRANSISTORIZED IGNITION CONTROL UNIT

Removing

1. Take off left front cover by disengaging locks on both sides with a screwdriver and taking off cover from above.

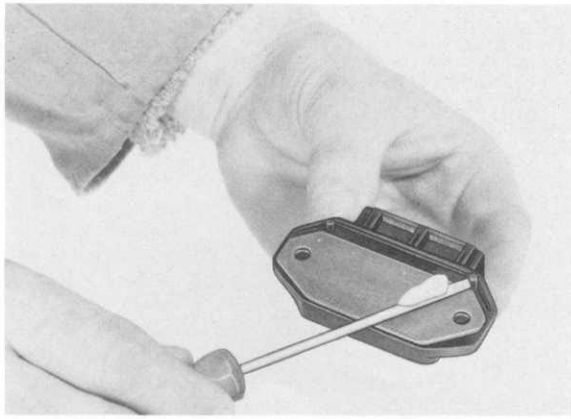


2. Pull off multiple-pin plug on ignition control unit and unscrew mounting bolts.

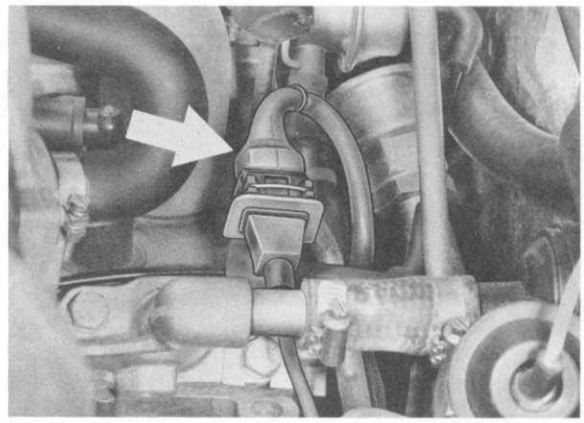


Note:

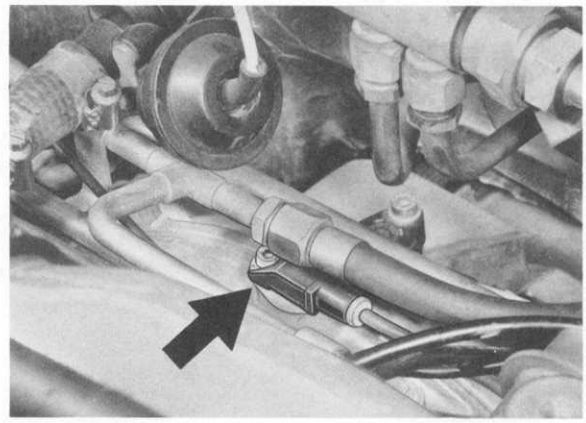
Baseplate must be coated with a heat-conducting paste prior to installation of the ignition control unit.



Use a suitable item (e. g. screwdriver, wood match, etc.) to apply coat of heat-conducting paste.
Heat-conducting paste: Bosch No. 5942 860 003.



3. Remove screw. Pull out sensor while turning back and forth at same time.



REMOVING AND INSTALLING SPEED/ REFERENCE MARK SENSOR

Removing

1. Remove air cleaner.

2. Disconnect plug.

Note:

- Sensor distance cannot be adjusted. The sensor distance of 0.8 mm + tolerance is given by design.

- Make sure that no metal parts are sticking on the sensor before installing.

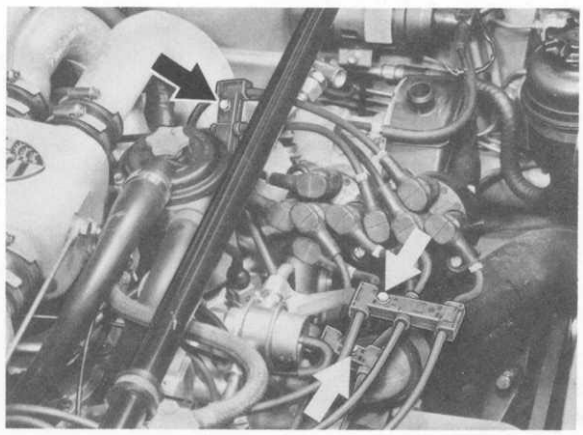
- Mounting screw tightening torque = 8 Nm (6 ftlb).

REMOVING AND INSTALLING DISTRIBUTOR

Removing

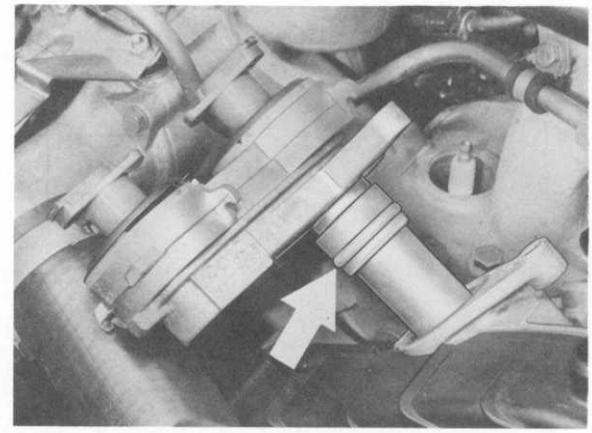
1. Set cylinder 1 at TDC.

2. Take ignition cables out of holders.

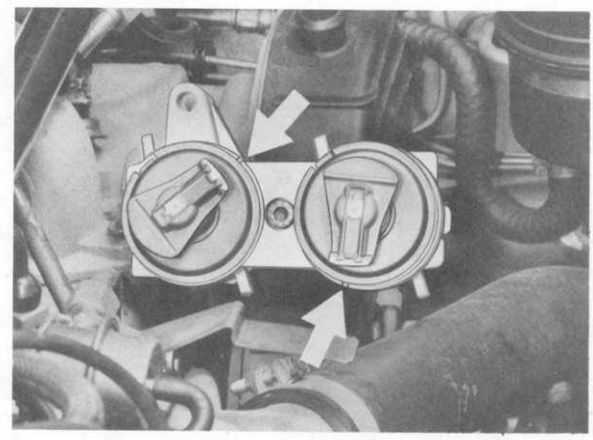


3. Unscrew and remove distributor caps.

4. Unscrew distributor and pull out of engine block.



3. Turn distributor rotor that it points to housing notches after installation.



Installing

1. Set cylinder 1 at TDC.

2. Check seal on distributor, replacing if necessary.

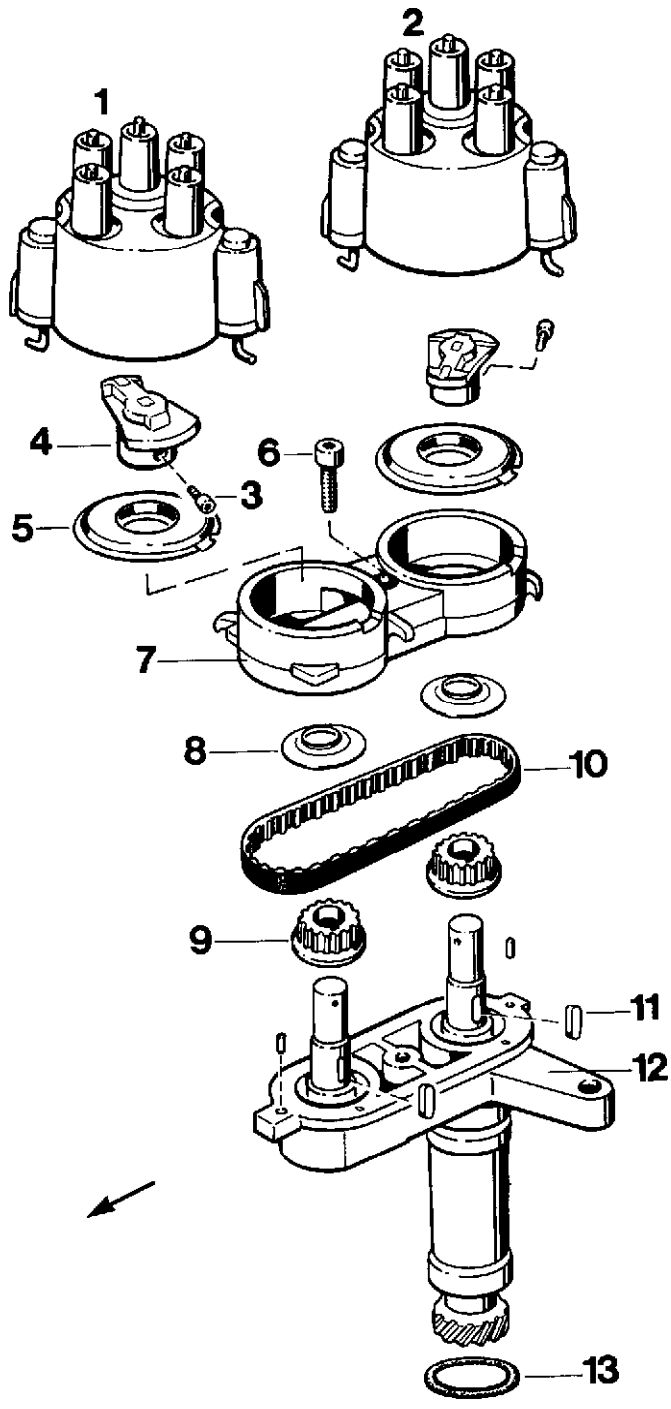
Note:

A basic ignition timing adjustment is not necessary.
Distributor only has the task of distributing high voltage.

Dismantling and assembling distributor

As of MY '84

Engine Type M 28.21/22



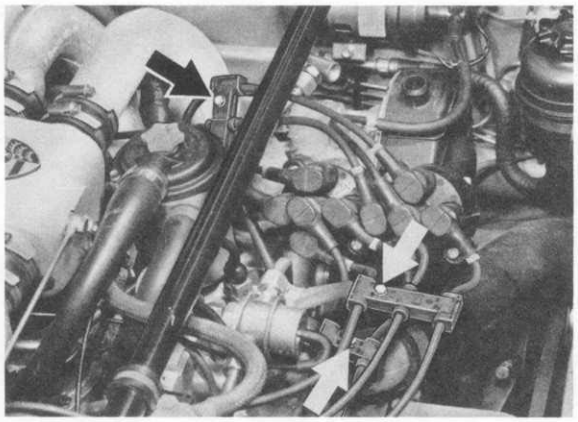
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REMOVING AND INSTALLING DISTRIBUTOR

Removing

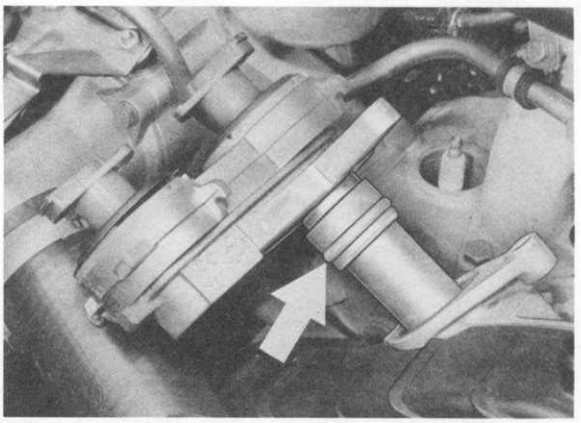
1. Set cylinder 1 at TDC.

2. Take ignition cables out of holders.

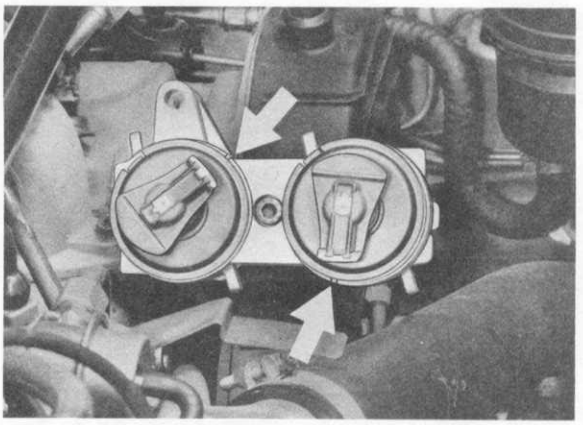


3. Unscrew and remove distributor caps.

4. Unscrew distributor and pull out of engine block.



3. Turn distributor rotor that it points to housing notches after installation.



Installing

1. Set cylinder 1 at TDC.

2. Check seal on distributor, replacing if necessary.

Note:

A basic ignition timing adjustment is not necessary.
Distributor only has the task of distributing high voltage.

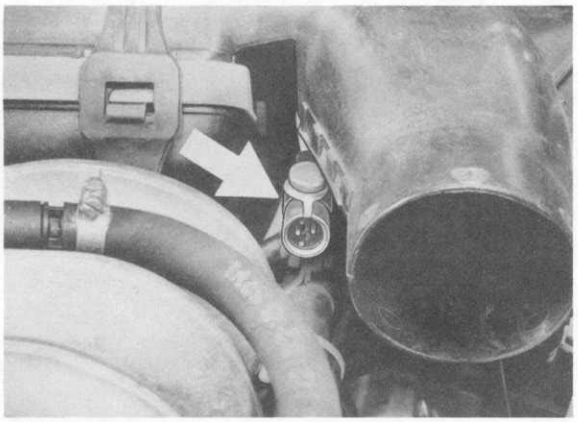
REMOVING AND INSTALLING TDC SENSOR

EXTRA
NOT IN LATEST MANUALS

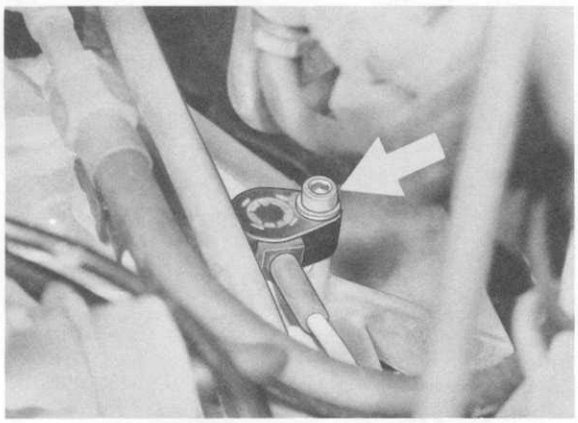
Removing

1. Remove air cleaner.

2. Detach test connection.



3. Unscrew TDC sensor and pull it out of housing.



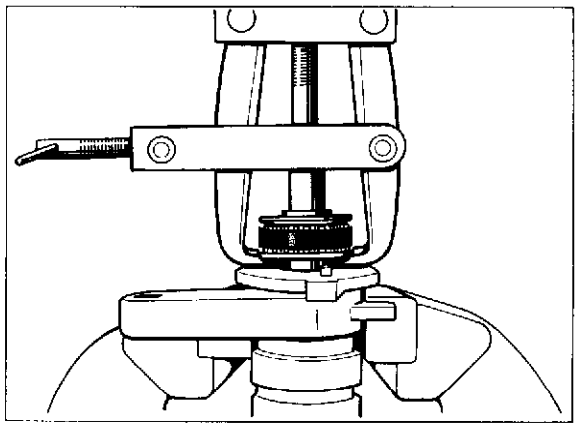
No.	Designation	Qty.	Note: Removal	Installation
1	Distributor cap cyl. 1-7-6-4	1		
2	Distributor cap cyl. 2-5-8-3	1		
3	Pan head screw M 4 x 6	2		Must always be replaced
4	Distributor rotor	2		
5	Protective cap	2		Make sure it is seated correctly in distributor housing cutout
6	Pan head screw M 8 x 25	1		
7	Housing upper section	1		
8	Flange washer	2	Pull off along with pulley	Must always be replaced, install in correct position
9	Pulley	2	Pull off	
10	Toothed belt *	1	Pull off flange washer and pulley prior to removal	Do not twist, handle with care observe basic setting of distributor shafts
11	Woodruff key	2		
12	Housing lower section	1		
13	Seal	1		Replace

* Toothed belt Part No. 928 602 541 00

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Assembly notes

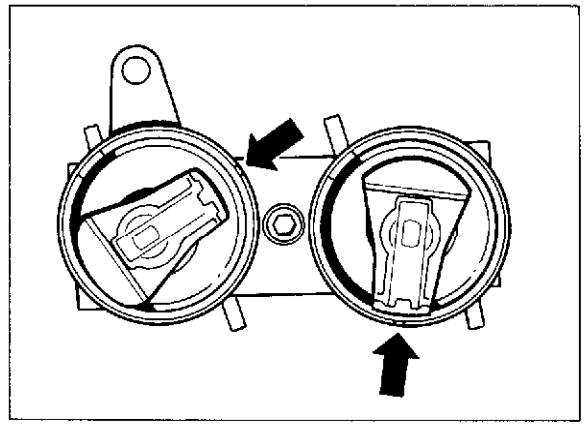
Dismantling



1156-28

Pull off pulley along with flange washer, e.g. with two-way bearing puller CORA No. 47-100

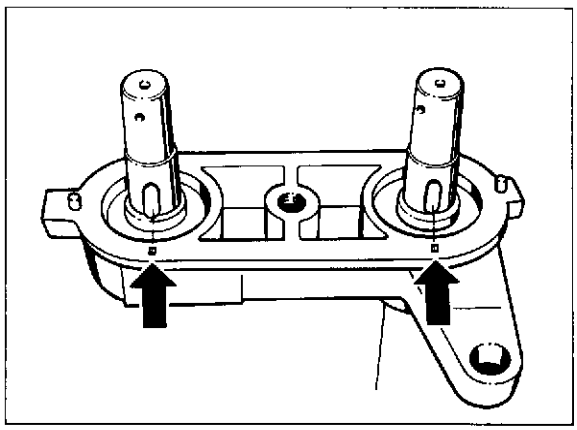
Supplier: Messrs. Albert Schrem
Postfach 1504
D-7928 Giengen 1



1157-28

After assembly, the distributor rotors must point towards the housing notches. Set engine to cylinder no. 1 firing TDC and install distributor in this position.

Assembly



1158-28

Set up distributor shafts in basic position.
Fit pulley and toothed belt.

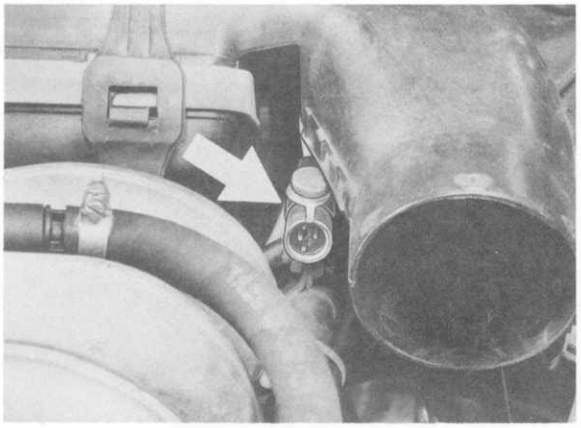
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Removing and installing TDC sender

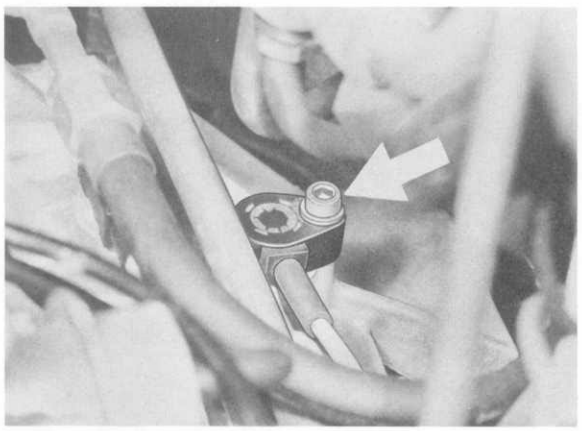
Removal

1. Remove air cleaner assembly.

2. Undo test connection.



3. Unscrew TDC sender and pull out of housing.



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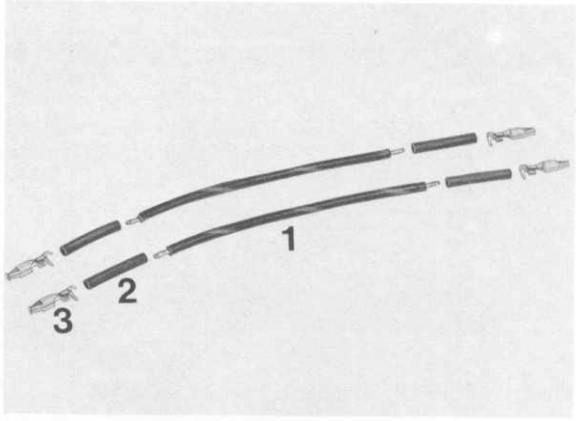
TROUBLESHOOTING ELECTRONIC IGNITION SYSTEM

TESTERS AND TOOLS

– Engine tester with oscilloscope, for example: 1010/1019, Bosch Mot 300/400.

– Multi-tester (internal resistance at least 20 k-ohms/V).

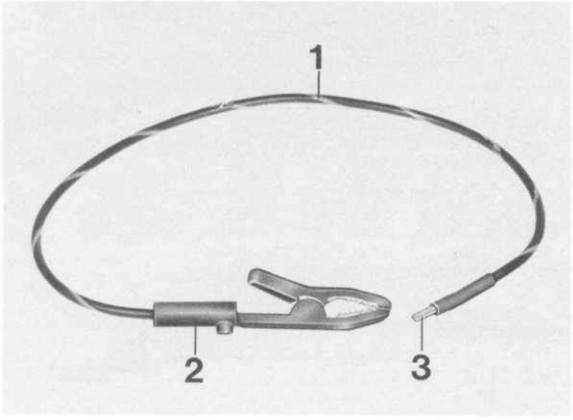
– Two test leads (made locally) for tests on multiple-pin plugs of control units and plug connections with same contact version (flat contacts).



1 – Highly flexible lead, approx. 10 cm long

2 – Insulating hose

3 – Flat contact N 17.182.2



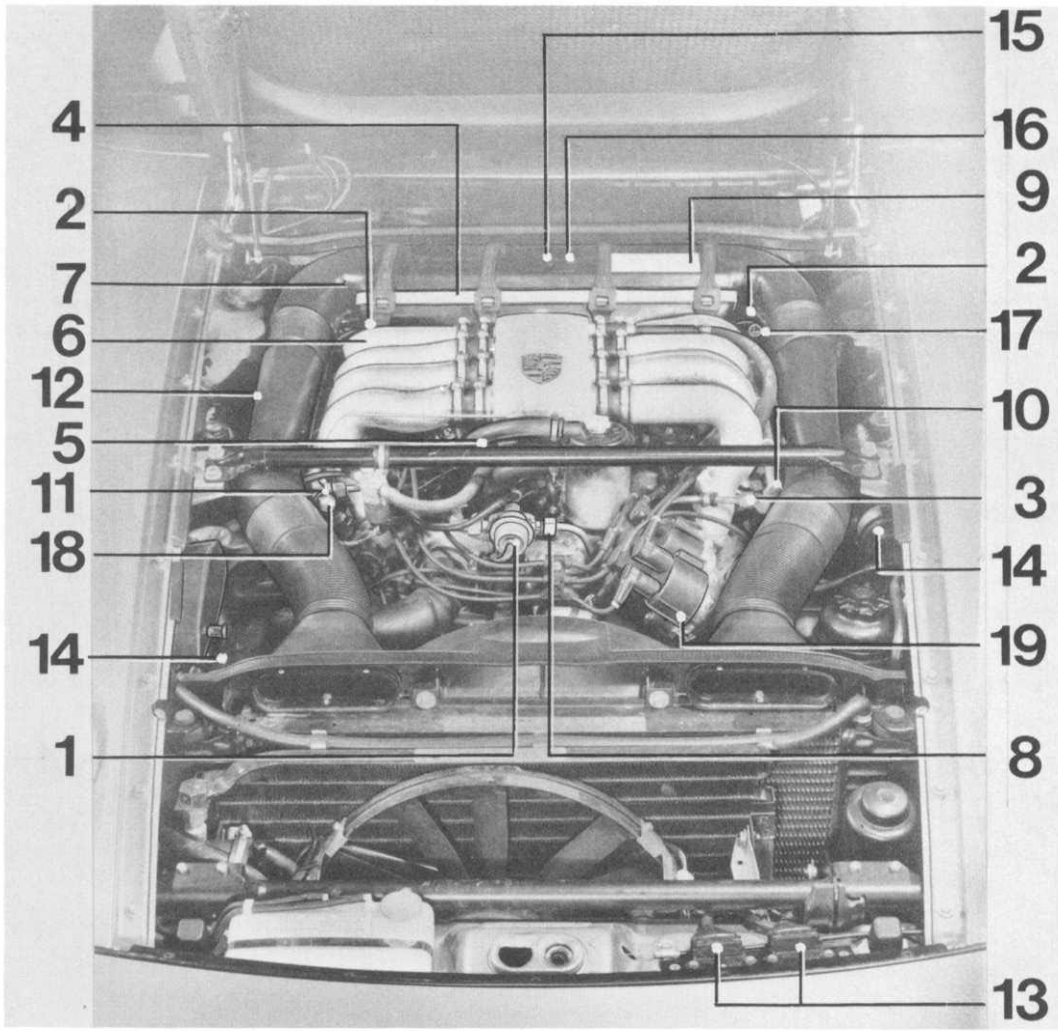
1 – Highly flexible lead

2 – Alligator clips (standard)

3 – Flat male plug 2.8 (N 17.457.2)

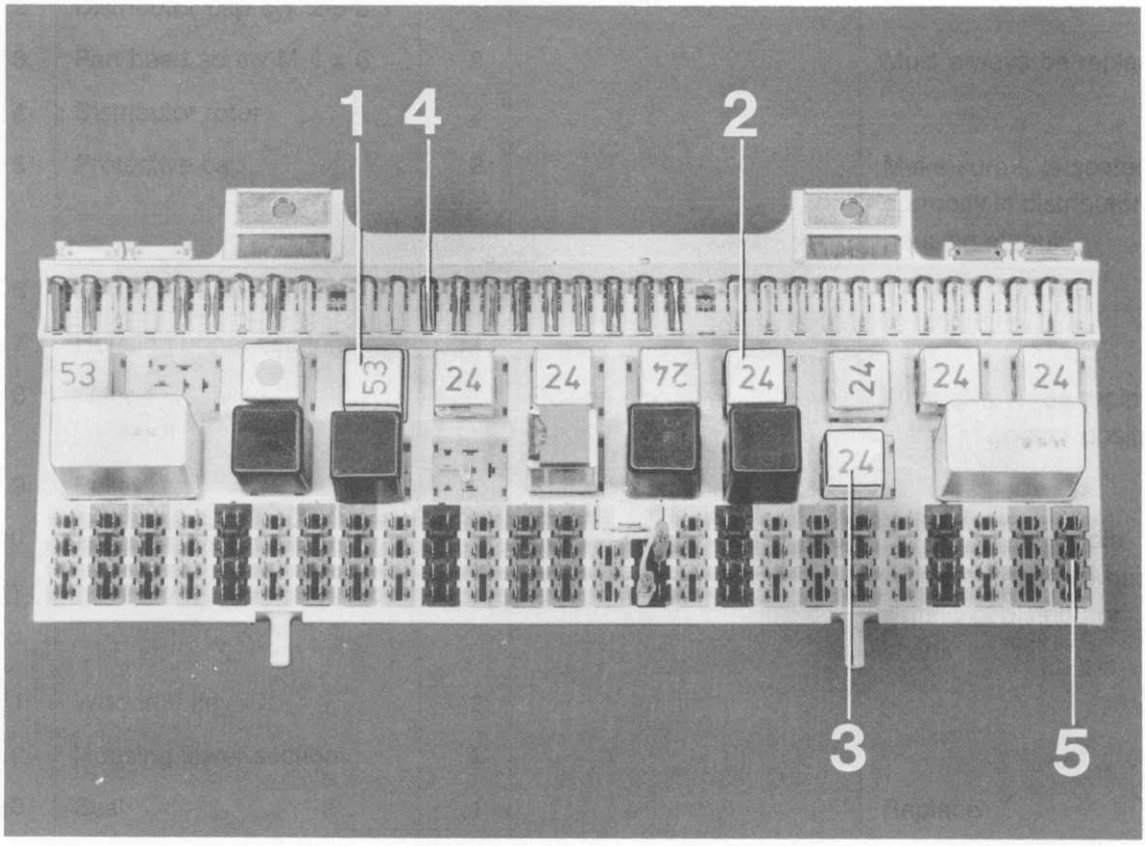
– Two adapter test leads (made locally).

LOCATION OF COMPONENTS



1 – Pressure damper
2 – Pressure regulator (two)
3 – Fuel injectors, left
4 – LH intake air sensor
5 – Throttle switch
6 – Auxiliary air regulator
7 – Control units (electronic ignition/LH injection)
8 – Temperature sensor II
9 – Temperature sensor I
10 – Fuel line
11 – Fuel injectors, right
12 – Blowoff switching valve
13 – Ignition control unit
14 – Ignition controls
15 – Speed/reference mark sensor
16 – TDC sensor
17 – Test connection – TDC sensor
18 – Test connection – fuel pressure
19 – Distributor

CENTRAL ELECTRIC POWER SUPPLY FOR LH FUEL INJECTION AND ELECTRONIC IGNITION SYSTEM



1 = Electronic ignition relay VIII
(power supply for electronic ignition and LH control units)

2 = LH-Jetronic relay XVI
(power supply for LH control unit and intake air sensor)

3 = Fuel pump relay XVII
(power supply for fuel pump, auxiliary air regulator and fuel injectors)

4 = Fuse no. 13 =
fuel pump, auxiliary air regulator

5 = Red plug X
(power supply for electronic ignition and LH fuel injection)

TESTING CONDTIONS	POSSIBLE CAUSES OF DEFECTS									
Engine in perfect mechanical condition. Battery charged. Starter turning.	Ground and plug connections	Control unit power supply	Speed/reference mark sensor	Load sensor	Temperature sensor I	Temperature sensor II	Throttle switch	Ignition system	Octane loop	Alternator/regulator
See Test Point	1	2	3	4	5	6	7	8	9	10
Engine does not start	X	X	X			X		X		
Engine hard to start	X		X			X		X		
Erratic idling						X		X		
Poor engine pickup	X		X			X	X	X		
Engine misfiring	X	X	X				X	X		X
High fuel consumption				X		X	X	X		
Poor engine output	X		X	X	X	X	X	X	X	
Engine hesitation	X	X	X	X		X	X	X		X
Engine knocks when accelerating				X	X			X		

X = Check with suitable tester

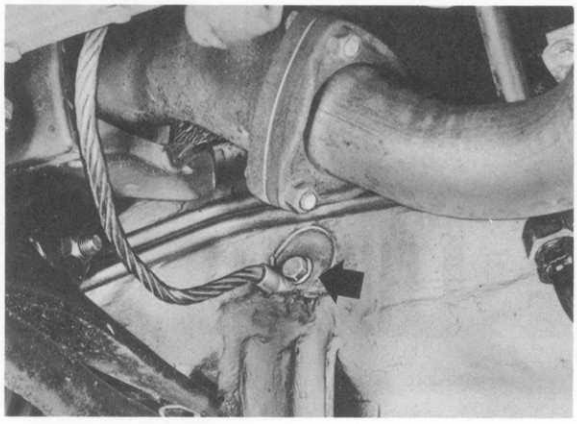
TEST POINT 1

Checking Ground and Plug Connections

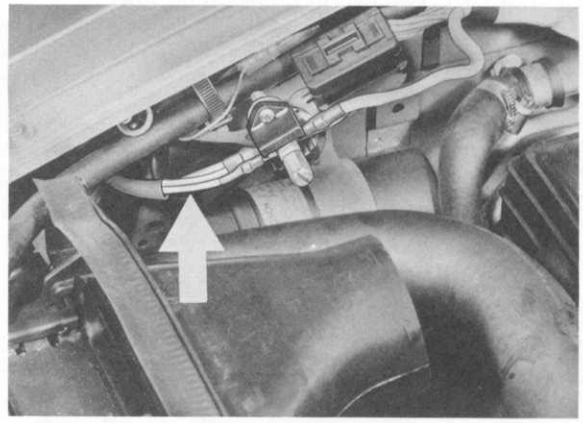
Note:

Go through test points in given sequence, especially if the complaint concerns no or poor engine running.

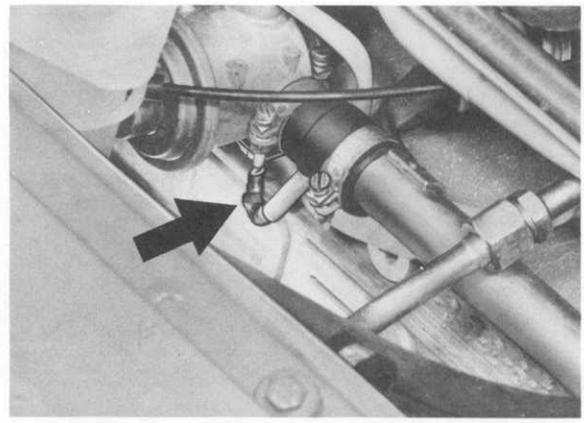
1. Ground connection between engine and body at bottom right.



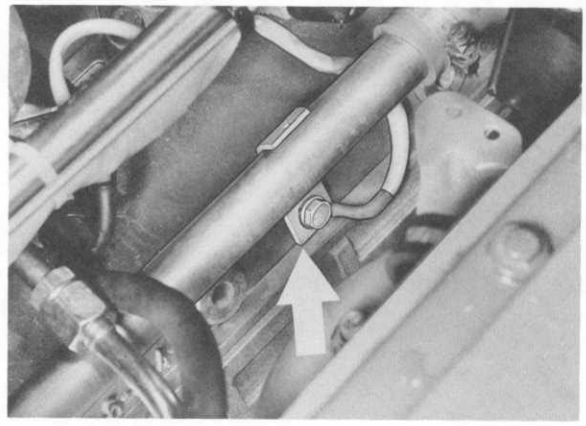
1.1 Ground connection of ignition control units next to right ignition coil.



1.2 Output ground connection on camshaft housing near blowoff switching valve.

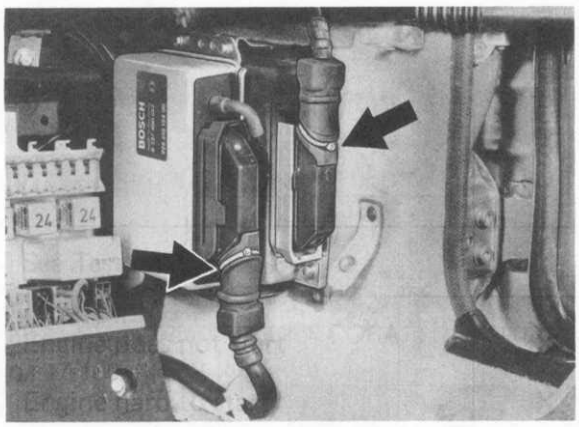


1.3 Electronic ground connection on camshaft housing near cylinder 2.

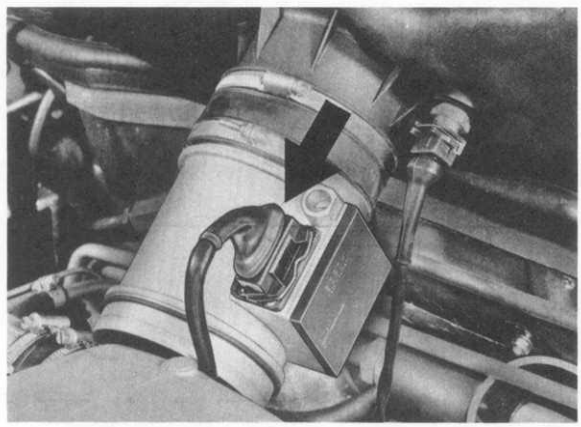


2. Check following plug connections for tight fit, bent plug receptacles and corrosion thoroughly.

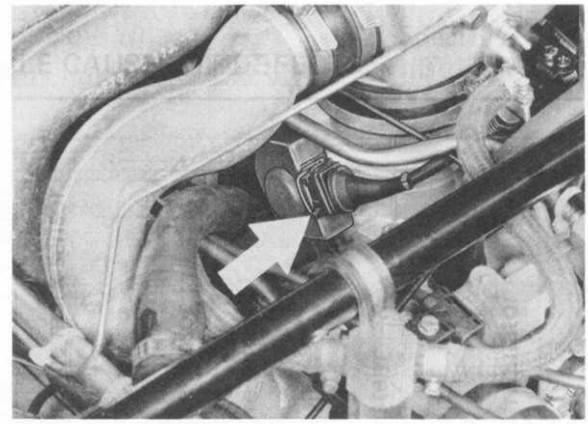
2.1 Plug connection of electronic ignition control unit. To remove, push back lock and swing out plug.



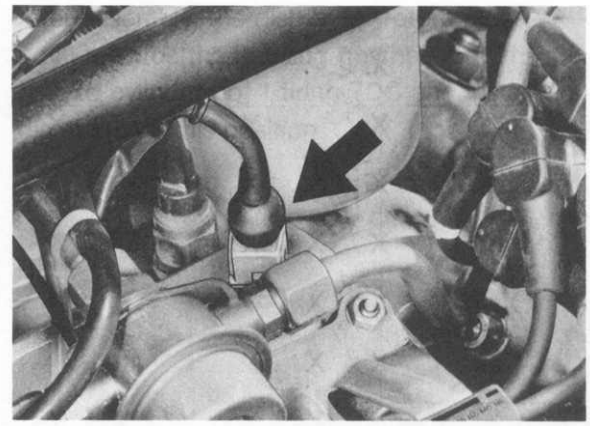
2.2 Plug connection on intake air sensor.



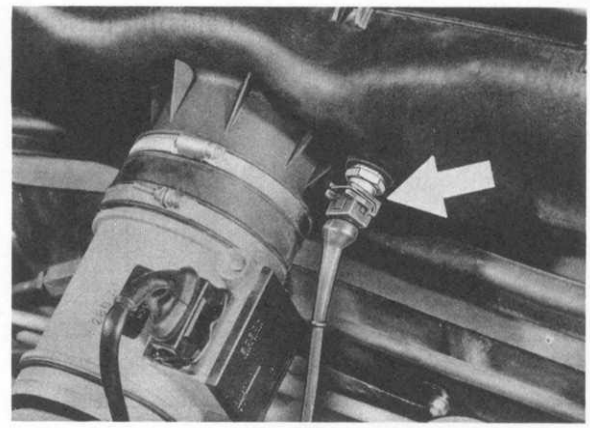
2.3 Plug connection on throttle switch.



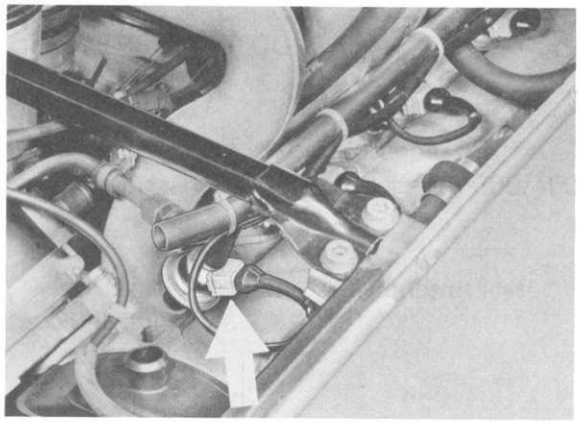
2.4 Plug connection on temperature sensor II (engine temperature).



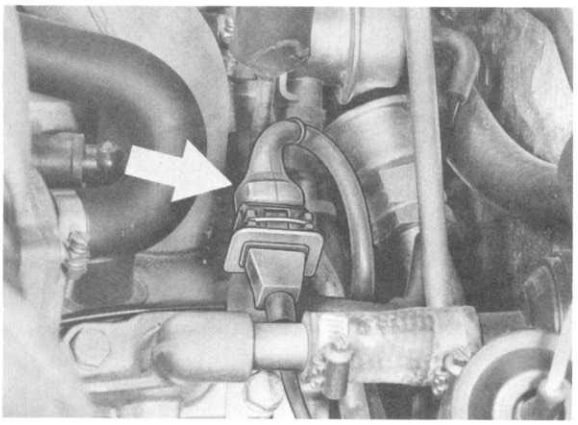
2.5 Plug connection on temperature sensor I (intake air temperature).



2.6 Plug connections on fuel injectors.



2.7 Plug connections on speed and reference mark sensors.

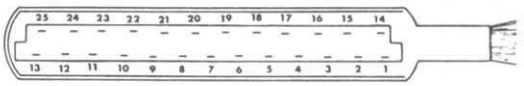


TEST POINT 2

Power Supply for Electronic Ignition Control Unit

1. Turn off ignition and pull off multiple-pin plug on electronic ignition control unit.

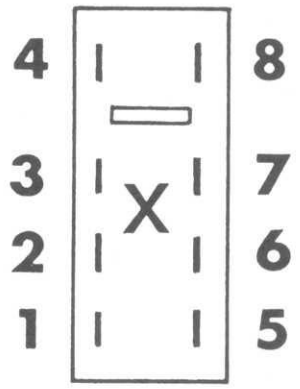
2. Turn on ignition. Measure voltage between terminals 25 and 12.



(Only connect tester with help of test leads.)

Specification: battery voltage.

If value deviates, measure voltage on connected plug X of central electric board between terminal 3 and ground.



Specification: battery voltage.

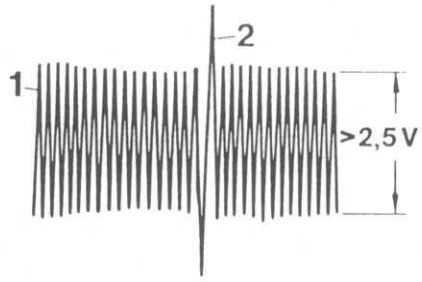
If battery voltage is not displayed, pull off relay VIII and bridge terminals 30 and 87.

Repeat voltage test on multiple-pin plug terminals 25 and 12 of electronic ignition control unit.
If there is now battery voltage, replace electronic ignition relay VIII.

1. Turn off ignition and pull off multiple-pin plug on electronic ignition control unit.

2. Connect positive tester lead on terminal 7 with help of locally made test lead and negative tester lead on terminal 19 of electronic ignition plug. Turn engine with the starter.

TEST POINT 3



Speed –
Reference Mark Sensor

1 = Speed signal

2 = Reference mark signal

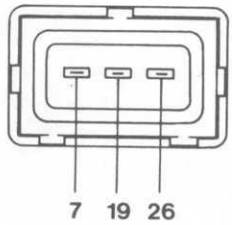
Note:

This test can only be made with help of an oscilloscope.
Adjust workshop oscilloscope to supplier's instructions.

Sine oscillations of at least 2.5 V (speed signal) and oscillation with definitely higher amplitude (reference mark signal) must be displayed on the screen.

If the amplitude of the speed signal is less than 2.5 V or no signal is displayed, check connections and test the sensor.

Measure internal resistance of terminal 7 against terminal 19 on the electronic ignition plug or on the speed/reference mark sensor plug connection.



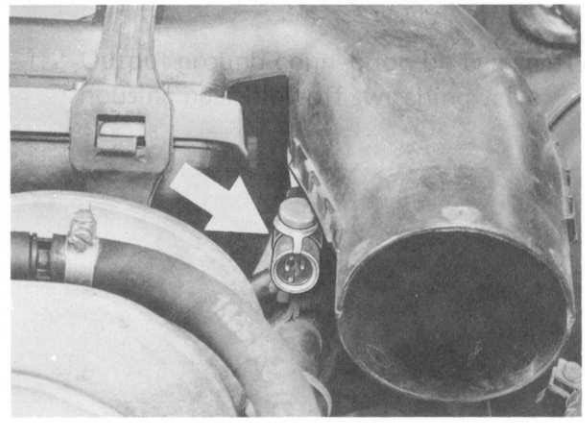
Specification: 0.6 to 1.6 k-ohms.

If necessary,
replace speed/reference mark sensor.

TEST POINT 4

Pressure Sensor
(Integrated in Electronic Ignition Control Unit)

Connect adjustable ignition timing light or engine tester with TDC sensor system on engine.

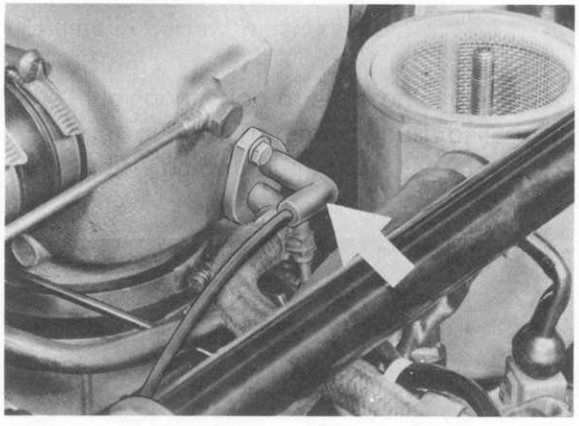


Note:

Tester must be set to "4 cylinders".

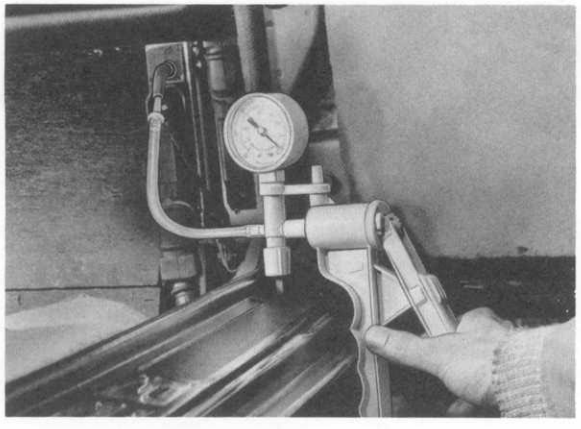
1. Accelerate engine in stopped car to 4,000 rpm.
   Ignition timing angle should be 40 ± 3°.

2. Detach vacuum connection on intake distributor.



This should reduce ignition timing to 20 ± 3°.

3. If 40 ± 3° ignition timing angle is not reached, supply approx. 500 mbar vacuum direct on control unit with help of a manual pump.



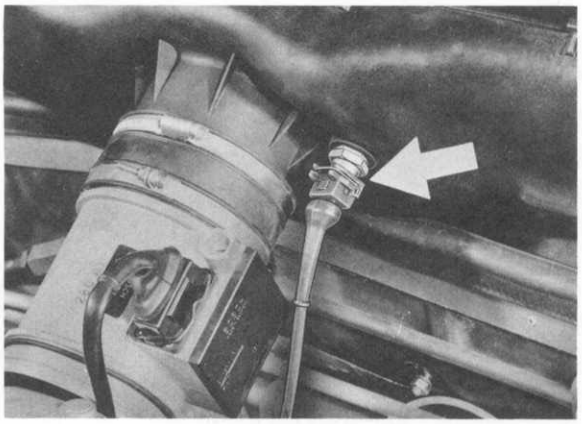
If specified ignition timing is still not reached, replace electronic ignition control unit.

If ignition timing is correct after supplying vacuum to the control unit, check vacuum hose between electronic ignition control unit and intake air distributor for leaks.

TEST POINT 5

Temperature Sensor I
(Intake Air Temperature)

1. Check plug connection on temperature sensor I underneath the air cleaner housing for tight fit and clean contacts.



2. Connect ohmmeter between terminals 10 and 22 on disconnected plug of electronic ignition control unit.

Specifications:

0 °C/	32 °F	= 4.4 to 6.8 kΩ
15 to 30 °C/	59 to 86 °F	= 1.4 to 3.6 kΩ
40 °C/	104 °F	= 0.9 to 1.3 kΩ

If specified values are not reached, make same tests on temperature sensor itself and, if necessary, replace temperature sensor.

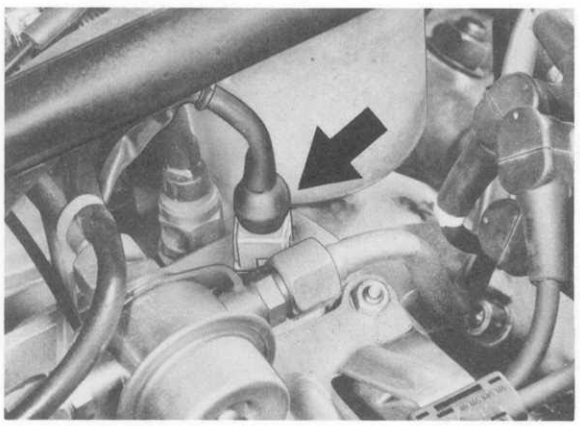
Note:

Breaks and short circuits will reduce the ignition timing by 3° on crankshaft. Intake air temperature greater than 50 °C/122 °F, closed full load contact and intake vacuum greater than 650 mbar will also reduce the ignition timing by 3° on crankshaft.

TEST POINT 6

Temperature Sensor II (Engine Temperature)

1. Check plug connection on temperature sensor II for tight fit and clean contacts.



2. Connect ohmmeter between terminals 23 and 12 of disconnected electronic ignition control unit plug.

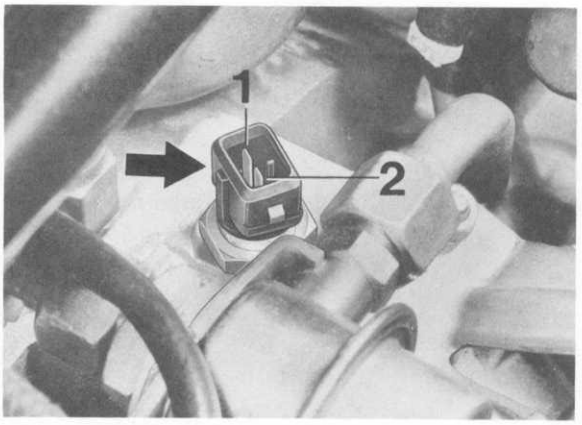
Specifications:

0 °C/	32 °F	= 4.4 to 6.8 kΩ
15 to 30 °C/59 to 86 °F		= 1.4 to 3.6 kΩ
40 °C/	104 °F	= 0.9 to 1.3 kΩ
60 °C/	140 °F	= 480 to 720 Ω
80 °C/	176 °F	= 250 to 390 Ω

If specified values are not reached, make same tests on temperature sensor itself.

Note:

Two independent temperature sensors are located in the temperature sensor housing. Connect tester on only one contact of sensor and a second test lead on ground.



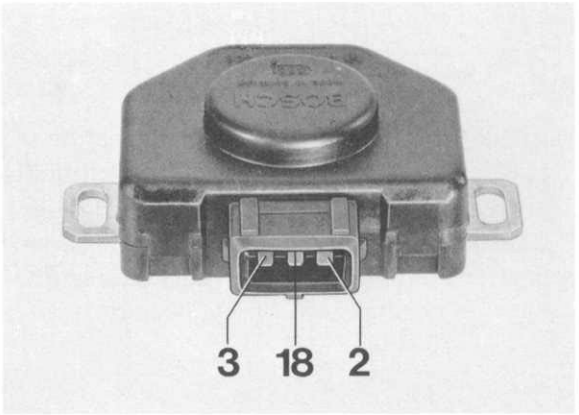
1 – Electronic ignition
2 – LH fuel injection

Temperature sensor II advances ignition timing for better engine pickup in partial load range with a cold engine.

TEST POINT 7

If switching points are not correct, make tests direct on throttle switch.

Throttle Switch



1. Idle Speed Contact:

Turn off ignition and pull off multiple-pin plugs on electronic ignition and LH fuel injection control units.

1.1 Connect ohmmeter on electronic ignition plug between terminals 4 and 12.

Throttle closed = 0 ohm
Throttle opened = inf. ohms

Switching over must take place already with a throttle gap of approx. 1°.

2 – Idle speed contact
18 – Ground
3 – Full load contact

Adjusting Throttle Switch

2. Full Load Contact:

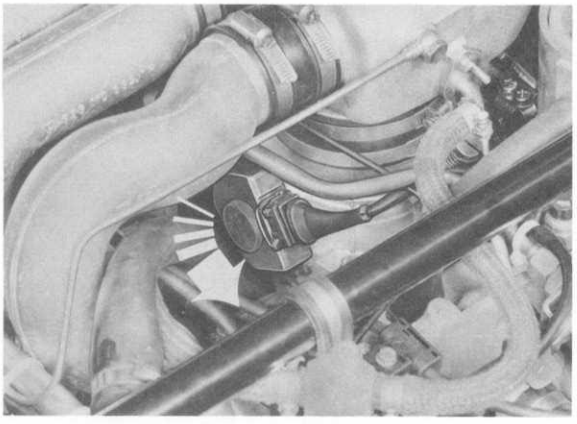
2.1 Connect ohmmeter on electronic ignition plug between terminals 17 and 12.

Throttle closed = inf. ohms
Throttle in full load pos. = 0 ohm

Switching point is after approx. 2/3 of throttle travel.

1. Unscrew mounting bolts on throttle switch.

2. Turn switch counterclockwise until inner stop is noticed (idle speed contact closed). Throttle, however, must not also be turned.
Full load contact is adjusted simultaneously and cannot be adjusted separately.



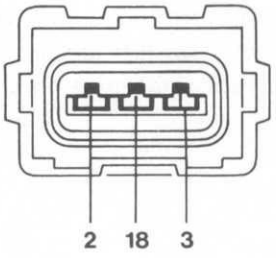
3. Tighten bolts.
   Throttle must have firm contact on stop screw.

Checking Throttle Switch with Engine Running

1. Pull off plug on throttle switch at idle speed.

   Ignition timing must be advanced by approx. 10°.

2. Accelerate engine to approx. 2,000 rpm. Connect full load contact terminal 3 and ground terminal 18 on plug with a piece of wire.



This should retard the ignition timing by approx. 10°.

3. Connect idle speed contact terminal 2 with ground. Engine should begin to surge, i. e. injection signal will be cut off above approx. 1250 rpm (coasting shutoff).

TEST POINT 8

Ignition System

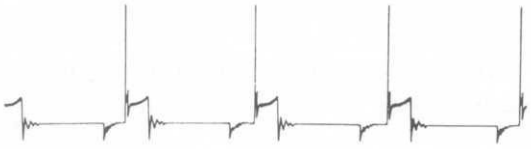
The ignition system is divided into two ignition circuits.

Left ignition circuit: cylinders 1–7–6–4

Right ignition circuit: cylinders 2–5–8–3

Firing order: 1–3–7–2–6–5–4–8

1. Adjust secondary display on ignition oscilloscope.
   Connect terminals 1 and 15 on left or right ignition coil, inductive clip on left or right ignition coil terminal 4 and trigger clip on cylinder 1 for left ignition circuit and cylinder 2 for right ignition circuit.



Note:

If an error is displayed for all cylinders, it will be in the primary or secondary circuit between the ignition coil and distributor rotor.
If the error is on only one cylinder, it will be after the distributor rotor.

2. Check distributor caps for damage, dirt and traces of burning.

   Resistance value: 1 k-ohm.

   Holding hooks must engage firmly when installing.

3. Check distributor rotor.

   Shielded resistance: 1 k-ohm.

   Check visually for damage and tight fit.

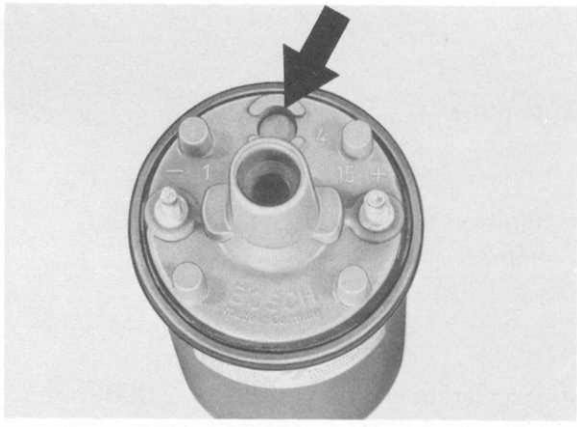
4. Check spark plug connectors and lines for damage and traces of burning.

   Shielded resistance: 3 k-ohms.

5. Check ignition coils.

   Primary resistance of term. 1 versus term. 15: 0.4 to 0.7 ohm.
   Secondary resistance of term. 1 versus term. 4: 5 to 8.7 k-ohms.

   Check that plugs are not missing.



If plugs are missing or casting compound has run out, replace ignition coil and ignition control unit.

Note:

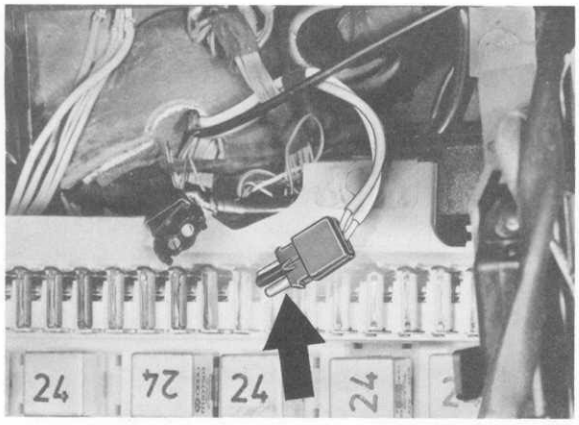
Avoid an ignition test via the spark gap by pulling off the spark plug connectors. There would be danger of destroying the ignition coil and control unit.

6. Check ignition timing at idle speed and with engine having operating temperature.

   Ignition timing at 700 + 50 rpm:
   10 ± 3° before TDC.
   Ignition timing can be measured with a timing light or engine tester with TDC sensor.

7. Activation of high voltage side.
   Procedures for checking whether there is an ignition triggering signal from the electronic ignition control unit to the ignition control unit:

7.1 Disconnect two-pin plug above central electric board.



7.2 Connect plug sections (plug pins) with a suitable piece of wire and turn on ignition.

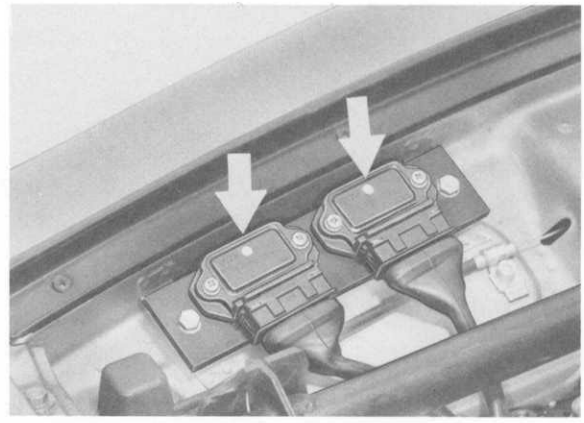
   White line = left ignition circuit.
   Green line = right ignition circuit.

   If piece of wire is touched on positive (term. 30, fuses 14 – 23), an ignition spark must be triggered on pertinent side of ignition line terminal 4.

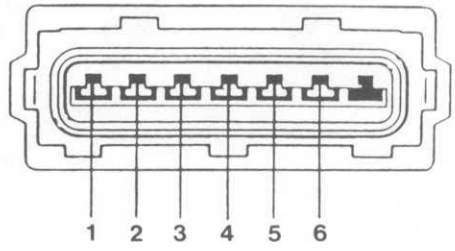
   For this purpose apply a booster gap with a 5 k-ohm sleeve-type suppressor on pertinent distributor terminal 4.

8. Check control signal for ignition control units.

8.1 Pull off multiple-pin plugs on ignition control units.

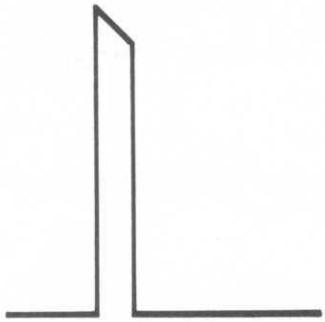


8.2 Connect oscilloscope with positive tester lead on terminal 5 and negative tester lead on terminal 2 of ignition control unit plug.



Make test on both multiple-pin plugs.

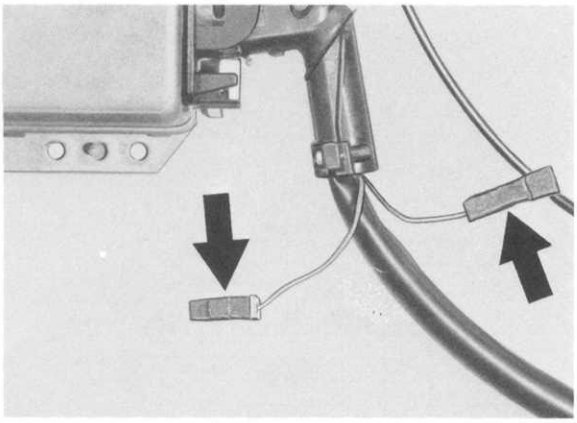
8.3 Oscilloscope must display a control signal on each of both multiple-pin plugs.



TEST POINT 9

Octane Loop

An additional single-pin plug is located on the bottom of the multiple-pin plug for the electronic ignition control unit.



With this plug connected the ignition timing will be retarded approx. 3° at full load and high partial load.
(Provision for adaptation to poor grade gasoline.)

TEST POINT 10

Alternator, Regulator

Peak voltage of the alternator could cause engine misfiring.

1. Take off flat drive belt on alternator.

2. Start engine.
   If misfiring has been eliminated, check alternator and regulator.

EQUIPMENT SURVEY - 1985 (32 VALVE ENGINE)

ENGINE TYPE M 28.43 / 44

Ignition Coil

Type/Model	Version	Remarks
928 S USA	944 602 115 00 Bosch No. 0221 118 322	2 ignition coils without ballast resistors

Distributor (Cap)

Type/Model	Version	Remarks
928 S USA	928 602 211 01 Bosch No. 1 235 522 395	Only high voltage distribution

Spark Plugs

Type/Model	Version	Remarks
928 S USA	WR 7 DC	Electrode gap: 0.7 + 0.1 mm

Control unit

Type / Model		Version	Remarks
928 S USA		928.618.124.05	EZF ignition
928 S USA	Mod. '85	928.618.123.03	LH-Jetronic control unit
	Mod. '86	928.618.123.04 Spare part: 928.618.123.04	

Final stage control unit

Type / Model	Version	Remarks
928 S USA	928.602.706.01	Transistor ignition control unit (two)

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Equipment table

Engine type M 28.45/46

Control units

Type / Model	Version	Remarks
928 S Australia M 298/M299	928.618.124.06	EZF control unit
	928.618.123.04	LH Jetronic control unit

Engine type M 28.41/42

Control units

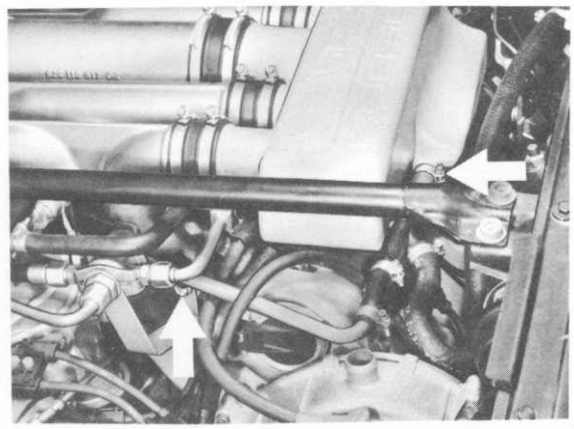
Type / Model	Version	Remarks
928 S 4 MY '87	928.618.124.10 928.618.124.11	EZK control unit
	928.618.124.11	Spare part
	928.618.123.10	LH Jetronic control unit
928 S4 MY '88	928.618.124.12 928.618.124.14	EZK control unit
	928.618.124.15	Spare part
	928.618.123.11	LH Jetronic control unit

Type / Model	Version	Remarks
928 S4 as of MY '89	928.618.124.15	EZK control unit
	928.618.123.13	LH Jetronic control unit
928 S4 Mod. '91	928.618.123.25	LH Jetronic control unit

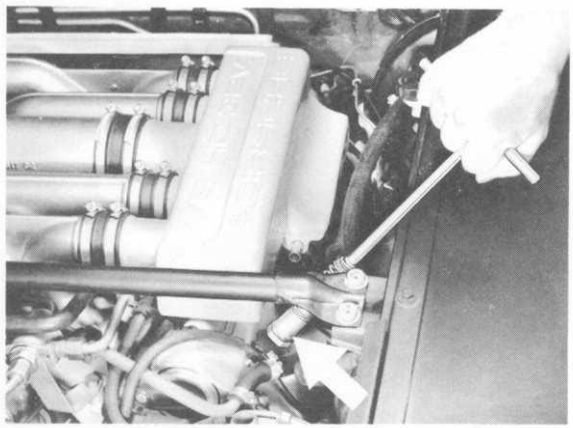
Printed in Germany – XXIX, 1992

REPLACING SPARK PLUGS (32 VALVE ENGINE)

1. Unscrew suction pump on left side of intake air distributor and clamp on vacuum hose.



2. Unscrew spark plug with a standard wrench (car tool set has a special spark plug wrench).

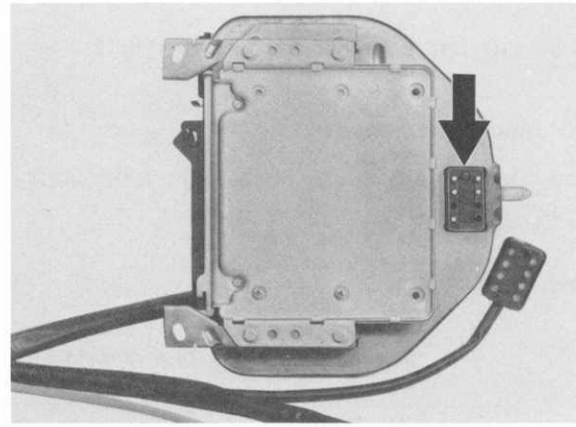


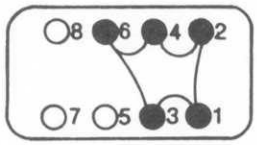
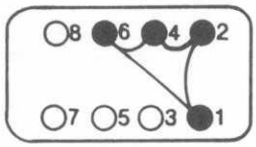
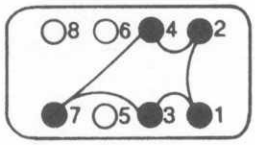
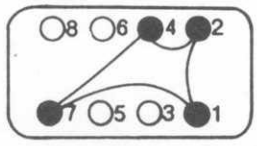
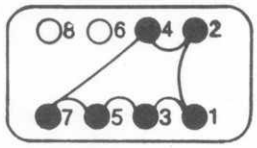
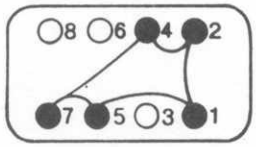
3. Lubricate spark plug threads with a light coat of grease , e.g. white Molykote HTP Paste.

Tightening torque: 30 Nm.

EIK CONTROL UNIT CODING,
'87 MODELS ONWARD

Only one control unit is used.
The appropriate characteristic can be called up by means of a coding plug on the rear of the control-unit holder.

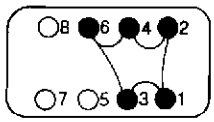
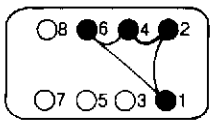
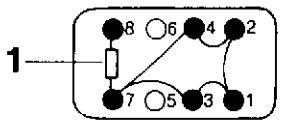
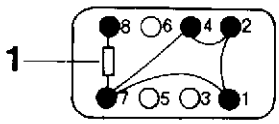
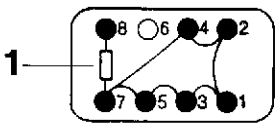
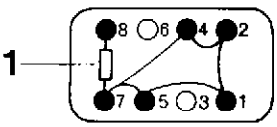


Switching diagram	Type
	R.o.W. without catalytic converter manual transmission
	R.o.W. without catalytic converter automatic transmission
	R.o.W. with catalytic converter and USA manual transmission
	R.o.W. with catalytic converter and USA automatic transmission
	Australia, manual transmission
	Australia, automatic transmission

Coding for EZK control unit

For Model 89 onwards

The coding connector is fitted to the mounting plate for the LH and EZK control units.

Wiring diagram	Version
	Rest of world without catalytic converter, manual transmission
	Rest of world without catalytic converter, automatic transmission
	Rest of world, USA with catalytic converter, manual transmission
	Rest of world, USA with catalytic converter, automatic transmission
	Fuel grade 91 RON, with catalytic converter, manual transmission
	Fuel grade 91 RON, with catalytic converter, automatic transmission

162 - 24

1 - resistor 150 Ω

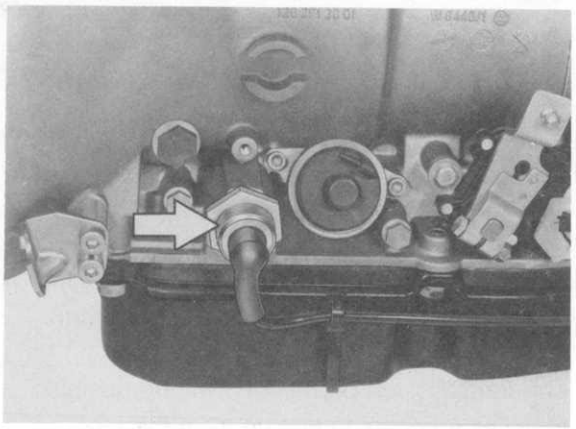
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Checking the transmission protection switch (automatic transmission)

From Model 87 onwards, transmission number
16 H 00 564 USA
16 H 10 447 Rest of world

Note

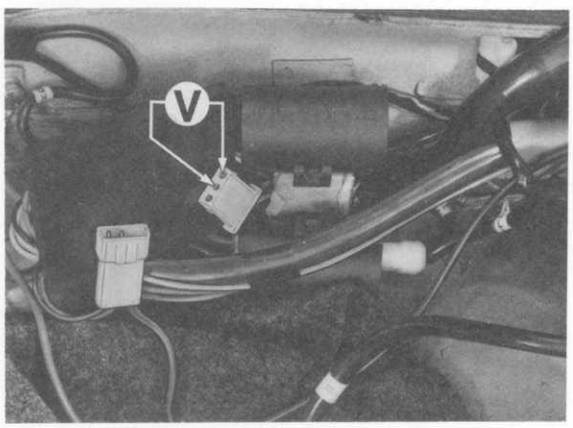
The transmission protection switch is located on the left-hand side of the transmission, viewed from the driving seat.



86/433

1. Separate the 3-pole connector in the spare-wheel well.

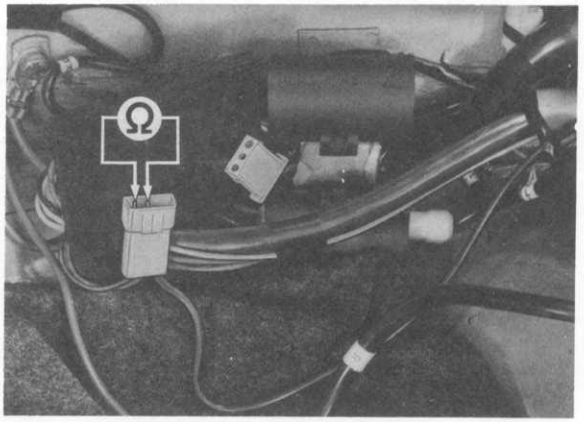
2. Connect voltmeter sleeves to terminals 1 and 2.



3. Switch on ignition.

Display: approx. 5 V

4. Connect ohmmeter plugs to terminals 1 and 2.



87/476

Note

The switch is checked with the engine running. Apply the handbrake and press the fo-otbrake. Observe safety regulations.

Display in positions P and N:
∞ Ohm (switch open)

Display in position D:
< 1 Ohm (switch closed).

If these values are not indicated, measure at the switch directly, replace if necessary.

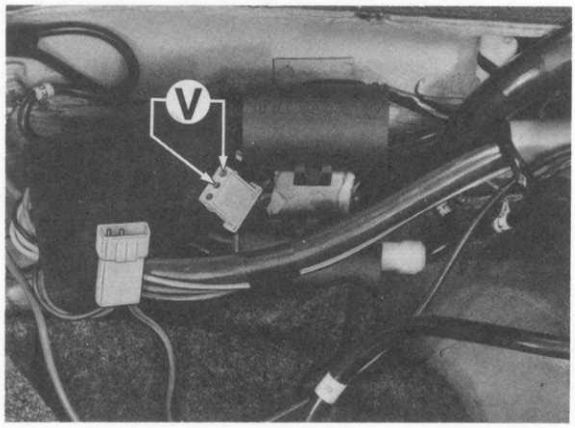
Printed in Germany – XXII, 1989

Check up to transmission number:
16 H 00 563 USA
16 H 10 446 Rest of world

It is only possible to check the transmission protection switch in these vehicles if the vehicle is in motion.

1. Separate the 3-pole connector in the spare-wheel well.

2. Connect voltmeter sleeves to terminals 1 and 2.

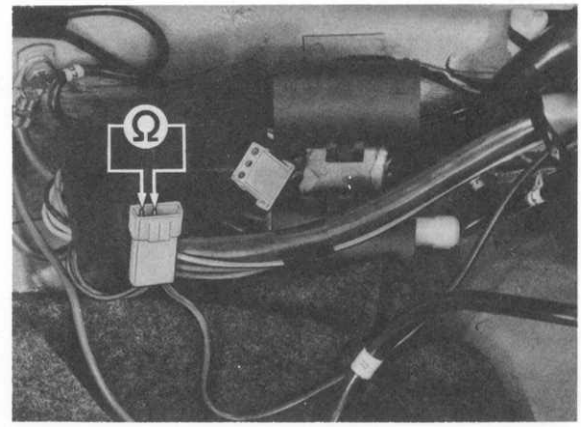


87/476

3. Switch on ingnition.

Display: approx. 5 V

4. Connect ohmmeter plugs to terminals 1 and 2.



87/476

The transmission protection switch must close while changing from first to second gear (Display <1 Ohm) and open when changing from second to third gear (Display ∞ Ohm).

The transmission protection switch must also close when changing down from third to second gear and open when changing down from second to first gear

Printed in Germany – XXII, 1989

Equipment table

As from Model 88 CLUB-SPORT-VERSION

Engine type M 28.41 CLUB SPORT

Control units

Type / Model	Version	Remarks
928 S 4 Club Sport as from Mod. '89	928.618.124.13 928.618.124.16	EZK-control unit Cut-off speed at 6775 1/min
928 S 4 Club Sport as from Mod. '89	928.618.123.12 928.618.123.14	LH-Jetronic control unit

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Equipment Table / Type 928 GT - 928 GTS (5,4 l)

As of MY 89 928 GT

Motortyp M 28.47

Steuergeräte und Zündkerzen

Type / Model	Version	Remarks
928 GT	928.618.124.22	EZK control unit cutoff speed 6800 rpm
928 GT Mod. '91	928.618.123.14 928.618.123.26	LH-Jetronic
928 GT	WR 7 DC WR 7 DP	0,7 ± 0,1 mm

As of MY '92 928 GTS (5,4 l)

Engine Type M 28.49/50

Control units and spark plugs

Type / Model	Version	Remarks
928 GTS	928.618.124.30	EZK control unit cutoff speed 6600 rpm
928 GTS	928.618.123.30	LH-Jetronic
928 GTS	WR 7 DTC	3 ground electrodes 0,8 ± 0,1 mm

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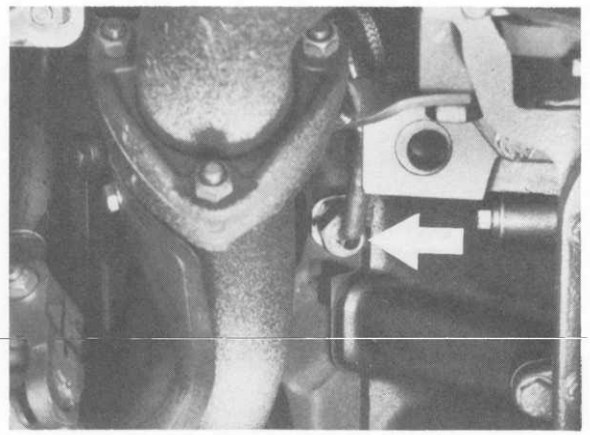
Ignition circuit temperature sensor, removing and installing

From Model 89
Engine type M 28. 41/42 onwards

Removing

1. Remove air-filter housing complete. Unclip the temperature sensor connector on the cylinder head and separate.

2. Remove rear engine guard. Remove temperature sensor with standard tool, e.g. Hazet 4550-1.



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Installing

1. Join connection from above and clip in.

2. Apply a film of Molykote HTP white paste to the thread of the union nut

   Tightening torques:

   Union in cylinder head **20 Nm (15 ft. lb.)**
   Union nut for temperature sensor **10 Nm (7.5 ft. lb.)**.

Note

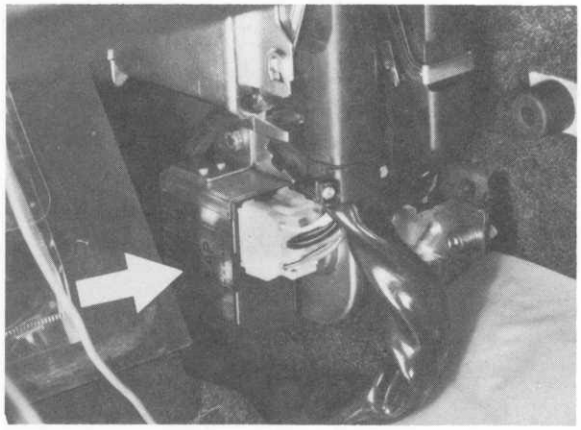
Make sure that the tip of the sensor is not bent when removing or installing the temperature sensor.

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Checking the ignition circuit monitoring relay

Note

The ignition circuit monitoring relay is fitted to the mounting plate for the LH and EZK control units.



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Signals at the ignition circuit monitoring relay

1. Terminal 31 - ground

2. Ground must be present at terminal AL when the ignition is switched off.

3. Battery voltage must be present at terminals 87, 15, A1 and A2 when the ignition is switched on.

4. Battery voltage must be present at terminals 61 and AL when the engine is running.

5. A voltage value of approx. 2.7 V must be present at both terminals E1 and E2 when the ignition is switched on.

6. The resistance between E1 and E2 is approx. 5 - 10 Ω(measured at the disconnected relay socket).

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Troubleshooting

Relay output	Effect	Cause	Possible test
E1	Injection circuit I switched off	Short circuit to + U_B	Measure voltage Display: Battery voltage
	Injection circuit I switched off	Short circuit to ground	Measure resistance to ground Display: 0 Ω
	Injection circuit II switched off	Discontinuity	Measure resistance between E1 and E2
E2	Injection circuit I switched off	Short circuit to + U_B	Measure voltage Display: Battery voltage.
	Injection circuit I switched off	Short circuit to ground	Measure resistance to ground Display: 0 Ω
	Injection circuit II switched off	Discontinuity	Measure resistance between E1 and E2
AL	Fault code 1132 or 1232	Short circuit to + U_B	Measure voltage Display: Battery voltage
		Shortcircuit to ground	Measure resistance to ground Display: 0 Ω
		Discontinuity	Measure resistance between terminal AL and pin 28 LH control unit
61	Fault code 1132 or 1232	Voltage at terminal 61 less than 3.5 V	Measure voltage Display: Battery voltage with engine running

Injection circuit I switched off red LED illuminated in relay housing

Injection circuit II switched off green LED illuminated in relay housing

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LH-EZK-Diagnosis / Troubleshooting



928 S4

928 GT

Dr. Ing. h.c. F. Porsche Aktiengesellschaft

Test point	Description	Page
	Precautions, Groups 24/28	2
	Important vehicle information, Groups 24/28	3
	Testing requirements, Groups 24/28	4
	Control unit encoding	8
	LH Fuel Injection System	
	Effect of faults (cross-reference list)	9
	Fault memory	10
	Plug connections at LH control unit	10
1	Power supply	11
2	Idle speed contact	11
3	Full load contact	13
4	Engine temperature sensor II	14
5	Air mass sensor	15
6	Idle speed control activation	16
7	Oxygen regulation control, rich	17
8	Oxygen regulation control, lean	18
9	Open circuit at oxygen probe	18
10	Fuel injection circuit shut down	19
11	Control unit faulty	19
12	No power supply	20
13	Ground and plug connections	21
14	Fuel pump voltage	21
15	Engine speed signal from EZK	22
16	Injection valves / Control	22
17	Fuel pressure	24
18	Intake system leaks	25
19	Resonance flap valve	25
20	Fuel tank venting	26
21	Alternator and voltage regulator	27
22	Leads K and L	27
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Precautions

The greater demands placed on ignition systems by modern engines and the desire for freedom from routine maintenance led some time ago to the introduction of electronic ignition systems on production cars. Normally speaking, the ignition power from electronic systems (of almost all makes) is greater than that of conventional systems, and further power increases can be expected in the future. This places electronic ignition systems in a power range where touching live parts or terminals (either the primary or secondary circuits) could lead to a fatal accident.

In this connection you are reminded that German VDE regulations, and in particular VDE 0104 of July 1967 (or the equivalent national regulations) must be complied with whenever work on or inspection of the ignition system takes place. The ignition must always be switched off (ignition or power source) before work on the ignition system is started. Such work includes:

- Connecting engine testers, for example
  timing light, dwell angle/speed tester, oscilloscope etc.

- Replacement of ignition system components, for example
  spark plugs, coils, distributors, ignition leads etc.

The above-mentioned dangerous voltages will be present in the entire system should it be necessary to switch on the ignition for ignition system testing or engine adjustments.

In other words, there is not only danger from the individual components of the ignition system (for example distributor, coil, control unit, wiring or associated components) but also at wiring harnesses, plug connections and testers.

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Important vehicle information

- Always turn off the ignition or disconnect the battery for resistance tests (if this is not done, the measuring instrument may be damaged beyond repair).
- Always disconnect both speed sensor plugs for compression tests. (If this is not done,dangerously high voltages and insulation damage at the coil, high-tension distributor and ignition leads could result.)
- The specified coil (refer to order number) must not be replaced by a different coil.
- Never connect an interference suppression capacitor to coil terminals 1 and 15.
- Never connect coil terminal 1 to ground for the burglar alarm. This could damage the coil and the control unit beyond repair.
- Never connect battery + or a test lamp to coil terminal 1, or the control unit will be damaged beyond repair.
- Never disconnect the ignition lead from coil terminal 4 to high-tension distributor terminal 4 while the engine is running.
- There must be no electrical flashover from coil terminal 4 to coil terminals 1 and 15, or the control unit could be damaged beyond repair.
- To avoid destruction of the control unit, the secondary circuit of the ignition system must be suppressed with at least 4 kΩ; the original distributor rotor with 1 kΩ suppressor resistor must be installed (do not use a 5 KΩ - distributor rotor even if radio and telephone interference suppression are necessary).
- Disconnect EZK/LH control units and ignition output stage plugs only after turning off the ignition.
- Flashovers or insulation breakdowns in the high-tension distributor cap area (poor isulation) could destroy the control unit.
- Never disconnect the battery when the engine is running.
- Incorrect battery polarity could damage the ignition output stage, coil and LH-EZK control unit beyond repair.
- External engine starting at more than 16 V or with a rapid battery charger is forbidden.
- Always comply with accident prevention regulations when working on the fuel system.

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Equipment required for LH/EZK testing:

- Diagnostic tester 9288 (9268) with connecting leads
- 1 oscilloscope approved by Porsche
- 1 digital-display multimeter, internal resistance at least 10 MΩ
- 1 Bosch L-Jetronic test lead, Bosch No. 1684 463 093 (check lead for correct polarity at plugs).
- 2 control-unit plug test leads (to be made up in your own workshop) with two No. 17.457.2 tab connectors, to avoid damage to the contacts in the control-unit plug during testing.
- 2 adapter test leads, consisting of: 4 N 017.483.1 plug connectors with 2 leads approx. 150 mm long, soldered.
- 1 3-pin test lead (e.g. VW VAG 1501).
- 2 control-unit plug test leads (to be made up in your own workshop) equipped with 4 N 17.457.2 tab connectors.
- The test leads must always be used for testing.
- All sensor and ignition timing signals on Porsche automobiles can be checked with the engine testers recommended by Porsche.
  Since each tester manufacturer issues different instructions for connection to the vehicle, these instrucitons should always be followed carefully to ensure correct tester connection.

The following sensor signals can be checked with the oscilloscope:

- Engine speed sensor signal / reference mark signal
- t_i signals
- Idle speed control activation
- Hall sensor signal
- Ignition trigger signal to ignition output stage
- Fuel tank venting activation signal
- Resonance flap activation signal

as well as:

- Reed switch signal (speedometer)
- ABS wheel sensor signals

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Control units

The LH and EZK control units were given diagnostic capability at the end of the 1988 model year (see 1988 Model Information, Fuel and Ignition System - Diagnosis).

Starting with the 1988 model year, self-diagnosis with a fault memory is integrated into the two fuel injection and ignition control units. This makes it possible to identify and store certain malfunctions of the fuel injection and ignition system and of the knock regulating system.
To make sure that faults identified and stored in this way are not erased when the ignition is turned off, a permanent + signal is supplied to both control units.

Important:
If the control unit plugs or the battery are disconnected, the fault memory will be erased.

Diagnostic tester:

To call up the contents of the fault memory on 1988 model cars a new diagnostic tester (special tool number 9268) was developed. It is connected to an existing plug connection on the control unit mounting plate.

For diagnostic work on cars from the 1989 model year on, a 19-pin plug-in connection under the booster cover is connected to the new 9288 system tester or the 9268 flashing code tester (using an intermediate adapter lead).

Note:
The test point concerned is supplemented by the equivalent flashing fault code on the 9268 tester.

Example:
Test point 2 = idle speed contact (1_12)
2nd digit display:
"1" = fault present, or
"2" = no fault present.

From tester module version 2.0 on, actual engine data can be read out from the EZK/control unit with system tester 9288.

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This LH/EZK diagnosis/troubleshooting plan is based on the contents of the fault memory.

Paths not included in the self-diagnosis can be diagnosed by conventional means (test points 12 - 22 on LH, 12 - 16 on EZK)

Preconditions for troubleshooting are that the person performing the tests

- is familiar with the location of compopnents and the functions of and technical inter-relationships between the systems to be tested (model information)
- can read and evaluate Porsche wiring diagrams
- knows the functions of electrical circuits and relays
- can use testing equipment such as oscilloscopes, voltmeters, ohmmeters and ammeters and knows how to evaluate their readings.

Important:

A fault indication on the display (fault list in the case of the flashing code) **does not always** indicate that the component in question is defective. It can also suggest a fault in the corresponding control unit or the connecting leads (paths) between the component and the control unit.

No troubleshooting involving disconnecting plugs etc. is to be performed with the engine running before the fault memory has been read out, or this in turn may be stored as a fault in the memory.

Note on the 9288 system tester

If the tester display shows

Fault not present, this may mean:

- Fault is no longer present at the time of testing (loose contact)
  Remedy: visual inspection of the path, erasure of the fault memory and a repeat test drive.
- The conditions in which the fault is being tested for do not correspond to those under which the fault originally occurred.
  Remedy: conform with conditions displayed on the tester.

Signal not plausible:

The signal from the monitored component is not within the tolerance range of the specified control-unit value

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In contrast to LH cars up to and including the 1986 model year, on which the injection valves, oxygen sensor and rotary actuator were activated from fuel pump relay XX, the power supply to the injector valves, idle speed control, fuel tank venting valve, encoding element and resonance flap switching valve from the 1987 model year on were supplied in addition from LH-Jetronic relay XXv, which previously had a burn-off function only. This change was necessary to permit self-diagnosis from the 1988 model year on.

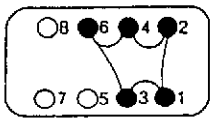
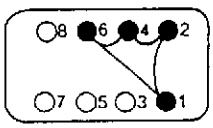
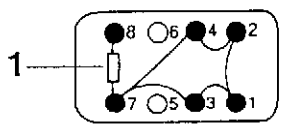
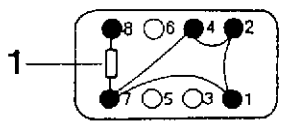
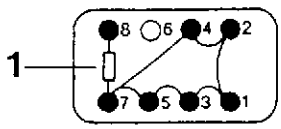
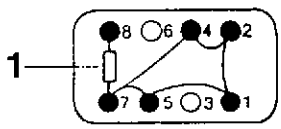
From the 1990 model year on, the connections to the central electrics and the installed direction of the control unit plugs have been altered.
The relay designation from the 1990 model year on is shown in brackets and the wiring entry into the plug as a broken line.

	up to 90	from 90	Power supply for:
Fuel pump relay	XX	XXVI	Fuel pump λ-sensor
EZK relay	XVI	XXII	LH control unit EZK control unit
LH-Jetronic relay	XXV	XXV	

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LH-Jetronic, EZK ignition system

Control unit codes

Circuit diagram	Version for
	ECE, manual gearbox, no catalytic converter
	ECE, automatic transmission, no catalytic converter
	Worldwide automatic transmission, with catalytic converter
	Worldwide, automatic transmission, with catalytic converter
	Fuel grade 91 octane (RM), with catalytic converter, manual gearbox
	Fuel grade 91 octane (RM), with catalytic converter, automatic transmission

1 - Resistance 150 Ω

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Engine mechanically OK Battery charged Starter motor cranks the engine	Plug, Control unit	35 → 17 9 → 17	2 → 17	13 → 17	13 → 17							
Tester		V	Ω	Ω	Ω		≅	V	V	V/Ω		
Fault code 1_		11	12 15	13	14	21	22	23	24	25	31	41
Terms in bold type = Fault memory display or fault path		**Supply voltage**	**Idle speed contact**	**Full load contact**	**Engine temperature sensor II**	**Air mass sensor**	**Idle speed control activation**	**Oxygen regulation stop, rich**	**Oxygen regulation stop, lean**	**Oxygen sensor, open circuit**	**Injection circuit shut down**	**Control unit faulty**
Test point		1	2	3	4	5	6	7	8	9	10	11
Engine will not start		x			x							x
Engine hard to start		x			x		x				x	
Irregular idling				x	x	x	x	x	x		x	
Poor pick-up					x	x		x	x		x	
Misfiring		x			x	x					x	
High fuel consumption			x	x	x	x		x				
Low power output				x	x	x		x	x		x	
Engine hesitation		x	x	x	x	x	x	x	x			
Poor hot starting					x		x				x	
Diagnosis not possible		x										x

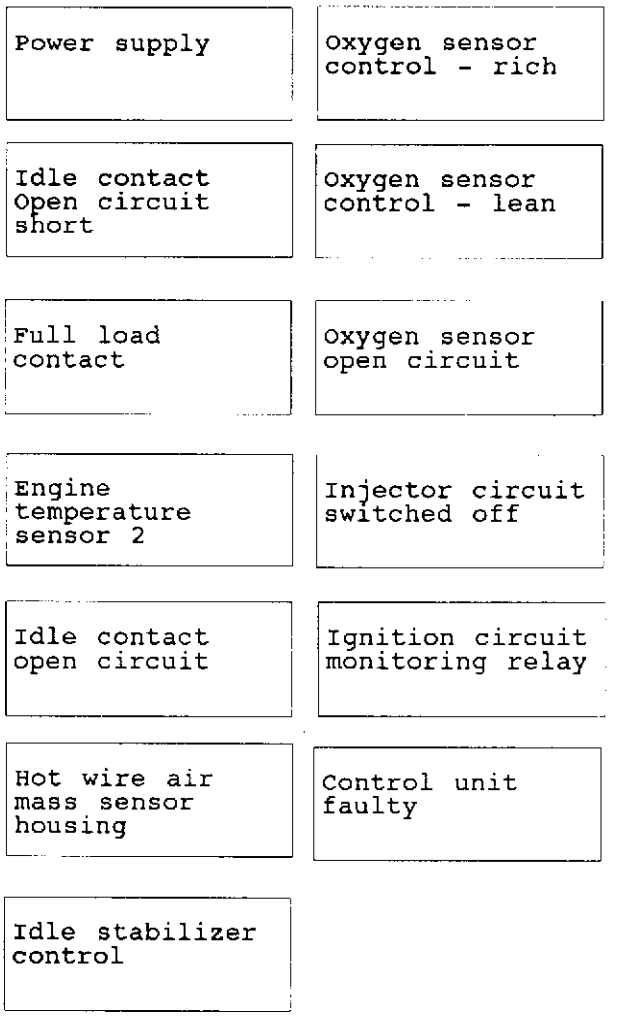
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								x	12	No power supply		V	35 - 17 9 - 17
	x	x	x		x	x		x	x	13	Ground and plug connections			
	x	x	x		x			x	x	14	Fuel pump voltage		V	
									x	15	Engine speed signal from EZK			
	x	x	x		x	x		x	x	16	Injector valves / control system		≅	
	x	x	x	x	x	x	x	x	x	17	Fuel pressure			
	x	x	x		x	x	x	x	x	18	Intake system leaks			
			x							19	Resonance flap		≅	
	x	x				x	x	x		20	Fuel tank venting		≅	
		x			x			x		21	Alternator and voltage regulator		V	
x										22	Leads K and L		Ω	

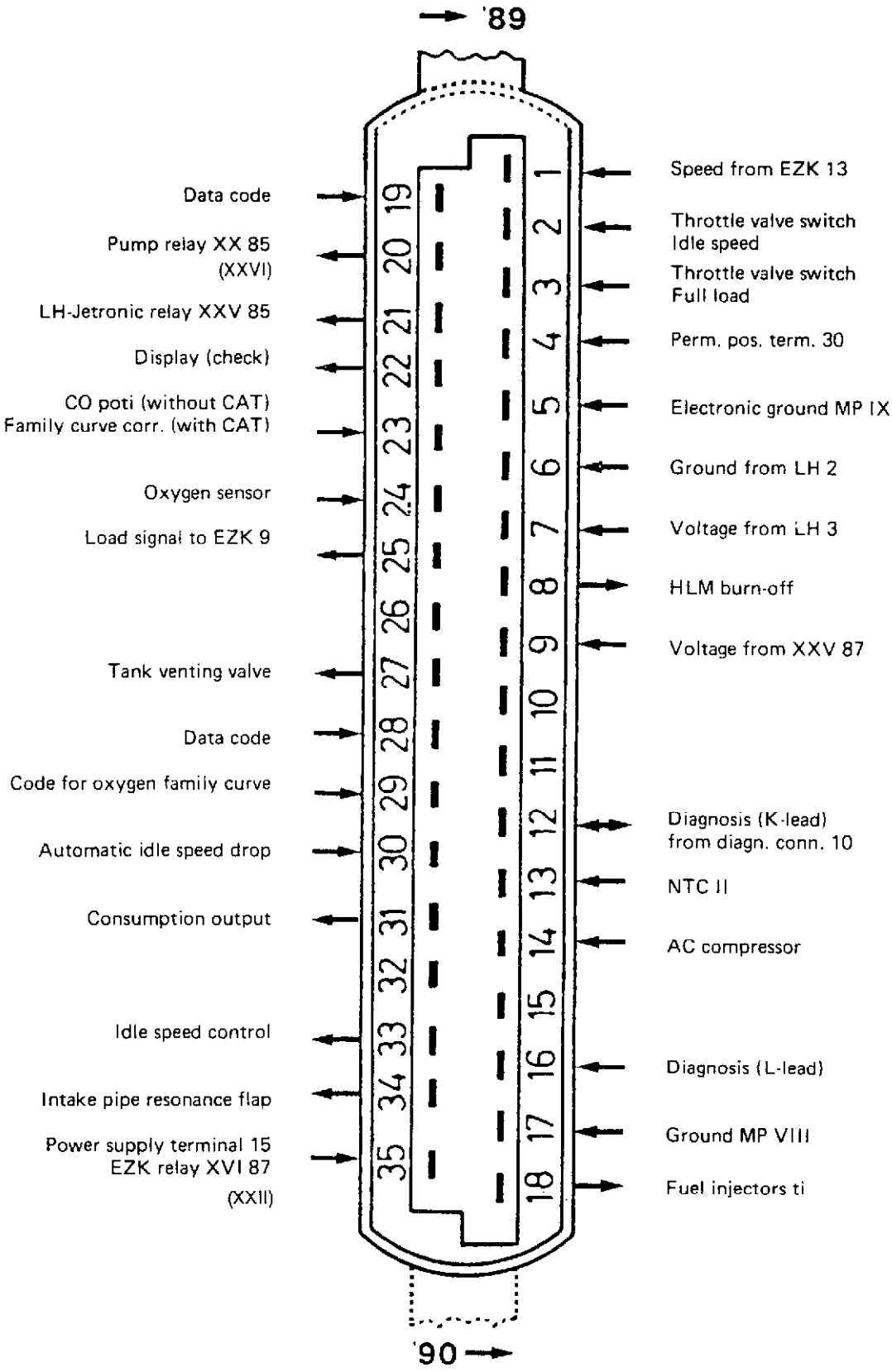
V = Voltmeter Ω = Ohmmeter ≅ = Oscilloscope

See inner page for plug terminal assignments on LH control unit

Fault memory, LH control unit, 928 S4/GT



Plug Connections LH



Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 1

Power supply voltage too high / too low
LH control unit
Fault code 1_11

If the power supply drops below 10 V or rises above q6 V, this is stored in the fault memory.

Check voltage at regulator; check plug connection and terminals for firm contact and freedom from corrosion.

Test point 2

Idle speed contact (Ω)
Short to ground
Fault code 1_12

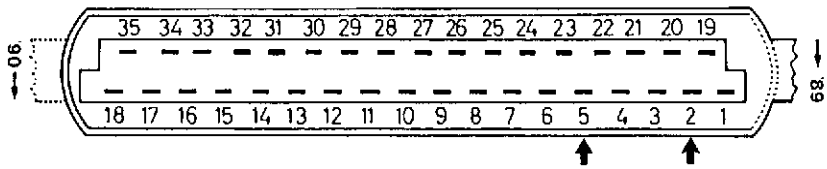
Check by means of circuit input test with 9288 system tester, or 9268 tester

Select the test step and depress the accelerator pedal.
9288 display: Idle speed contact closed
Idle speed contact open
9268 display: 1332 (idle speed contact closed)
0000 (idle speed contact open).

No display:

Disconnect plugs from EZK and LH control unit.

Connect ohmmeter betweern terminals 2 and 5, using test leads.



Display:
Throttle valve closed < 10 Ω
Throttle valve opening angle > 1° = ∞ Ω

The idle speed contact must open immediately.

pen circuit: Ignition timing at idle speed approx. 20° CS (crankshaft rotation).
No fuel cutoff when coasting, higher idle speed.

Short circuit: Fuel cutoff as engine runs up, once after every engine start. Ignition timing approx. 10° retarded.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
	If the idle speed contact values are not obtained in this test, repeat it directly at the throttle valve switch: disconnect the plug from the throttle valve switch. Connect an ohmmeter between terminals 1 and 2 of the throttle valve switch, using test leads. Display: Throttle valve closed < 10 Ω Throttle valve opening angle > 1° = ∞ Ω 
Idle speed contact (Ω) **Open circuit** Fault code 1_15	Test procedure same as for short to ground. (From 1991 models on, fault is memorized.) Check that setting is correct and adjust if necessary. Cause may be incorrectly set throttle valve switch or accelerator cable, for example.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 3

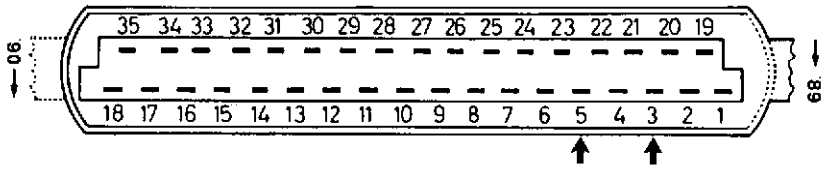
Full load contact Ω
Fault code 1_13

Check by means of circuit input test with a 9288 system tester or 9268 tester

Select test step and operate the accelerator pedal.
9288 display: Full load contact open
Full load contact closed.
9268 display: 1333 (full load contact open)
0000 (full load contact closed).

No display:

After disconnecting the EZK and LH control unit plugs, connect the ohmmeter to terminals 3 and 5 by means of the test leads.



Display:
Throttle valve closed ∞ Ω
Throttle valve after opening by approx. two-thirds of its travel < 10 Ω

If the full load contact values are not reached in this test, it should be repeated directly at the throttle valve switch:

Disconnect plug at throttle valve switch. Connect ohmmeter between terminals 3 and 2 of the throttle valve switch by means of the test leads.

Display:
throttle valve closed ∞ Ω
Throttle valve open < 10 Ω



Note:

If the full load contact failsm the control unit generates a load threshold by way of the air mass sensor. Values below thisload are the same as if the switch were open, values above it the same as if the switch were closed.

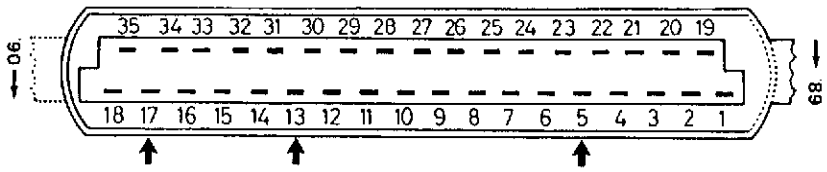
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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 4

Engine temperature sensor II Ω
Fault code 1_14

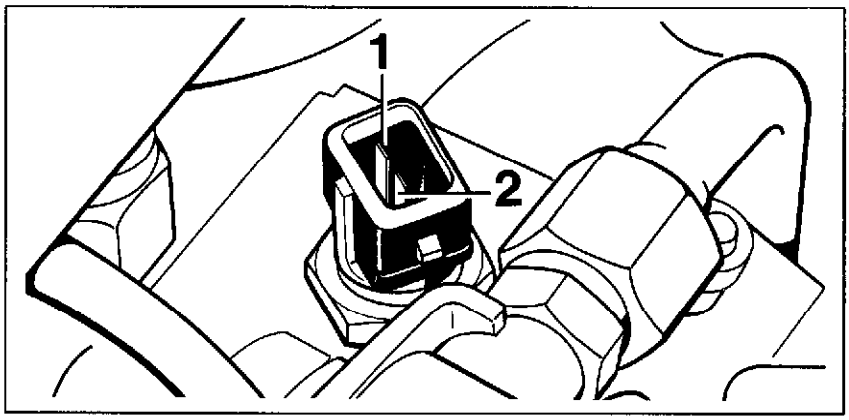
Disconnect the LH control unit plug.
Connect the ohmmeter to terminals 13 and 5 or 17 of the LH control unit plug using the test leads.



Display: resistance

Test values at:	0°C	=	4.4 - 6.8 kΩ
	15 - 30°C	=	1.4 - 3.6 kΩ
	40°C	=	1-1.3 kΩ
	80°C	=	250 - 290 Ω
	100°C	=	100 - 210 Ω

If the values are not reached, check directly at the engine temperature sensor. Do not connect both contact tabs to the ohmmeter, but chect each contact tab saeparately against ground (there are 2 independent temperature sensors).



1 - EZK
2 - LH

Note: temperature sensor II supplies the cylinder head temperature to the control unit. It is responsible for mixture enrichment during cold starts and when the engine is warming up.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
	Break (∞ Ω): The LH control unit reverts to a fixed, previously stored program. If the engine is warm, there is no mixture enrichment. If the engine is cold, however, this causes starting problems (since there is no cold-start enrichment).
	Short circuit (0 Ω): When the engine is cold it does not respond to the throttle being opened; the mixture is too weak and the engine stalls.No effect at regular operating temperature.

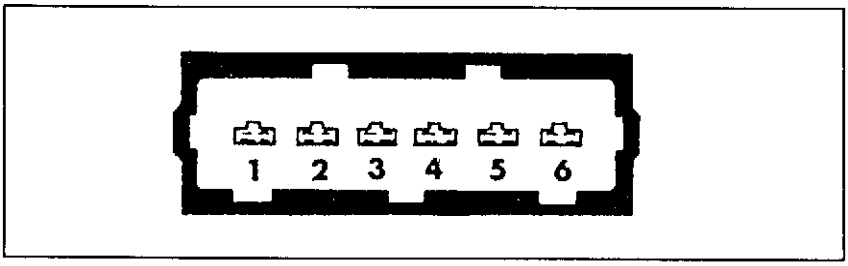
Test point 5

Air mass sensor

Fault code 1_21

a) Power supply (V)

Disconnect the plug at the air mass sensor and connect the voltmeter to plug terminals 2 and 4 using the test leads.



Use the test leads to connect terminals 17 and 21 on the LH control unit plug after it has been disconnected.
Display: battery voltage

No display:
Remove LH relay XXV and bridge terminals 87 and 30 at the relay base. Display on voltmeter connected to air mass sensor plug:
battery voltage.

If there is a battery voltage display, check the LH relay and its activation.
If there is no display, check leads and plug connections according to wiring diagram.

b) Checking resistance of hot wire circuit at the air mass sensor (Ω)

Disconnect the plug connection at the air mass sensor. Connect terminals 3 and 5 at the air mass sensor with the ohmmeter.
Display: 3.6 - 4.1Ω

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Fault, Fault Code	Possible Causes, Elimination, Remarks

c) Checking the hot wire signal (V)

Connect the plug to the air mass sensor. Take out LH relay XXV entfernen and bridge terminals 87 and 30 at the base of the relay. Connect terminals 6 and 7 at the LH control unit plug with a voltmeter.
Display: ≈ 1.6 V

Blow on the hot wire in the air mass sensor and watch the voltmeter. The voltage reading must change. **(≈ 1.6 - 5 V)**

d) Checking the hot wire burn-off circuit (visual check)

Run the engine with the air mass sensor installed and connected. When an engine temperature of > 60°C is reached, raise engine speed above 2000 min^{-1}
and then stiop the engine by switching off the ignition. After a delay of approx. 4 seconds, the hot wire must glow for approx. 1 s (burn-off function).

e) Emergency operating program

The emergency operating program stored in the LH control unit is activated if the air mass sensor fails, so that the car can be driven to the nearest authorized repair shop.

With engine warm and at engine speeds < 2000 min^{-1} ≈ 3.5 ms ti
With engine warm and at engine speeds > 2000 min^{-1} ≈ 6.3 ms ti

(ti = injection time)

Test point 6

Idle speed control (V)
Fault code 1_22

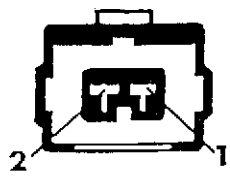
Call up actuator activation menu point

If no pulse is audible, check:

Power supply

Connect voltmeter to terminal 2 of disconnected idle speed actuator plug and ground with the test leads.
Switch on the ignition.
Display: battery voltage.
No display:

Check power supply according to wiring diagram.



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Fault, Fault Code	Possible Causes, Elimination, Remarks

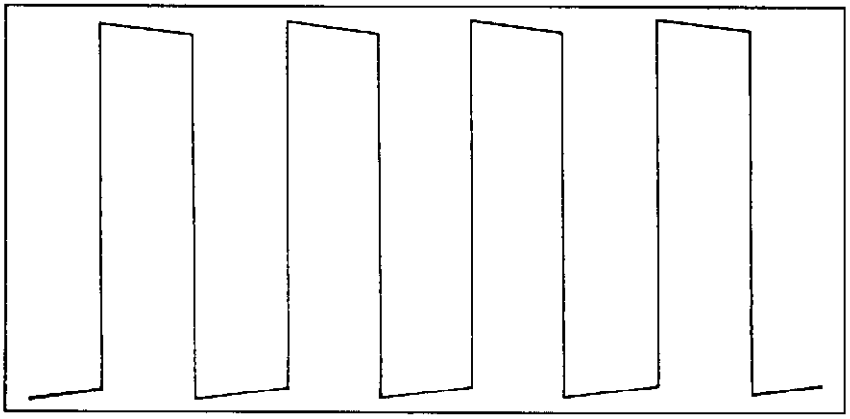
Checking the control signal

Insert 2-pin DME test lead (Bosch No. 1 684 463 093) between rotary actuator and plug connection.

Connect engine tester as stated in manufacturer's instructions, and adjust.

Make sure that there is no contact between the lead connectinos and ground on the vehicle (risk of short circuit).

With the engine running, the following display must be seen:



Frequency approx. 100 Hz.

If there is no audible pulse in spite of the power supply and the signal being present, renew the idle speed control.

Test point 7

Oxygen regulation
Control (rich)
Fault code 1_23

Mixture preparation problems are preventing the oxygen regulator from operating within its control range. It therefore moves back to its stop.

Test 1: With the engine running and a CO tester connected, note the CO content (between 0.4-1.2 %)

Too lean: check intake system (test point 19)

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 8

Oxygen regulator
Control (lean)
Fault code 1_24

Mixture preparation problems are preventing the oxygen regulator from operating within its control range. It therefore moves back to its stop.

Test 1: With the engine running and a CO tester connected, note the CO content (between 0.4-1.2 %)

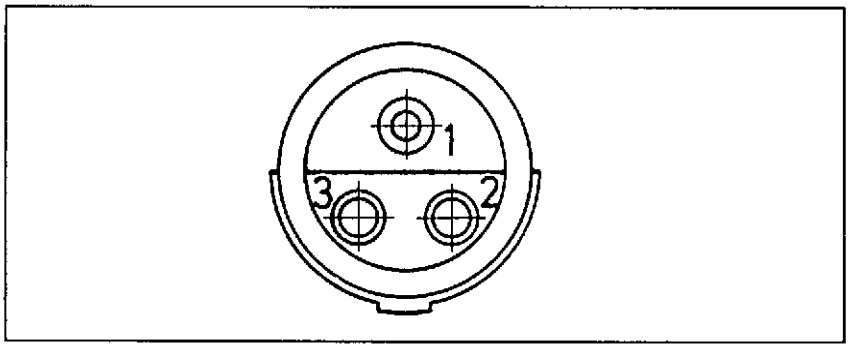
Too rich: Check fuel pressure (test point 17)
Check injector valves for leaks

Test point 9

Oxygen sensor
Open circuit
Fault code 1_25

a) Checking sensor signal (V)

Disconnect the oxygen sensor plug close to the central electrics. Connect voltmeter at the sensor end to the single plug pin and ground.



Test connection

1 = Sensor voltage
2, 3 = Sensor heating

Start the engine and warm it up so that the oxygen sensor can reach its regular operating temperature. When the mixture is richened (for example when the accelerator pedal is pressed down), the voltage signal displayed must go up.

Display on voltmeter: **0.1 - 1 V**

b) Checking the control unit

Raise engine to operating temperature. Connect the exhaust tester to the exhaust test tube. Disconnect the oxygen sensor and connect the plug sleeve to ground on the control-unit side. Watch the exhaust tester:

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Fault, Fault Code	Possible Causes, Elimination, Remarks
	The CO content must go up. **Important:** Continue this test only until a change is noted in the CO content at the CO tester. **If the control unit does not process the ground signal, check its coding (see testing plan page D24/28-8) before replacing it.**
Test point 10 **Injection circuit shut down** Fault code 1_31	The ignition circuit monitoring relay is mounted on the retaining plate for the LH and EZK control units. If an ignition circuit fails, the power supply to the injector valves is interrupted. At the same time one of the two colored LEDs integrated into the relay lights up. Injection circuit I shut down - red LED lights up. Injection circuit I shut down - green LED lights up. Fo troubleshooting, see 928 Repair Manual volume I-A, pages 28-77
Test point 11 **Defective control unit** Fault code 1_41	Renew control unit

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 12

No power supply to LH control unit (V)

a) Permanent positive supply (B+)

Connect voltmeter to terminals 17 and 4 of LH control unit plug with a test lead.
Display: battery voltage

Checking current path according to wiring diagram.

b) Power supply through LH relay XXV

At the LH control unit, connect a voltmeter to terminals 17 and 9, and run to terminal 21 (ground on body) using test leads. The LH relay must be energized.
Display: battery voltage

No display:
Check relay Relais XXV and current path according to wiring diagram.

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Test point 13: Ground connections / Plug connections

Ground connections

- Engine ground, between engine and right side of body
  under engine.
- Ground for ignition output stages above the right ignition coil.
- Ground for control units under the fuel pressure regulator and the fuel pressure vaporizer.

Are the ground connections tight and free from corrosion?
Loosen the ground points, clean them and tighten them again as specified.

Note:

Never start the engine when the body-engine ground lead is not connected.
This will destroy the control unit immediately.

Plug connections

Are all plug connections correctly wired up and not loose or corroded? Separate the plug connections. Neither the pins nor the sleeves of the plug connections must be bent or corroded.

- At the central electrics, the relays for the fuel pump, EZK and LH and
  plug W.
- At the EZK and LH control units, the 35-pin plug in each case.
- Plug connection for activating the ignition output stages (green/white lead). Above the central electrics
- At the air mass sensor, a 6-pin plug (only 5 contacts are occupied in the plug housing).
- At temperature sensor, II a 2-pin plug.
- At the engine speed reference mark sensor, a 3-pin plug (behind the air mass sensor).
- At each of the 8 injector valves a 2-pin plug (first remove the ring pipe cover).
- Knock sensor plug connections. Front sensor: plug connection at the front left, below the fuel ring pipe.
- Rear sensor: plug connection above the right fuel ring pipe at the rear.
- Hall sensor plug connection. Behind the housing for the camshaft drive gear, cylinder bank 1-4.
- Plug connection for solenoid valve to operate resonance flap (at toothed belt cover for cylinder bank 5-8).
- Plug connection, fuel tank venting solenoid (at toothed belt cover for cylinder bank 1-4, below the water hose).
- Plug connections for the output stages (on the cover, left cross-wall).

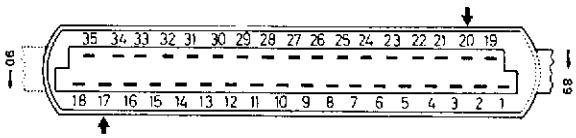
Test point 14: Fuel pump voltage (V)

Fuel pump relay XX (XXVI) is activated by the LH control unit against ground. To check fuel pump activation, connect terminals 200 and 17 at the LH control unit plug with the test leads and switch on the ignition. The relay will be energized and the pump will run.

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If the pump does not run:
Check fuse No. 42 (38). If the fuse is in good working order, remove the fuel pump relay and connect terminals 87 and 30 at the base of the relay. The fuel pump must then run.

If the pump runs, check the relay or activation circuit. If the pump does not run, examine the pipes and connections leading to the pump and the pump itself.

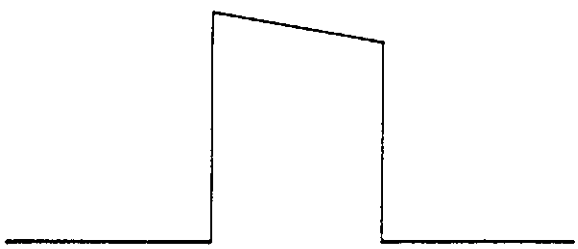


Test point 15: Engine speed signal from EZK

Important: the EZK control unit plug must be attached and the LH control unit plug detached.

At the LH control unit plug, connect terminals 17 and 1 with the engine tester leads, using the test leads.

Adjust the oscilloscope as stated by its manufacturer. Start the engine with the starter motor. A control signal must be visible on the oscilloscope.



Test point 16: Injector valves Control system (V/Ω)

If the engine can be run, pull off the injector valve plugs one after the other. If the injector valve is in good working order and combustion in that cylinder is correct, engine speed will fall.
If the engine cannot be run, check:

a) Power supply

Pull off injection valve plug (to do this, first remove the
cover over the ring pipe). Remove LH relay XXV and bridge terminals 87 and 30 at the relay base. Connect voltmeter to the valve plug contacts and ground, using the test leads.

Display: battery voltage

If no battery voltage is displayed, check the current flow path according to the wiring diagram.

b)Check injection valve coil resistances

Pull off the valve plugs. Use an ohmmeter at the injection valve connection contacts to measure the coil resistance.

Test value: approx. 16 Ω

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c) Injection output stage

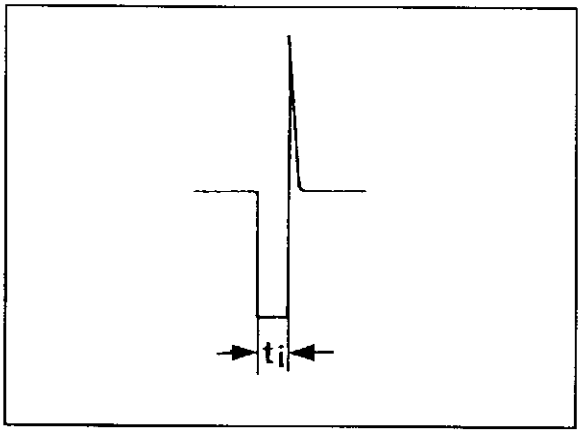
Adjust the oscilloscope in accordance with the manufacturer's instructions. Connect a Bosch test lead (1 684 463 093) between one injection valve and plug. Connect the tester lead to the test lead in accordance with the manufacturer's instructions.

Important:

Tester leads must not have any contact with ground.

Start the engine. If the injection output stage is working correctly and the tester connections are correct, the following displays must appear:

Starter speed



Note

If the engine does not start or if idle speed drops, interchange the tester connections at the test lead and check the tester setting.

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Test point 17: Fuel pressure

The fuel collection pipe has a test connection at the front right. Unscrew the cap nut of the test connection.

Warning: the ball seal inside could fall out.

Connect a P 378 or VW 1318 pressure gauge to the test connection. Start the engine and run at idle speed with vacuum at the pressure regulator.

Test pressure 3.3 ± 0.2 bar

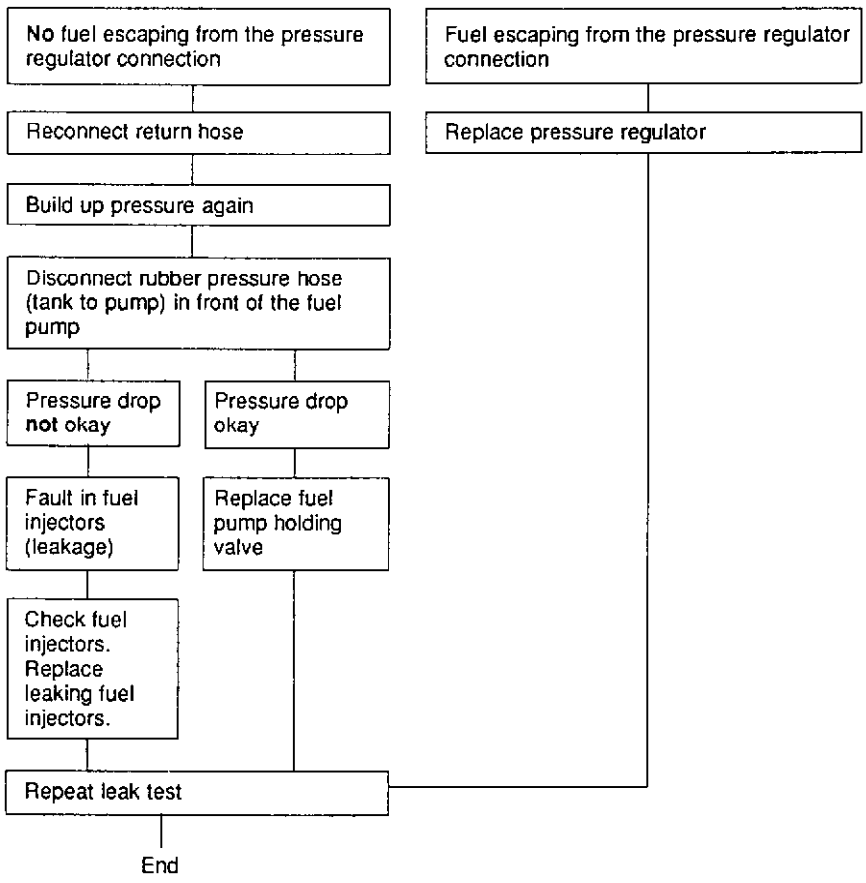
If there are hot starting problems:

Check with the engine stopped and the fuel pump running, without vacuum at the pressure regulator (to do this, remove the relay and bridge terminals 87 and 30):

Test pressure 3.8 ± 0.2 bar

- Switch off the fuel pump. Read off the pressure value at the test pressure gauge (nominal value 3.8 ± 0.2 bar).
- Maximum permissible pressure drop with engine warm: **0.5 bar in 30 minutes.**
- If pressure drops below the specified value, proceed as follows:

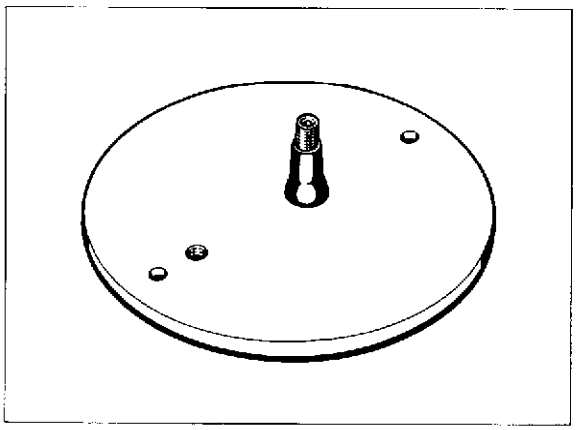
Build up pressure again by switching the fuel pump on briefly. Remove the return pipe at the pressure regulator)the fuel pump must not be switched on).



Test point 18: Intake system leaks

Check all connections after the air mass sensor for tightness and freedom from leaks.

Attach special tool 9264/1 to the air mass sensor with M 4 x 45 mm bolts and build up a pressure of 0.3 bar. If there are any leaks, pressure will drop in the intake system or air will be heard escaping..



551-24

Note

On cars with oxygen regulator, flashing fault code 1_23 (oxygen regulator at rich stop) appears if there are severe leaks in the intake system (for example the intake pipe gasket).

Test point 19: Resonance flap

In certain engine speed ranges and at not less than one-third of full engine load, the resonance flap in the intake system is opened by vacuum. It is also opened whenever the engine is started (provided that vacuum is present in the reservoir).

a) Checking function of flap

Remove the resonance flap shaft cover (rubber cover) attached above the intake pipe cluster. Using a felt marker or similar, mark a central line on the surface of the flap shaft (this makes it easier to detect opening movement).

Start the engine: **the flap will open and close again as the engine is started.**

When the engine is running, depress the accelerator pedal to the full throttle position suddenly: **the flap will open and close.**
(However, this does not happen unless the engine is running at more than 3500 rpm and at not less than one-third of its full load.)

b) Checking operation of resonance flap without running the engine: vacuum side

Detach the vacuum supply pipe from the vacuum reservoir at the solenoid valve. Check vacuum with a vacuum tester
≈ 0.6 bar.

After this, build up a vacuum of approx. 0.4 bar at the pipe to the diaphragm valve (below the intake air pipe cluster = **the resonance flap will open.**

If the flap does not open:
check diaphragm valve and supply pipe.

c) Power supply (V)

Use the test leads to bridge terminals 17 and 21 at the LH control unit plug. Use other test leads to connect temrinal 34 of the control unit plug to ground = **the resonance flap will open.**

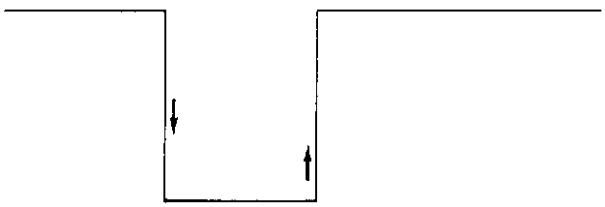
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If the flap does not open:
At the LH control unit plug, connect terminals 17 and 21 with the test leads. Separate the plug connection at the solenoid valve. Connect voltmeter to plug socket (2) and ground.
Display: battery voltage

No display:
Check power supply to solenoid valve by way of LH relay XXV according to the wiring diagram. Check that there is no break in the circuit from LH control unit terminal 34 to the solenoid.

d) Checking the control signal with the oscilloscope

Attach the LH control unit plug. Disconnect the plug at the solenoid valve. Connect the engine tester with the test leads to the sleeve side of the solenoid valve plug in accordance with the manufacturer's instructions, and adjust (bei Bosch MOT 300/400, but select screen range of 20 V). While starting the engine and if the throttle is opened suddenly when it is running, the following picture must be visible on the tester:



Test point 20: Fuel tank venting (V)

When the engine is at regular operating temperature and the throttle valve is opened (idle speed contact), the solenoid valve is activated by the LH control unit with an intermittent signal to ground. The greater the airflow at the air mass sensor, the longer the solenoid valve remains open.

a) Checking solenoid valve activation

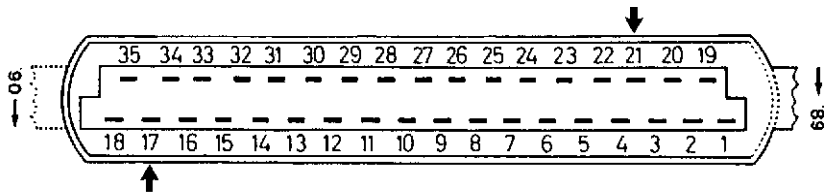
Connect terminals 17 and 21 with test leads at the LH control unit plug. Use another test lead to connect terminal 27 to ground (on body):
the solenoid valve is energized.

If the valve does not open:
Check power supply and continuity of circuit from terminal 27 to solenoid valve according to the wiring diagram.

b) Checking power supply (V)

At the control unit plug, connect terminals 17 and 21 with the test leads. Disconnect the solenoid valve plug and connect the voltmeter between the plug connection and ground with the aid of test leads.
Display: battery voltage

No display:
Check power supply through LH relay according to wiring diagram.



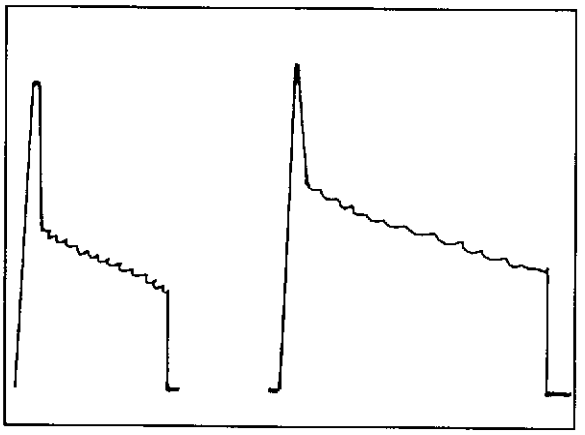
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c) Checking control signal with oscilloscope

Connect DME test lead (Bosch No. 1 684 463 093) between solenoid valve and plug connection. Connect the engine tester in accordance with the manufacturer's instructions and adjust it.

Start the engine and open the throttle slightly (the idle speed contact must open, engine temperature must be > 60°C). The following display is then obtained:

Fuel tank venting



As air flow increases, the signal broadens.

Test point 21: Alternator, regulator

Engine misfiring may be caused by alternator voltage peaks.

Remove the drive belt from the alternator and start the engine.

If this eliminates the fault, check the alternator and regulator.

Test point 22: Leads K and L

The diagnostic connectino between the LH control unit and the diagnosis testers is by way of the two leads K and L. If no diagnosis is possible, the following tests must be carried out:

1. Continuity test (refer to wiring diagram)

Lead L: Pin 7 (19-pole diagnostic socket - Pin 16 (LH plug)

Lead K: Pin 8 (19-pole diagnostic socket - Pin 12 (LH plug)

2. Ground short test (refer to wiring diagram)

Lead L: With the ignition switched on, the voltage at Pin 7 (19-pole diagnostic socket) must be > 8 V betragen.

Lead K: With the ignition switched on, the voltage at Pin 8 (19-pole diagnostic socket) must be > 8 V betragen.

Possible fault causes:

- Ground short or break in wiring or at plug connections.
- Faulty control unit connected to these leads (this may be any control unit with diagnostic capability and must not necessarily be the LH control unit).

Checking: disconnect plugs in succession at the control units with diagnostic capability until the voltage > 8 V. Renew the control unit which is causing the fault.

- Tester faulty.
- No power supply at the diagnostic plug.
- No ground at the diagnostic plug.

Notes on idle speed and CO testing at idle speed:

a) Idle speed

The 928 S4 is equipped with an adaptive idle-speed cylinder filling control. This makes it unnecessary to adjust the idle speed of any version. On cars with adaptive idle-speed cylinder filling control, system adaptation must only be carried out after disconnecting the LH control unit from thepermanent positive supply and after each inspection.

Idle speed control value with engine at regular operating temperature: GT 775 ± 25/min
S4 675 ± 25/min

b) Idle speed CO value on cars without catalytic converter

The CO level is still adjusted at the CO adjusting screw on the potentiometer. The following preconditions must be observed:

Engine at regular operating temperature

- Engine in good working order mechanically and ignition system OK
- All electrical consumers switched off
- Exhaust emission tester at operating temperature, calibrated and correctly adjusted.

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Check-Engine Lamp

(Malfunction Indicator Light M.I.L.)

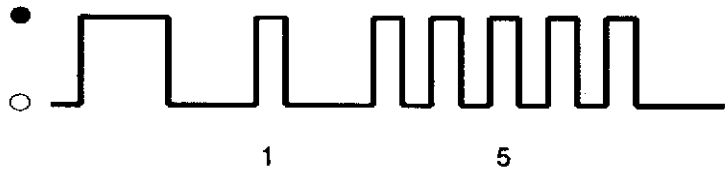
As from model year '91, Californian legislation prescribes a warning lamp which lights up if a part relevant to the exhaust gas fails.

As a function check of the warning lamp, it lights up when the ignition is switched on and goes out once the engine is running when this is started without depressing the accelerator.

The warning lamp has a flashing code to indicate a defective fault path.

To trigger off the flashing code, fully depress the accelerator pedal with the engine off and the ignition on for 3 seconds until the Malfunction Indicator Lamp flashes. Then remove foot from accelerator.

If no fault is recorded, i.e. no warning came from the indicator light, there appears the flashing code

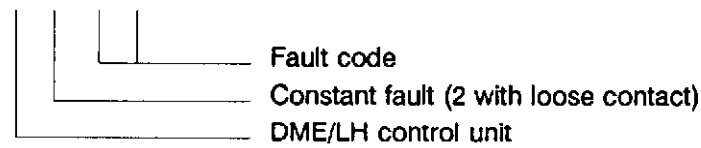


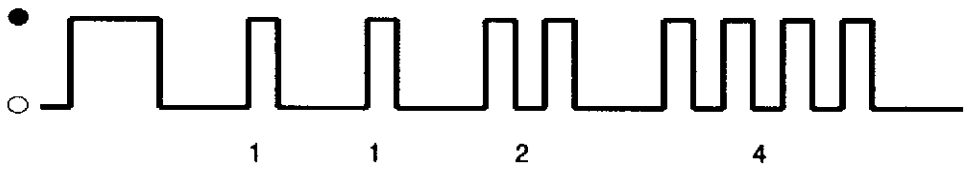
1500
no fault.

● = Lamp on O = Lamp off

If the warning light did indicate a warning, i.e. there is a fault, there appears a flashing code, e.g.

1 1 2 4





1124
Oxygen sensor

The flashing code is listed in the Diagnosing/Troubleshooting plan on page D 24/28-7.
The fault can also be read direct using System Tester 9288. After a repair the fault memory must be erased using the **System Tester**.

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Test point	Title	Page
	EZK ignition system	
	Effect of faults (checklist)	3
	Fault memory	4
	Connections to plugs, EZK control unit	4
1	Idle speed contact	5
2	Full load contact	6
3	Engine temperature sensor II	7
4	Idle and full load contact	7
5	Load signal	7
6	Transmission protection switch	7
7	Knock sensor I	8
8	Knock sensor II	9
9	Control unit (knock sensor)	9
10	Hall signal	9
11	Control unit faulty	10
12	Permanent power supply	10
13	Engine speed/reference mark transmitter	11
14	Ignition circuit monitoring	12
15	Ignition system - output stages	12
16	Leads K and L	15

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Engine mechanically OK Battery charged Starter cranks the engine	Terms in bold type = Fault memory display or fault path	Plug, Control unit	2→ 8 LH → EZK	26→18	19 →18							
Tester			Ω	Ω	Ω	Ω						≅	
Fault code 2_			12	13	14	15	21	26	31	32	33	34	41
Test point			1	2	3	4	5	6	7	8	9	10	11
Engine will not start													x
Engine hard to start													x
Irregular idling			x		x	x							
Poor pick-up					x	x	x		x	x	x	x	
Misfiring						x	x	x					
High fuel consumption			x	x	x	x	x		x	x	x	x	
Low power output				x	x	x	x		x	x	x	x	
Engine hesitation			x		x	x	x						
Poor hot starting													
Diagnosis not possible													x

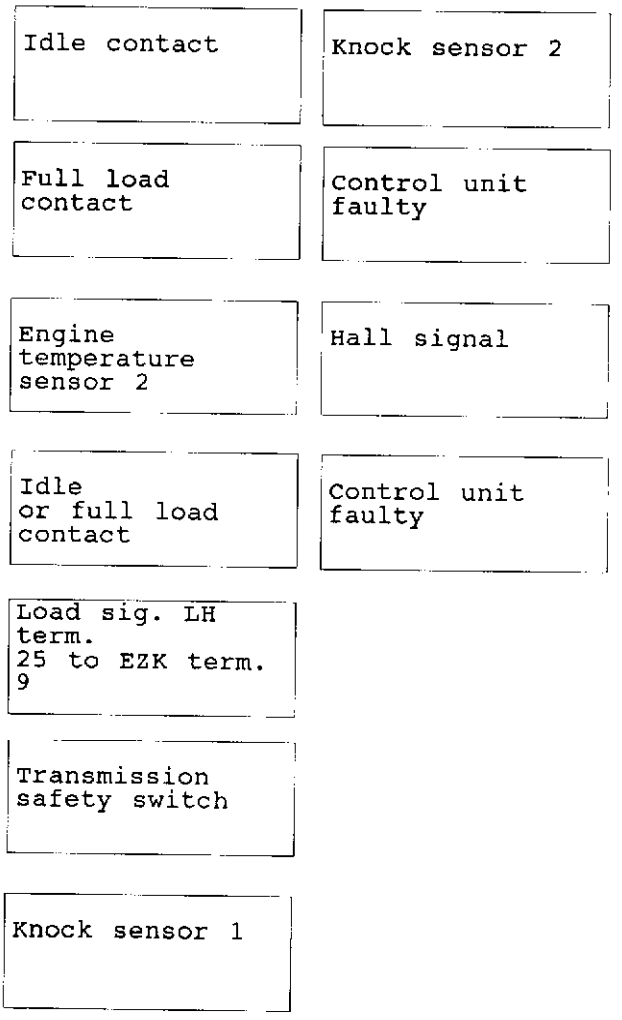
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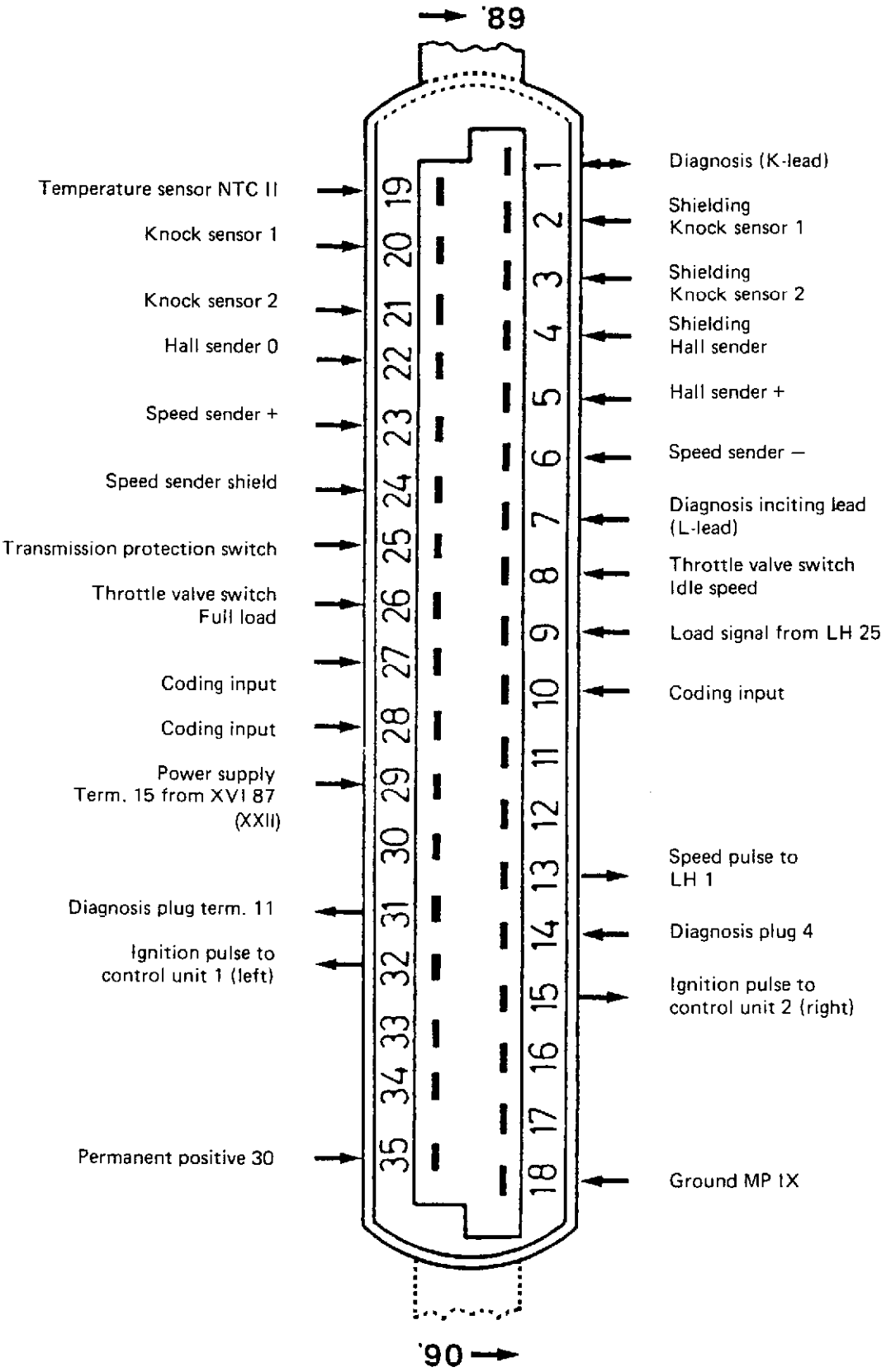
x									x	12	Power supply		V	35 → 18 29 → 18
		x			x				x	13	Engine speed reference mark sensor		≅	23 → 6
	x	x	x	x	x	x	x	x		14	Ignition circuit monitoring			
	x	x	x	x	x	x	x	x		15	Ignition system output stages		≅	
x										16	Leads K and L		Ω	

V = Voltmeter Ω = Ohmmeter ≅ = Oscilloskope

See inner page for plug terminal assignments on EZK control unit

Fault memory, EZK control unit, 928 S4/GT




'89
'90
Temperature sensor NTC II
Knock sensor 1
Knock sensor 2
Hall sender 0
Speed sender +
Speed sender shield
Transmission protection switch
Throttle valve switch Full load
Coding input
Coding input
Power supply Term. 15 from XVI 87 (XXII)
Diagnosis plug term. 11
Ignition pulse to control unit 1 (left)
Permanent positive 30
Diagnosis (K-lead)
Shielding Knock sensor 1
Shielding Knock sensor 2
Shielding Hall sender
Hall sender +
Speed sender –
Diagnosis inciting lead (L-lead)
Throttle valve switch Idle speed
Load signal from LH 25
Coding input
Speed pulse to LH 1
Diagnosis plug 4
Ignition pulse to control unit 2 (right)
Ground MP IX
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 1

Idle speed contact Ω
Ground short
Break
Fault code 2_12

Check with circuit input test, using 9288 system tester or 9268 tester
9268 tester

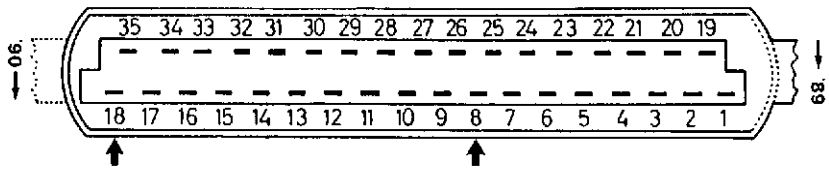
Select the test step and depress the accelerator pedal.
9288 display: Idle speed contact closed
Idle speed contact open

9268 display: 1332 (idle speed contact closed)
0000 (idle speed contact open).

If the display does not change,

disconnect the plugs from the EZK and LH control units.

Using test leads, connect ohmmeter between terminals 8 and 18.



Display:
Throttle valve closed < 10 Ω
Throttle valve opening angle > 1° = ∞Ω

If the idle speed contact values are not reached during this test, it must be repeated directly at the throttle valve switch:

Pull off plug at throttle valve switch. Connect ohmmeter between terminals 2 and 3 of the throttle valve switch, using test leads.

Display:
Throttle valve closed < 10 Ω
Throttle valve opening angle > 1° = ∞ Ω



Check that setting is correct and adjust if necessary.
Possible cause: incorrectly adjusted throttle valve switch or accelerator cable.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 2

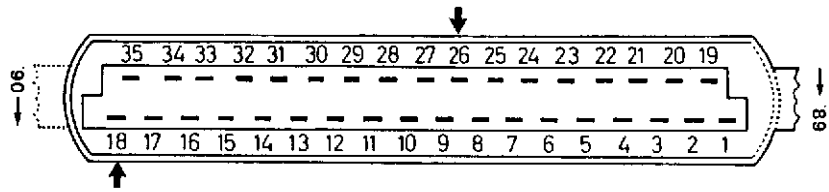
Full load contact (Ω)
Ground short
Fault code 2_13

Check by means of circuit input test with 9288 system tester or 9268 tester

Select the test step and depress the accelerator pedal.
9288 display: Full load contact open
Full load contact closed.
9268 display: 1333 (full load contact open)
0000 (full load contact closed).

No display:

Disconnect the plug from the EZK and LH control unit and connect the ohmmeter with terminals 18 and 26, using test leads.



Display:
Throttle valve closed ∞ Ω
Throttle valve open < 10 Ω

If the full load contact values are not reached during this test, repeat the test directly at the throttle valve switch:

Disconnect the plug at the throttle valve switch. Connect the ohmmeter between terminals 1 and 2 of the throttle valve switch, using test leads.

Display:
Throttle valve closed ∞ Ω
Throttle valve open < 10 Ω



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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 3

Temperature sensor II Ω
Fault code 2_14

Disconnect the EZK control unit plug.

At the EZK control unit plug, connect terminals 19 and 18 with the ohmmeter.

Test values at:	0°C	=	4.4 - 6.8 kΩ
	15 - 30°C	=	1.4 - 3.6 kΩ
	40°C	=	1 - 1.3 kΩ
	80°C	=	250 - 390 Ω
	100°C	=	160 - 210 Ω

If these values are not reached, test at the sensor in the thermostat housing. However, do not connect both contact tabs with the ohmmeter but test each plug contact at the temperature sensor separately against ground (there are two independent temperature sensors).

Test point 4

Idle or full load contact
Fault code 2_15

To identify a ground short.

Test as stated in test point 1 or 2 (EZK test plan)

Test point 5

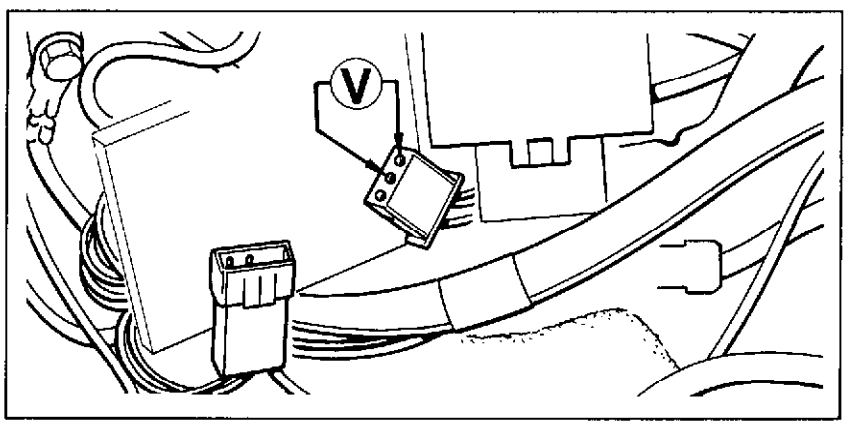
Load signal
Fault code 2_21

From LH control unit terminal 25 a lead runs to EZK control unit terminal 9 and transmits a signal representing actual load.
If a fault occurs here, check the wiring and the plug contacts. If the load signal is not present at the EZK control unit, the ignition is retarded in the part-load operating range by up to 25° CS (full load mapped zone, as protective circuit). Renew the control unit if necessary.

Test point 6

Transmission protection switch (automatic transmission only)
Fault code 2_26

To protect the transmission shift elements, the ignition is retarded during transmission shifts.
If a fault is indicated here, connect the voltmeter to the socket sleeve side of terminals 1 and 2 at the 3-pin plug in the trunk well.



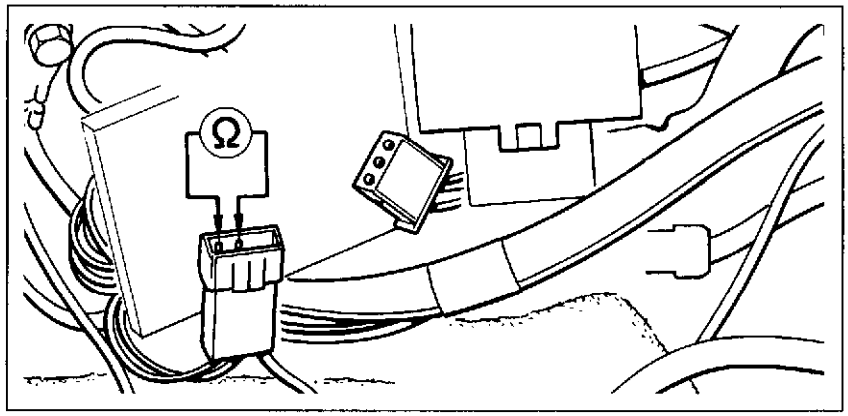
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Fault, Fault Code	Possible Causes, Elimination, Remarks

Switch on the ignition.

Display: approx. 5 V

Connect the ohmmeter to terminals 1 and 2 on the plug side



Note

The switch is checked with the engine running. Apply the handbrake and operate the foot brake. Comply with relevant safety regulations.

Display in position P or N:
∞ Ohm (switch open)

Display in position D:
< 1 Ohm (switch closed).

If these values are not reached, measure directly at the switch or renew.

Test point 7

Knock sensor I

Fault code 2_31

Knock sensor I: sensor signal is not plausible. Check:

- Knock sensor mounting (note tightening torque and type of screw)
- Wiring and plug connections according to wiring diagram Reconnect the sensors to eliminate contact resistance.
- Is any coolant or other fluid present at the knock sensors?
- Renew knock sensor

If the knock sensor is faulty, the ignition will be retarded (safety circuit).

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 8

Knock sensor II
Fault code 2_32

Knock sensor II: sensor signal not plausible. Check:

- Knock sensor mounting (note tightening torque and type of screw)
- Wiring and plug connections according to wiring diagram Reconnect the sensors to eliminate contact resistance.
- Is any coolant or other fluid present at the knock sensors?
- Renew knock sensor

If the knock sensor is faulty, the ignition will be retarded (safety circuit).

Test point 9

Control unit (knock sensor)
Fault code 2_33

This fault causes the ignition to be retarded by 6°.

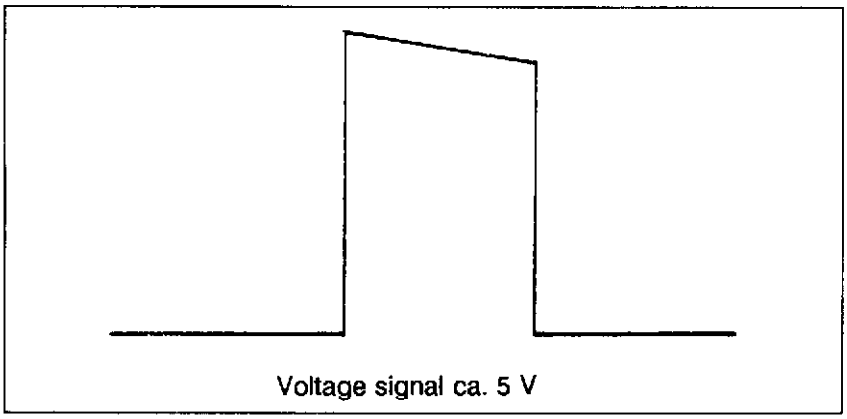
Renew the control unit.

Test point 10

Hall signal
Fault code 2_34

To check the Hall signal, disconnect the plug connections at cylinder head 1-4 behind the camshaft drive gear, and insert a 3-pole adapter lead (VW 1501) into the signal lead. Connect oscilloscope + and - test leads to terminals 1 and 2 of the adapter lead. Start the engine.

If the Hall transmitter is in good working order, the following signal must appear on the screen:



Voltage signal ca. 5 V

If the EZK control unit identifies the absence of the Hall signal, the ignition is retarded.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 11

Control unit faulty
Fault code 2_33

If this fault occurs, renew control unit

Test point 12

Permanent power supply
EZK control unit (V)

a) Permanent positive (B+)

If B+ is not present the fault memory is erased

Test procedure:

At the control unit plug, connect the voltmeter with terminals 18 (-) and 35 (+) by means of the test leads.

Display : battery voltage

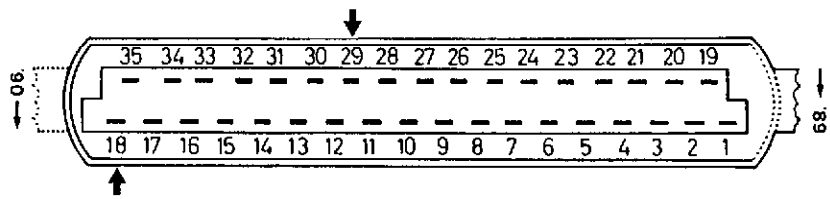
No display: check according to wiring diagram

b) Power supply through EZK relay

At the control unit plug, connect the voltmeter by means of the test leads to terminals 18 (-) and 29 (+). Switch on the ignition.

Display: battery voltage

No display: check according to wiring diagram

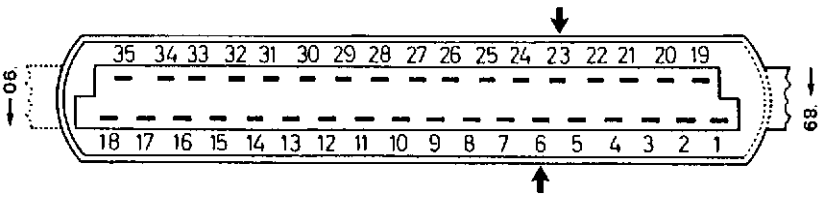


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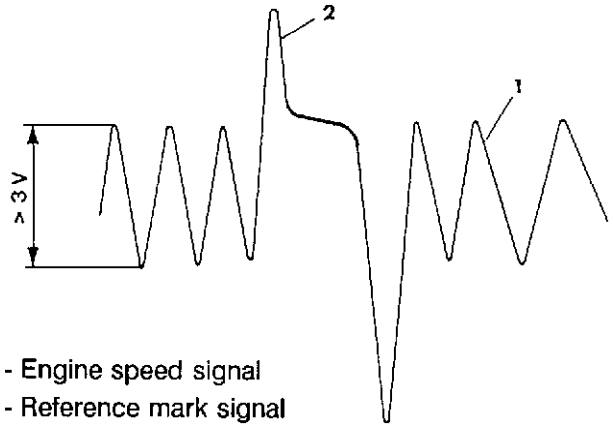
Test point 13: Engine speed / reference mark sensor

This test can only be performed with an oscilloscope. Connect up and adjust the workshop oscilloscope in accordance with the manufacturer's instructions.

Using test leads, connect the positive tester lead to control unit plug terminal 23, and the negative tester lead to control unit plug terminal 6.



Crank the engine with the starter motor. The screen must display sine waves of at least 3 V (engine speed impulses), and these must include a higher amplitude peak (reference mark).



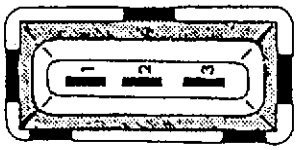
1 - Engine speed signal
2 - Reference mark signal

If the voltage signal is too low (<3 V), dirt may have affected the distance between the sensor and the gear ring.

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No display:

Disconnect the engine speed sensor plug connection at the plug strip in the engine compartment. Using test leads, connect the lead from the tester to the center and outer plug contact (terminals 1 and 2, pin side). Start the engine. The sine wave pattern must be displayed on the screen.



Engine speed sensor plug

Note

If connection 3 is grounded, the image must not change.

If it changes, check sensor for continuity, correct gap and freedom from dirt.

Test point 14: ignition circuit monitoring (refer to test point 10, LH test plan)

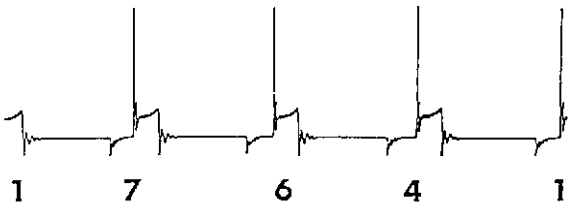
If the exhaust gas temperature changes, for instance on account of misfiring, the faulty injection circuit is shut down. The engine then runs on 4 cylinders.
An ignition circuit monitoring relay at the LH/EZK control unit controls this protective device. 2 light-emitting diodes on the relay housing show which injection circuit has been shut down. For repairs, refer to 928 Repair Procedures, volume I-A, page 28-77.

Test point 15: Ignition system - output stages

Checking ignition timing		
At idle speed	675 ± 25 1/min	10° bTDC ± 2°
928 GT	775 ± 25 1/min	10° bTDC ± 2°

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To display a secondary image at the oscilloscope, the engine tester must be switched to 4 cylinders, since the car's ignition system is divided into 2 separate ignition circuits.
Firing order:1-3-7-2-6-5-4-8



Ignition circuit I:

High-tension distributor on exhaust camshaft for cylinders 1-4:

1-7-6-4

Ignition circuit II:

High-tension distributor on exhaust camshaft for cylinders 5-8:

5-8-3-2

The high-tension power supply for **ignition circuit I** comes from the coil installed at the front right, the high-tension power supply for **ignition circuit II** comes from the coil installed at the front left.

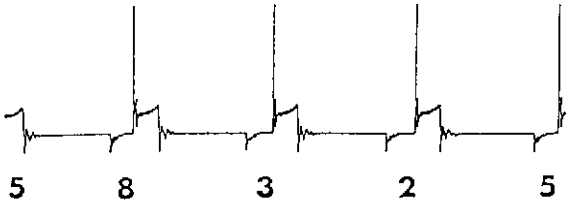
a) Connecting the engine tester

Connect and adjust the engine tester in accordance with the manufacturer's instructions (note that the 4-cylinder measuring range must be selected).

To display the ignition pattern for ignition circuit I (right side), connect the tester to the ignition lead for cylinder 1 and the front right coil.

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To display the ignition pattern for ignition circuit II (left side), connect the tester to the ignition lead for cylinder 5 and the front left coil.



Cylinders:

Note:

If a fault is indicated for all cylinders, it must be in the primary or secondary current circuit from the coil to the distributor rotor.
If the fault is indicated for one cylinder only, it must be located after the distributor rotor.

b) Resistances at coil, high-tension distributor and spark plug caps

Coil (Ω/V):

Primary resistance	
Terminals **1 + 15**	**0.4 - 0.7 Ω**
Secondary resistance	
Terminals **1 + 4**	**5 - 8.7 kΩ**
Voltage at terminal 15 with engine running	**> 10 V**

High-tension distributor (Ω):

Distributor rotor	
Suppression resistor	**1 kΩ**

Inspect for damage, tracking or oxidation.

Spark plug caps (Ω)

Suppression resistor	3 kΩ

Inspect for damage, tracking or oxidation.

c) Activating the high-tension side

To speed up troubleshooting in the ignition system, the ignitrion trigger signal can be simulated. To do this, disconnect the 2-pin connector (arrow) above the ZEL (green/white lead). **Connect plug pins with test leads.**

Connect oscilloscope tester lead terminal 4 to ignition lead terminal 4.

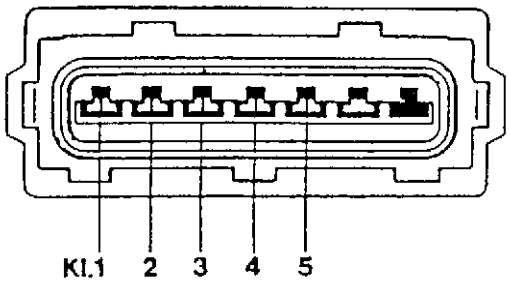
Switch on the ignition. If 12 V is applied at intervals to one of the two plug pins with the test lead, a high-tension peak should be visible each time on the oscilloscope screen (ignition trigger).

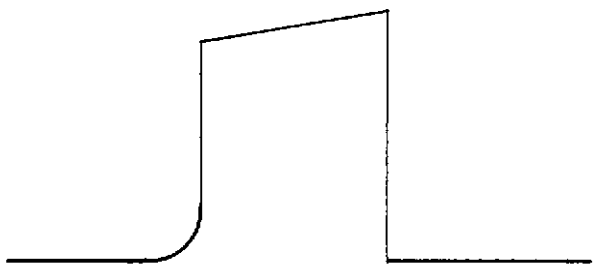
- If no signal is visible, check:
- Power supply to output stage and coil.
- Ground point for output stages (under right-hand coil).
- Plug connections at output stages, coils and high-tension distributor.
- The high-tension components (e.g. coil, ignition leads, spark plug caps ...)
- Wiring continuity from control unit plug to output stage (green lead: ignition lead I, white lead: ignition lead II).

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d) Check output stage control signal

Check at **both** (disconnected) output stage plugs.
Connect the positive tester lead to terminal 5 and the negative tester lead to terminal 2 of the disconnected output stage plug.
Crank the engine with the starter motor.
The oscilloscope must display a control signal for each output stage plug.





Test point 16: leads K and L

The diagnostic connection between the EZK control unit and the diagnosis tester is by way of the two leads K and L. If diagnosis is not possible, perform the following checks:

1. Continuity test (refer to wiring diagram)

Lead L: Pin 7 (19-pole diagnosis socket)
- Pin 7 (EZK plug)

Lead K: Pin 8 (19-pole diagnosis socket)
- Pin 1 (EZK plug)

2. Ground short test (refer to wiring diagram)

Lead L: The voltage at Pin 7 (19-pole diagnosis socket) must be > 8 V with the ignition switched on.

Lead K: The voltage at Pin 8 (19-pole diagnosis socket) must be > 8 V with the ignition switched on.

Possible causes of faults:

- Short to ground or break in wiring or plug connections.
- A faulty control unit connected to these lines (it may be any control unit with diagnosis capability, not necessarily the EZK control unit).
- Checking: disconnect plugs successively at the control units with diagnosis capability until the voltage becomes > 8 V. Renew the control unit which is causing the fault.
- Faulty tester.
- No power supply at diagnostic plug.
  No ground at diagnostic plug.

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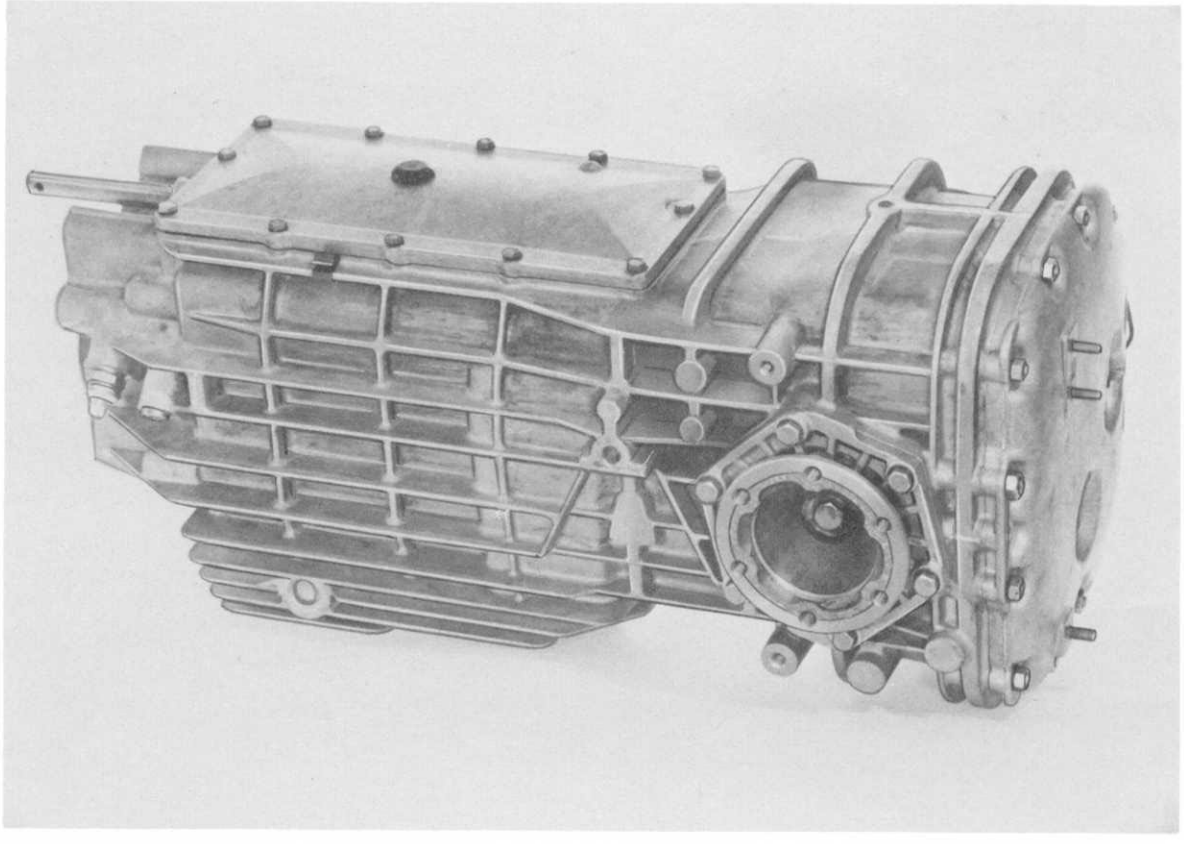
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PSD diagnosis / Troubleshooting: beginning with supplement 35, pages see voume III.

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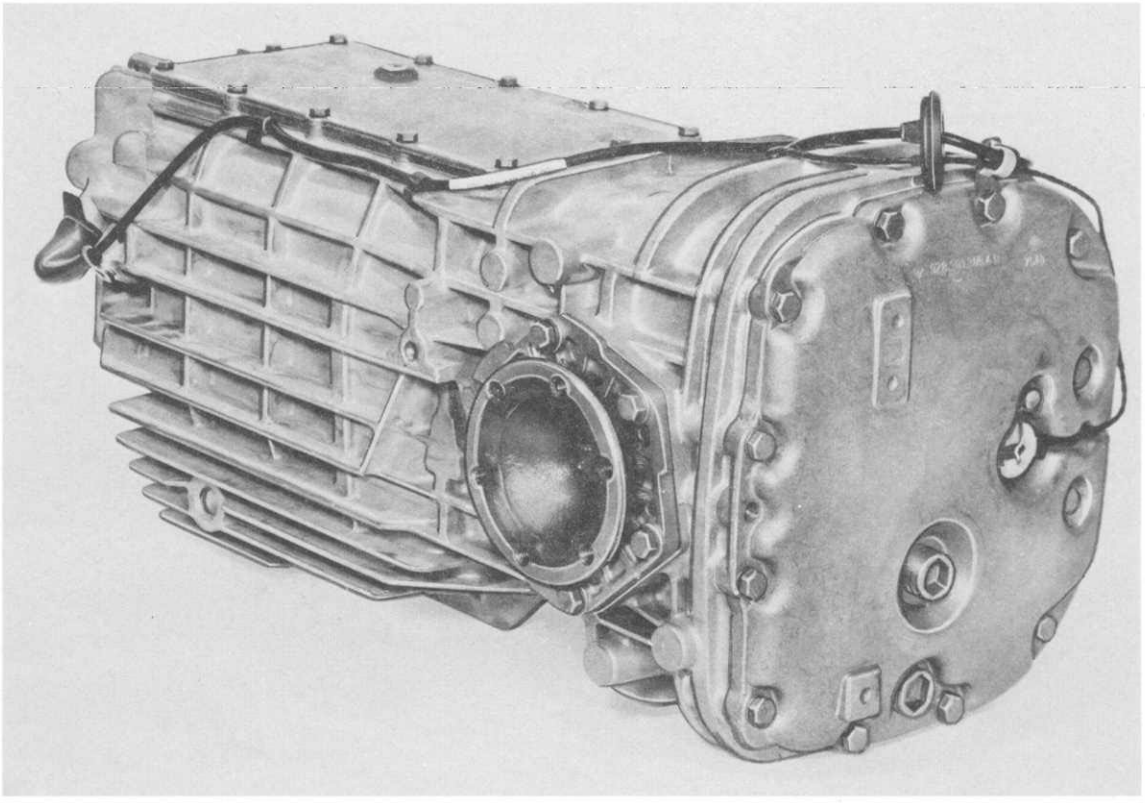
FIVE SPEED MANUAL TRANSMISSION / TYPE G 28.03



This transmission was installed worldwide in 928 cars up to June 13, 1980.

FIVE SPEED MANUAL TRANSMISSION / TYPE G 28.05

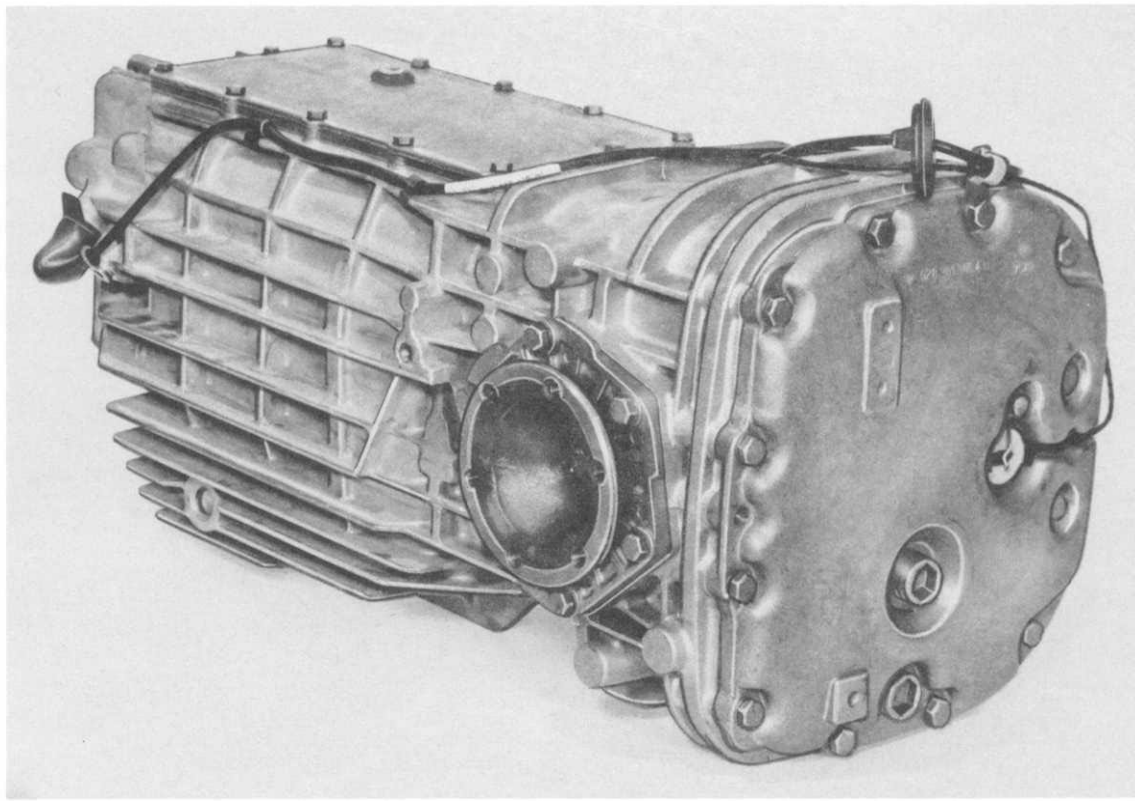
Installed in 928 cars beginning with 1981 models (June 1980)



This transmission is similar in design and repairing procedures to transmission type G 28.03, but has the following modifications.

1. Transmission moved forward by 30 mm.
2. Drive shaft longer.
3. Transmission case with modified ribs and hexagon head bolts instead of studs for the rear transmission cover.
4. Split needle bearings for loose gears.
5. Light alloy selector forks.
6. Modified pinion/ring gear (R = 70.70 mm).

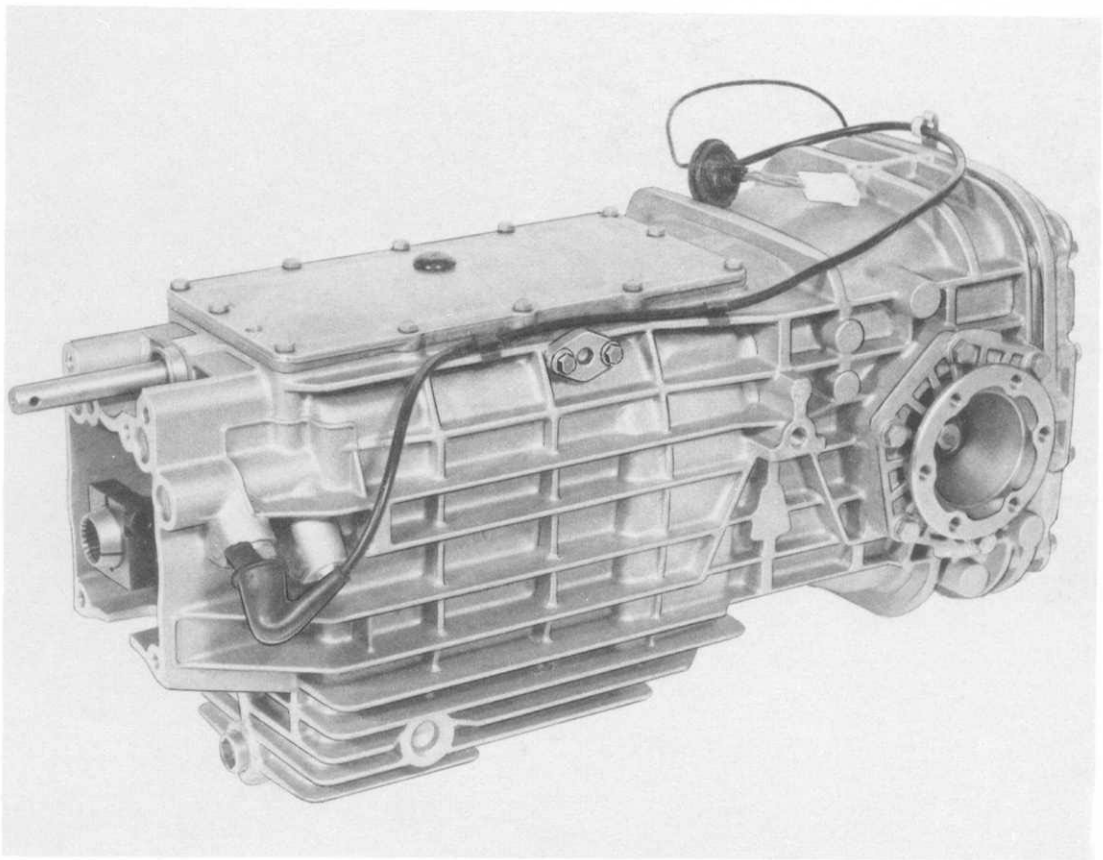
FIVE SPEED MANUAL TRANSMISSION / TYPE G 28.08



Transmission Type	Installed In
G 28.08	928 S – 1983 Model

This transmission is similar in design and repairing procedures to transmission type G 28.05, but the ratios are different (see page 30 - 06).

5-speed manual gearbox type G 28



Type	Key number	Equipment	installed in	model
G 28/10	-	5 Speed	928 S Eur./R.o.W.	1985/86
G 28/11	-	5 Speed	928 S USA	1985/86
G 28/12	-	5 Speed	928 S 4 Eur./R.o.W.	1987/88
G 28/13	-	5 Speed	928 S 4 USA/Japan	1987/88
G 28/55*	-	5 Speed	928 S 4 Clubsport 928 S4, 928 GT (worldwide)	1988 1989/90/91
G 28/57	-	5 Speed	928 GTS (worldwide)	1992/93

* Model '88 / 89 standard with limited slip differential (40%).
As of Model '90 standard with controlled limited slip differential (PSD).

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General Data	Manual transmission Type G 28/10/12/55					Manual transmission Type G 28/11/13				
Design	Direct transmission with layshaft									
Ratios*	Z_1	Z_2	i_Z $Z_2:Z_1$	i_{lay} 32:22	$i_Z \times i_{lay}$	Z_1	Z_2	i_Z $Z_2:Z_1$	i_{lay} 33:21	$i_z \times i_{lay}$
1st gear	17	44	2,5882	1,4545	3,7645	17	44	2,5882	1,5714	4,0672
2nd gear	22	38	1,7272	1,4545	2,5122	22	38	1,7272	1,5714	2,7142
3rd gear	26	32	1,2307	1,4545	1,7900	26	32	1,2307	1,5714	1,9339
4th gear	29	27	0,9310	1,4545	1,3541	29	27	0,9310	1,5714	1,4629
5th gear	direct		1,0000	direct	1,0000	direct		1,0000	direct	1,0000
Reverse gear	22 (30)	(30) 50	2,2727	1,4545	3,3056	22 (30)	(30) 50	2,2727	1,5714	3,5714
Final drive	Drive pinion without hypoid displacement									
Final drive ratio	11:30 i = 2,7272 (G28/10/55) 11:29 i = 2,6363 (G28/12)					15:33 i = 2,200				
Transmission oil	Multigrade gear lube SAE 75 W 90 API - Classification GL 5 (or MIL L 2105 B)									
Oil capacities	85 models and earlier = approx. 3,8 liters 86 models onward = approx. 4,5 liters									

* Z_1 = Number of teeth on first gear wheel in the load path of the gear concerned

Z_2 = Number of teeth on second gear in the load path of the gear concerned

i_Z = Gear ratio

i_{lay} = Layshaft ratio

General Data	Manual transmission Type G 28.57				
Type	Direct transmission with countershaft				
Ratios*	Z_1	Z_2	iz Z_2:Z1	i_{coun} 35:24	iz x i_{coun}
1st gear	17	44	2.5882	1.4583	3.7745
2nd gear	22	38	1.7272	1.4583	2.5188
3rd gear	26	32	1.2307	1.4583	1.7948
4th gear	29	27	0.9310	1.4583	1.3577
5th gear	direct		1.0000	direct	1.0000
Reverse	22 (30)	(30) 50	2.2727	1.4583	3.3143
Final drive	Bevel gear without hypoid offset				
Final drive ratio	11:30 i = 2.7272				
Transmission oil	Multigrade transmission oil SAE 75 W 90 API classification GL 5 (or MIL L 2105 B)				
Capacity	approx. 4.8 l				

* Z_1 = No. of teeth of first gearwheel in power flow of respective gear

Z_2 = No. of teeth of second gearwheel in power flow of respective gear

iz = Transmission ratio of gear

i_{coun} = Countershaft

TORQUE SPECIFICATIONS FOR MANUAL TRANSMISSION G28.10/11

Location	Designation	Thread/ lead	Material	Torque (Nm)
Oil filler and drain plug	*Threaded plug	M 24 x 1.5 M 22 x 1.5	-	22
Transmission output flange	Hex bolt	M 10 x 1,5	8.8	43
End cover to transmission housing	Hex bolt	M 8 x 1,25	8.8	22
Side cover to transmission housing	Hex bolt	M 8 x 1,25	8.8	22
Top cover to transmission housing	Hex bolt	M 6 x 1	8.8	9
Reverse gear stop to top cover	Hex bolt	M 6 x 1	8.8	9
Guide sleeve transmission housing	Hex bolt	M 6 x 1	8.8	10
Back-up light switch to housing	Back-up light switch	M 18 x 1.5	-	22
Plug to transmission housing	Plug	M 12 x 1.5	5.8	19
Selector fork to selector rod	Hex bolt	M 8 x 1,25	8.8	25

*Bolts with sealing rings from 86 models onward

Torque specification for manual transmission

Location	Description	Threads/ Pitch	class	Torque Nm (ftlb)
Cap and hexagon - nut on stud for preselector spring	Nut	M 14 x 1	-	50 (36)
Drive pinion bearing unit/ transmission case	Bolt-	M 8 x 1,25	10.9	30 (22)
Lock nut on drive pinion	Nut-	M 32 x 1,5	-	300 (217)
Ring gear/ differential housing-	Bolt-	M 12 x 1,25	12.9	165 (119)

TORQUE SPECIFICATIONS FOR MANUAL TRANSMISSION, GEAR SHIFT, CENTRAL TUBE

Location	Description	Threads/Pitch	Material	Torque Nm (ftlb)
Central tube/transmission	Bolt	M 10 x 1.5	10.9	58 (42)
Pinion bearing assembly	Nut	M 42 x 1.5	15CrNi6	280 (202)
Bearing cap/ transmission case	Bolt	M 8 x 1.25	10.9	30 (22)
Plug/locks	Plug	M 12 x 1.5	5.8	19 (14)
Upper cover/ transmission case	Bolt	M 6 x 1	8.8 12.9	9 (7) 16 (12)
Reverse gear deflector/ upper cover	Bolt	M 6 x 1	8.8	9 (7)
Ring gear	Bolt	M 12 x 1.25	12.9	165 (119)
Side cover/ transmission case	Bolt	M 8 x 1.25	8.8	22 (16)
Rear cover/ transmission case	Nut	M 8 x 1.25	8.8	22 (16)
Oil filler and drain plugs	Plug	M 24 x 1.5		22 (16)
Clamping sleeve/ drive shaft	Bolt	M 10 x 1.5	8.8 12.9	48 (35) 80 (58)
Backup light switch	Switch	M 18 x 1.5		22 (16)
Joint flange/ transmission outlet	Bolt	M 10 x 1.5	8.8	43 (31)
Bearing/internal selector rod	Bolt	M 8 x 1.25	8.8	15 (11)
Transmission mount/ transmission case	Bolt	M 12 x 1.5	8.8	85 (61)

Location	Description	Threads/Pitch	Material	Torque Nm (ftlb)
Central tube/ clutch housing	Bolt	M 10 x 1.5	8.8	43 (31)
Selector rod/ bearing assy. (selector rod coupling)	Bolt	M 8 x 1.25		25 (18)
Ball socket/ guide tube	Nut	BM 10		25 (18)
Guide tube bracket to body or central tube	Nut	M 6 x 1		9 (7)

General data	Manual transmission type G 28.03 and 28.05				
Design	Direct transmission with countershaft				
Ratios *	Z_1	Z_2	i_Z $Z_2 : Z_1$	i_{Vor} 32 : 23	$i_Z\ i_{Vor}$
1st gear	17	44	2.5882	1.3913	3.6010
2nd gear	22	39	1.7727	1.3913	2.4664
3rd gear	26	34	1.3077	1.3913	1.8194
4th gear	29	28	0.9655	1.3913	1.3433
5th gear	direct	direct	1.0000	direct	1.0000
Reserve gear	$\frac{22}{(30)}$	$\frac{(30)}{50}$	2.2727	1.3913	3.1620
Final drive	Drive pinion without hypoid offset				
Final drive ratio	12 : 33 i = 2.7500 up to Jan. 13, 1981 11 : 30 i = 2.7272 since Jan. 14, 1981				
Transmission oil	Multigrade gear lube SAE 75 W 90 API Classification GL 5 (or MIL-L-2105 B)				
Oil capacity	approx. 3.8 liters				

* Z_1 = Number of teeth on first gear meshed for selected gear

Z_2 = Number of teeth on second gear meshed for selected gear

i_Z = Gear ratio

i_{Vor} = Countershaft ratio

General Data	Manual Transmission Type G 28.08				
Design	Direct transmission with countershaft				
Ratios *	Z_1	Z_2	i_Z $Z_2 : Z_1$	i_{Vor} 33 : 20	$i_Z\ i_{Vor}$
1st gear	17	44	2.5882	1.650	4.2705
2nd gear	22	38	1.7272	1.650	2.8498
3rd gear	26	32	1.2307	1.650	2.0306
4th gear	29	27	0.9310	1.650	1.5361
5th gear	direct	direct	1.0000	direct	1.0000
Reverse gear	$\frac{22}{(30)}$	$\frac{(30)}{50}$	2.2727	1.650	3.7499
Final drive	Drive pinion without hypoid offset				
Final drive ratio	15 : 34 i = 2.2666				
Transmission oil	Multigrade gear lube SAE 75 W 90 API Classification GL 5 (or MIL-L 2105 B)				
Oil capacity	approx. 3.8 liters				

* Z_1 = Number of teeth on first gear meshed for selected gear

Z_2 = Number of teeth on second gear meshed for selected gear

i_Z = Gear ratio

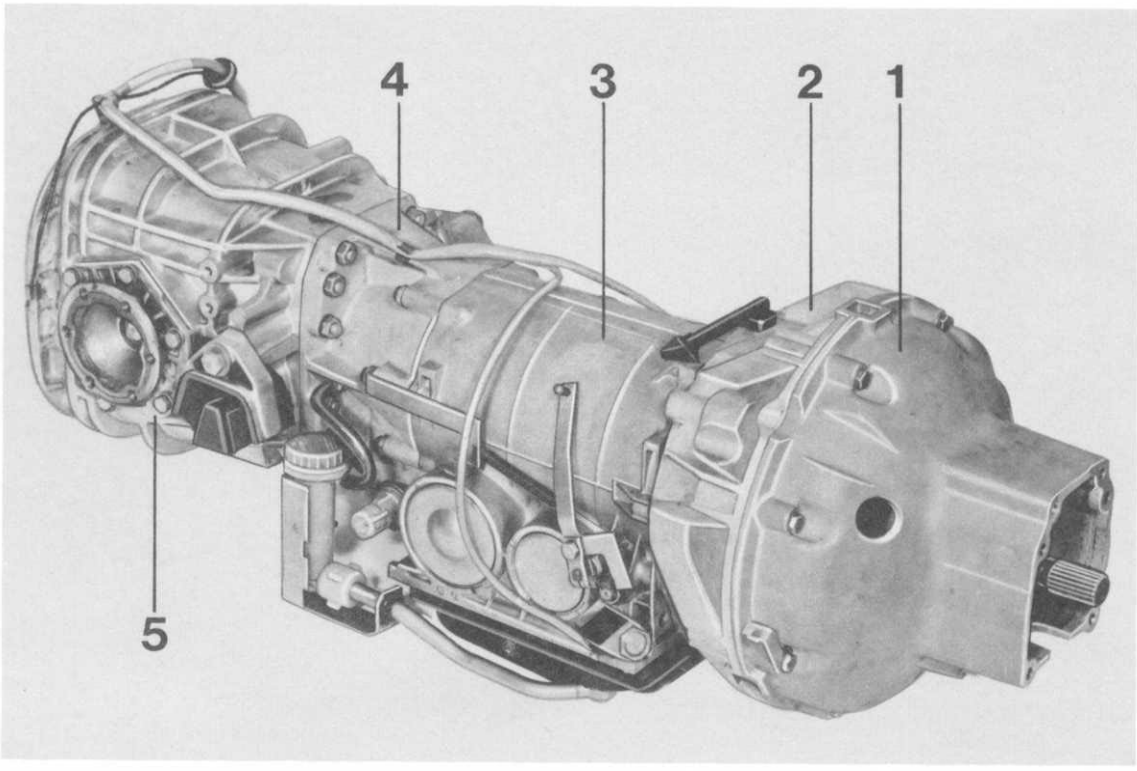
i_{Vor} = Countershaft ratio

General Data		Clutch
Design		Double disc, dry clutch with diaphragm springs, pulled version, engine end arrangement, hydraulically operated
Pressure plate	1978/1979 models	MFZ 2/215 KS ph (200 mm dia.; as spare part after depletion of stocks)
	from 1980 models	MFZ 2/200 KS ph
Spring pressure	1978/1979 models	5000 to 5700 N (1124 to 1281 lb)
	from 1980 models	5400 to 5900 N (1214 to 1326 lb)
	from 1984 models	5600 to 6200 N
Clutch disc (flywheel end)		200 mm dia.
Clutch disc (clutch end)		200 mm dia.

TORQUE SPECIFICATIONS FOR CLUTCH

Location	Description	Threads	Material	Torque Nm (ftlb)
Starter ring/interm. plate	Bolt	M 7 x 1	8.8	14 (10)
Guide tube/clutch housing	Bolt	M 6 x 1	8.8	9 (6.5)
Clutch slave cylinder	Bolt	M 8 x 1.25	8.8	22 (16)
Clamp/input shafts	Bolt	M 10 x 1.5	8.8	48 (35)
			12.9	80 (58)
Clutch housing/central tube	Bolt	M 10 x 1.5	8.8	43 (31)
Engine/clutch housing	Bolt	M 12 x 1.5	8.8	77 (56)
Clutch housing/cover	Bolt	M 8 x 1.25	8.8	22 (16)
Clutch/flywheel	Bolt	M 8 x 1.25	8.8	22 (16)
Ball stud/clutch housing	Ball stud	M 6		10 (7)
		M 8		23 (17)
Flywheel/crankshaft	Bolt	M 10 x 1.25		90 + 5 (70 + 4)

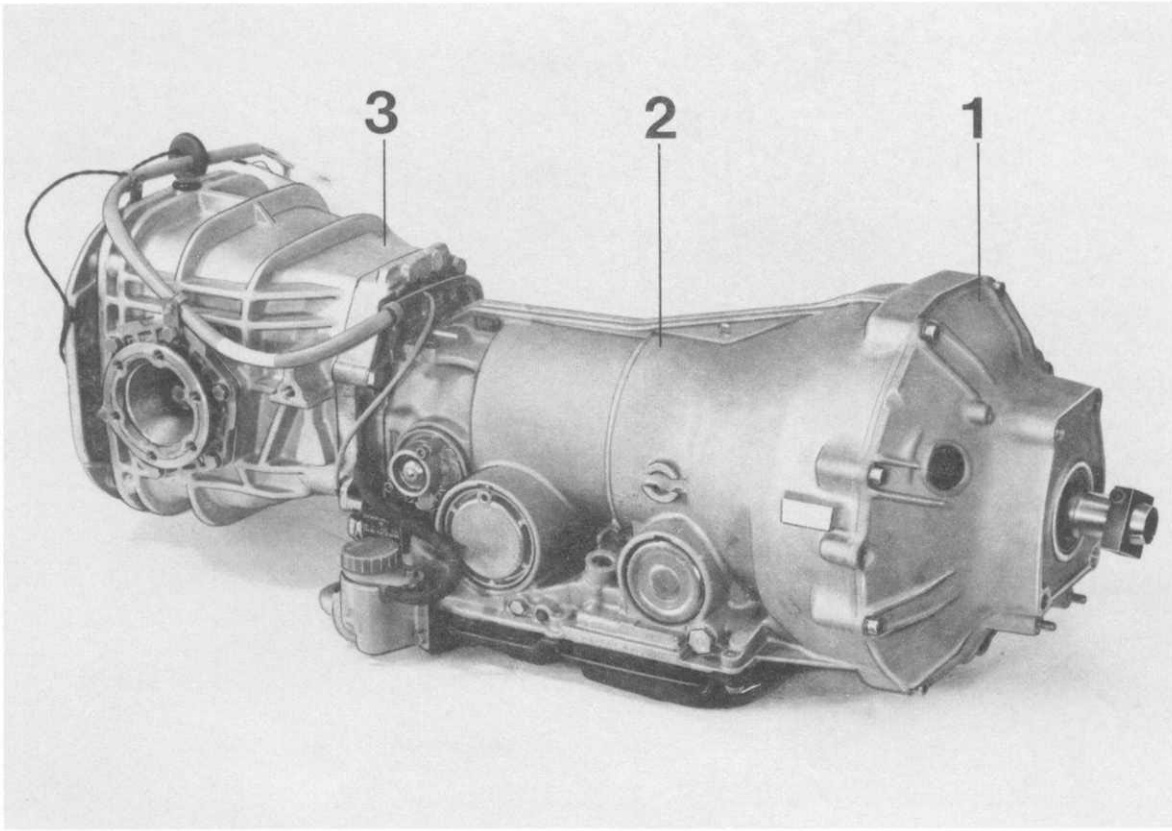
THREE SPEED AUTOMATIC TRANSMISSION



1 – Front converter housing
2 – Rear converter housing
3 – Automatic transmission
4 – Rear transmission case
5 – Final drive

Transm. Type	Installed In
A 22.01	928 – from 1980 models
A 22.02	928 – 1978/1979 models

FOUR SPEED AUTOMATIC TRANSMISSION



1 – Front converter housing

2 – Automatic transmission

3 – Final drive

Transmission Type	Installed In
A 28.01	928 S – standard from 1983 models

TORQUE SPECIFICATIONS FOR AUTOMATIC TRANSMISSION
(Central Tube and Final Drive)

Location	Description	Threads	Material	Torque Nm (ftlb)
Ring gear/flywheel	Bolt	M 8 x 1.25	12.9	32 . . . 39 (23 . . . 28)
Drive plate/flange	Bolt	M 10 x 1.25	10.9	54 . . . 64 (39 . . . 46)
Engine/clutch housing	Bolt	M 12 x 1.5	8.8	70 . . . 83 (51 . . . 60)
Clutch housing/cover	Bolt	M 8 x 1.25	8.8	19 . . . 23 (14 . . . 17)
Cover plate/cover	Bolt	M 8 x 1.25	8.8	19 . . . 23 (14 . . . 17)
Clutch housing/ central tube	Bolt	M 10 x 1.5	8.8	39 . . . 46 (28 . . . 33)
Central tube/ transmission	Bolt	M 10 x 1.5	10.9	54 . . . 64 (39 . . . 46)
Flange/central shaft	Bolt	M 10 x 1.5	12.9	80 (58)
Bolt/double clamp	Bolt	M 10 x 1.5	12.9	80 (58)
Final drive housing/ transmission case	Nut	M 10 x 1.5	8	39 . . . 46 (28 . . . 33)
Ring gear	Bolt	M 12 x 1.25	12.9	150 . . . 180 (110 . . . 131)
Side bearing cover/ final drive housing	Bolt	M 8 x 1.25	8.8	19 . . . 23 (14 . . . 17)
Joint flange/differential	Bolt	M 10 x 1.5	8.8	39 . . . 46 (28 . . . 33)
Rear cover/ final drive housing	Nut	M 8 x 1.25	8	19 . . . 23 (14 . . . 17)

TORQUE SPECIFICATIONS FOR AUTOMATIC TRANSMISSION
(Central Tube and Final Drive)

Location	Description	Threads	Material	Torque Nm (ftlb)
Bearing assembly/ rear transmission case	Bolt	M 8 x 1.25	10.9	27 . . . 32 (20 . . . 23)
Pinion/output shaft Transmission without fixed governor (see page 39 - 24 a)	Nut	M 26 x 1.5	L 35 V	200 . . . 240 (145 . . . 174)
Pinion/output shaft Transmission with fixed governor (see page 39 - 24 a)	Nut	M 26 x 1.5	L 35 V	280 (202)

General Data	Automatic Transmission Type A 22.01 and A 22.02
Design	Fully automatic, 3-speed, planetary gear transmission
Ratios 1st gear 2nd gear 3rd gear (D) Reverse (R)	 2.306 1.460 1.000 1.836
Final drive	Pinion without hypoid offset
Final drive ratio	12/33 2.750
Stall speed	2350 ± 200 rpm – 1978/1979 mod. 2470 ± 200 rpm – from 1980 models
Converter ratio	2.00
Final drive oil capacity	Approx. 2 liters/2.1 US qt of hypoid gear lube API classification GL 5 (MIL-L 2105 B) SAE 90
Automatic transmission and converter oil capacity	Approx. 6 liters/6.3 US qt total oil capacity. Approx. 5.5 liters/5.8 US qt oil change capacity including converter; ATF Dexron B

General data	Automatic transmission Type A 28.01
Design	Fully automatic four speed planetary gear transmission
Ratios: 1st gear 2nd gear 3rd gear 4th gear Reverse gear	 3.6760 2.4120 1.4360 1.0000 5.1390
Final drive	Drive pinion without hypoid offset
Final drive ratio	15 : 33 i = 2.2000
Stall speed	2200 . . . 2600 rpm
Converter ratio	i = 2.12
Oil capacity – final drive	approx. 3 liters of hypoid gear lube SAE 90 APL Classification GL 5 (MIL-L-2105 B)
Oil capacity – automatic transmission + converter	approx. 8 liters total initial amount; approx. 6.2 liters for change including torque converter; ATF Dexron B sperm whale oil free

Clutch operation

Checking clutch free travel

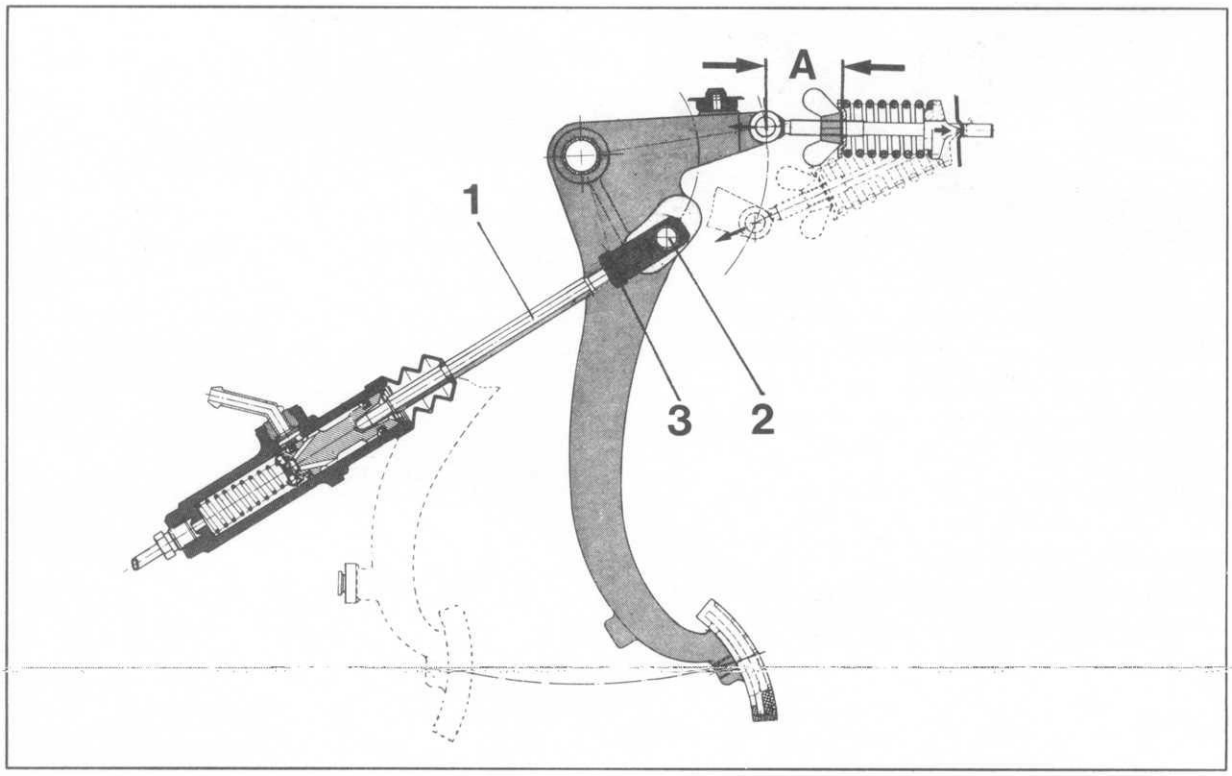
Due to the fact that the clutch is fitted with an automatic hydraulic adjuster, the clutch free travel cannot be checked at the clutch pedal. To ensure proper operation of the clutch, however, the pushrod must be adjusted correctly.

Adjusting the pushrod

Adjust for zero clearance with the pushrod (1) disengaged to allow the pushrod to be pushed over the pin (2) without any load being present. Then preload the pushrod by rotating by one turn and lock with nut (3).

Adjusting the clutch spring

To boost foot pressure, a boost spring is fitted to reduce the pedal force required. To achieve this effect, the boost spring must be preloaded sufficiently.
When measuring from the inside of the spring cup to the center of the mounting pin, dimension A must be 43 mm for vehicles up to MY '91 and 21 mm for vehicles as of MY '92 with the clutch engaged (clutch pedal at end stop).
If required, correct setting by rotating the wing nut or the hexagon nut, respectively.



30-1

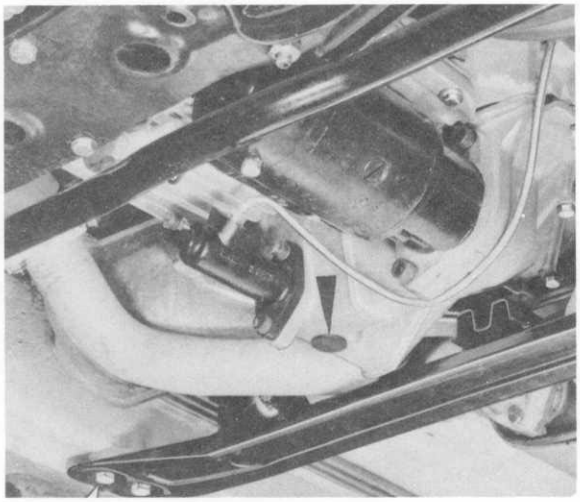
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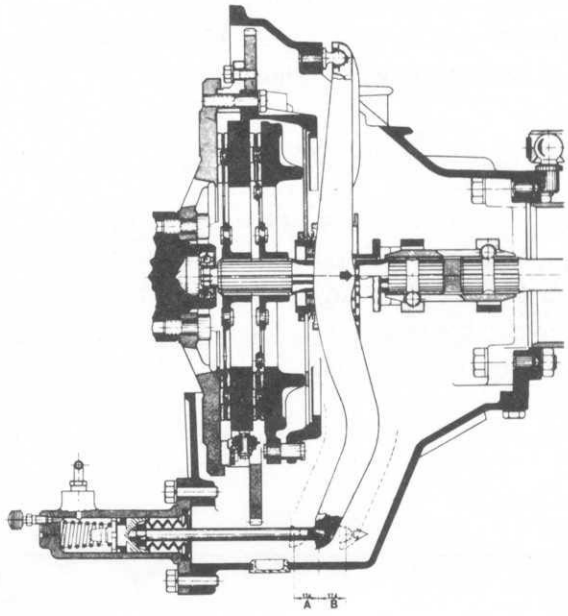
CHECKING WEAR OF CLUTCH DISCS

The amount of clutch disc wear will not be indicated at the clutch pedal because of the automatic hydraulic clutch adjustment.

Check for wear according to the following procedures.

1. Remove plug from inspection hole.





A = Wear travel of clutch 17.4 mm
B = Operating travel 17.4 mm

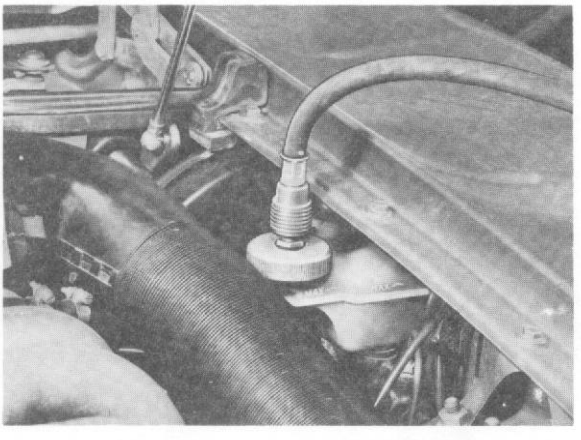
2. Visually inspect position of release lever.
   The wear limit has been reached for cars up to and including 1982 models when front edge of lever just appears in inspection hole.
   Beginning with 1983 models there were changes in starter installation and inspection hole location.
   The wear limit has been reached when front edge of lever reaches end of inspection hole.

BLEEDING CLUTCH

General Information

An electric bleeder is recommended for fast and accurate bleeding.

1. Fill tank to upper edge with brake fluid. Remove strainer. Connect bleeder.



2. Turn on bleeder and open bleeder screw on clutch slave cylinder until escaping fluid is without air bubbles. Depress clutch pedal several times during this step.

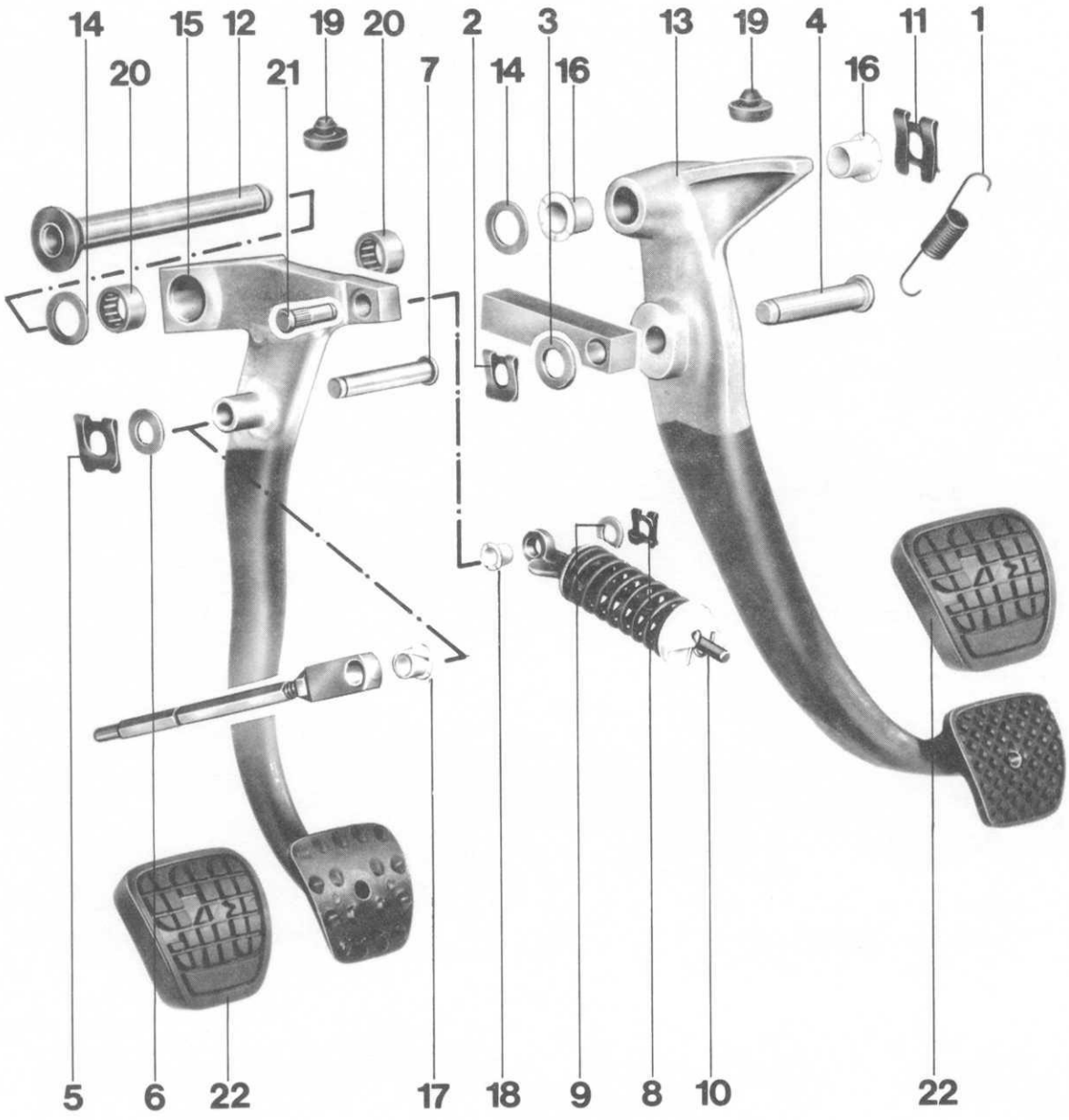
3. If necessary (air still in system/operating travel too small), unscrew slave cylinder on clutch housing. Press push rod into slave cylinder against stop and release again slowly (bleeder switched off/tank not filled to edge). This will force back remaining air into the clutch line or master cylinder/tank.

Note

Never operate clutch pedal as long as slave cylinder is removed.

4. Install slave cylinder and repeat bleeding procedures.

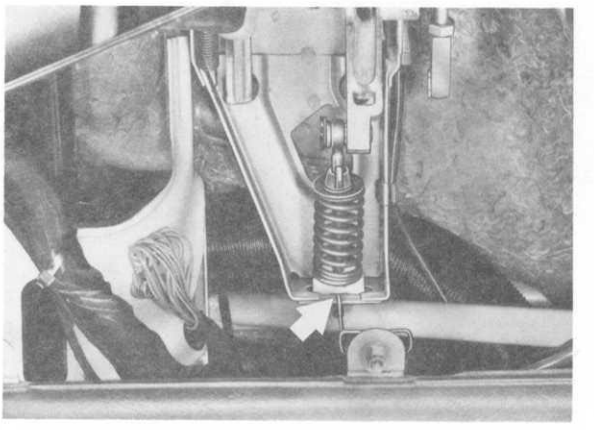
REMOVING AND INSTALLING CLUTCH PEDAL



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Return spring	1		Position correctly	The return spring (from 1982 models on) can also be used in older cars
2	Retainer	1		Replace if necessary	
3	Washer	1			
4	Shaft	1		Coat with multi-purpose grease	
5	Retainer	1		Replace if necessary	
6	Washer	1			
7	Shaft	1		Coat with multi-purpose grease	
8	Retainer	1		Replace if necessary	
9	Washer	1			
10	Guide rod/ clutch power spring assy.	1	Insert assembly wire (see page 30 - 2 e)		
11	Retainer	1		Replace if necessary	
12	Bearing shaft	1		Install with multi-purpose grease. Can only be pushed in fully when surfaces on bearing shaft and console are aligned.	
13	Brake pedal	1			Spacers (pedal adjustment) are available

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
14	Washer 1 mm thick LHD cars after 1982 models (altered clutch pedal)	2		In cars with one 2 mm thick washer (between two pedals) two 1 mm thick washers may be installed (see page 30 - 2 b)	
	Washer 2 mm thick between two pedals	(1)			
15	Clutch pedal	1			Spacers (pedal adjustment) are available
16	Bushing	2		Replace if necessary	
17	Bushing	1		Replace if necessary	
18	Bushing	1		Replace if necessary	
19	Stop (pad)	2		Replace if necessary	
20	Needle bearing	2		Press in flush, pack with all-purpose grease	
21	Shaft	1	Press out, using a suitable sleeve for support	Press in against stop	
22	Pedal rubber cover	2		Replace if necessary	

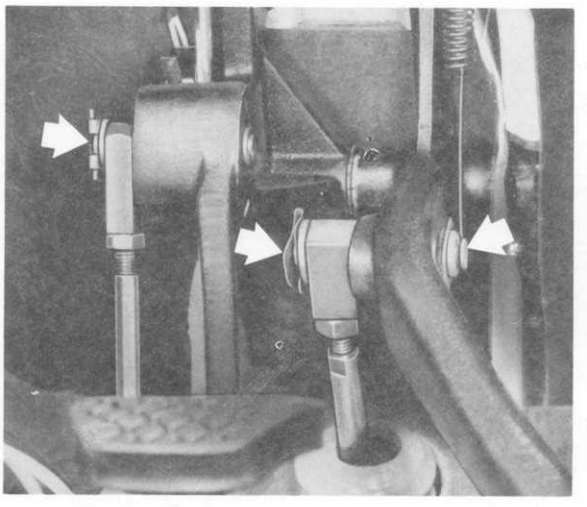
REMOVING AND INSTALLING CLUTCH PEDAL



Removing

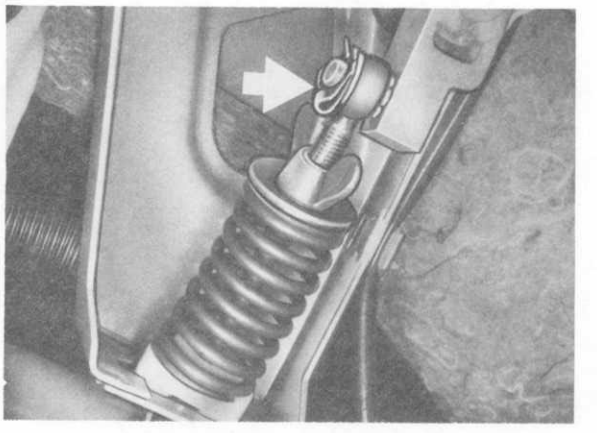
1. Move seat back and steering wheel up to make procedures easier. Remove shelf if applicable.

2. Disconnect return spring on brake pedal. Remove shafts for brake and clutch push rods.



3. The guide rod for clutch power spring has an assembly bore. Operate clutch pedal far enough (press down) until bore has cleared the bearing. Insert 3 mm dia. wire through bore (in this position) to take spring force off of pedal.

4. Remove complete clutch power spring/guide rod. This requires removing the retainer, pressing guide rod off clutch pedal and taking the assembly out of console.



5. Remove brake and clutch pedals after sliding out the bearing shaft.



Installing

1. Check needle bearing, bearing shaft, retainers, stops, all sleeves and shafts, replacing if necessary. Coat all bearing and sliding surfaces with a multi-purpose grease.

2. Install pedals.

   Note:

   Bearing shaft can only be pushed in fully, if surfaces on bearing shaft and console are aligned.

3. Place complete clutch power spring/guide rod in console and mount on clutch lever.

4. Take assembly wire out of guide rod and move clutch pedal to final stop.

5. Mount clutch and brake push rod on pedals. Connect return spring for brake pedal. Check push rod play, correcting if necessary.
   See pages 30 - 1 and 46 - 9.

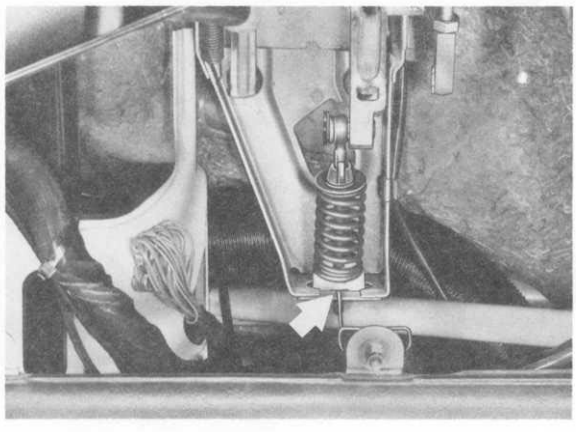
REMOVING AND INSTALLING CLUTCH SPRING

Removing

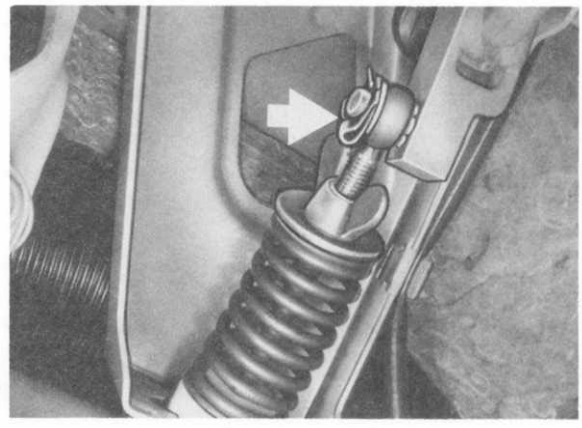
1. Move seat back and steering wheel up to make procedures easier.
   Remove tray if applicable.

2. Remove shaft for clutch push rod.

3. The guide rod for clutch power spring has an assembly bore. Operate clutch pedal enough (press down) until bore has cleared the bearing. Insert 3 mm dia. wire through bore in this position.



4. Remove complete clutch power spring/guide rod. This requires removing the retainer, pressing guide rod off of clutch pedal and taking out of console.

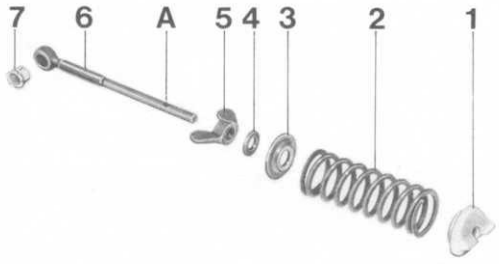


5. Release clutch power spring by turning winged nut as far as possible.

6. Remove piece of wire and take parts off of guide rod.

Installing

1. Slide clutch power spring and pertinent parts on to guide rod. Insert piece of wire.



A Assembly bore

1 Bearing

2 Clutch power spring

3 Spring retainer

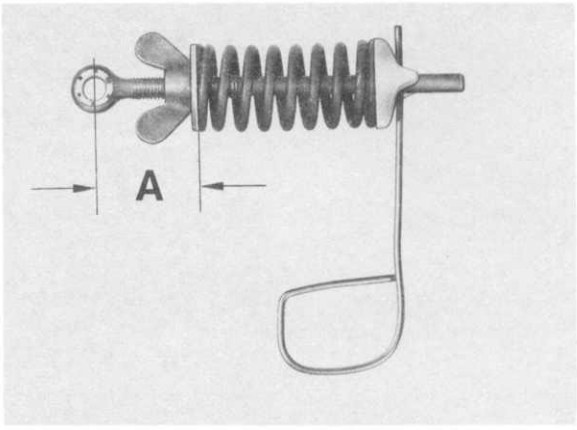
4 Washer

5 Winged nut

6 Guide rod

7 Bearing sleeve

2. Adjust clutch power spring. Distance A between inside of spring retainer and center of bearing shaft should be 43 mm*. If necessary, correct by turning the winged nut.



3. Install adjusted complete part in car and mount on clutch pedal.

4. Take piece of wire out of guide rod and adjust clutch pedal to final position.

5. Mount clutch push rod on pedal. Check push rod adjustment and correct if required.

* As of MY '92, dimension A is 21 mm. At the same time, the parts listed under item 1 have been modified.

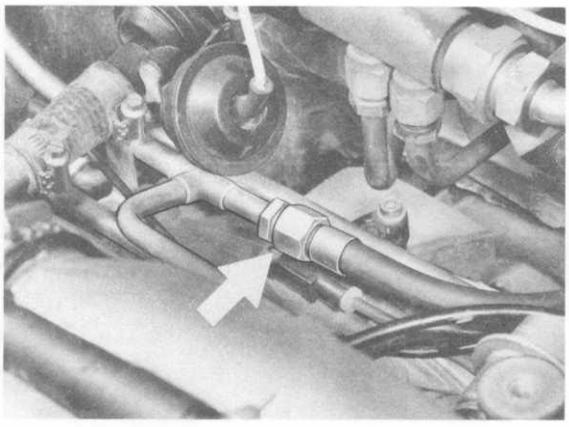
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REMOVING AND INSTALLING CLUTCH

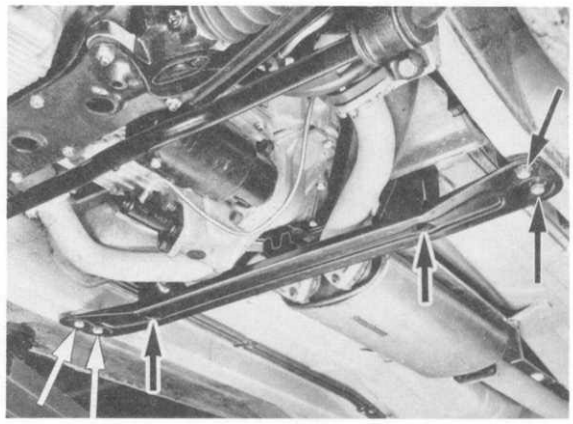
Removing

1. Disconnect ground strap at battery.

2. Jobs required additionally beginning with 1984 models:
   Remove TDC sensor on clutch housing by taking off air cleaner, loosening screw and pulling TDC sensor out of clutch housing. On cars with LH-Jetronic pull speed/ reference mark sensor for electronic ignition out of crankcase upper section while turning back and forth, after loosening the screw.



3. Remove lower body brace, if applicable.

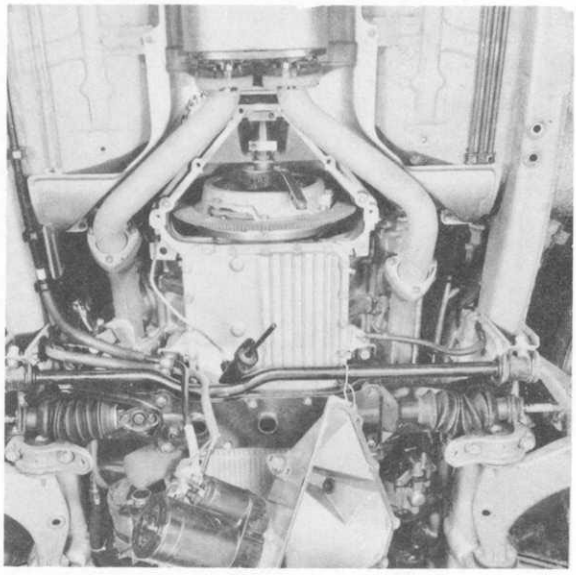


4. Unscrew clutch slave cylinder, remove clamp on clutch hose holder and take out cylinder with line connected.

Note:

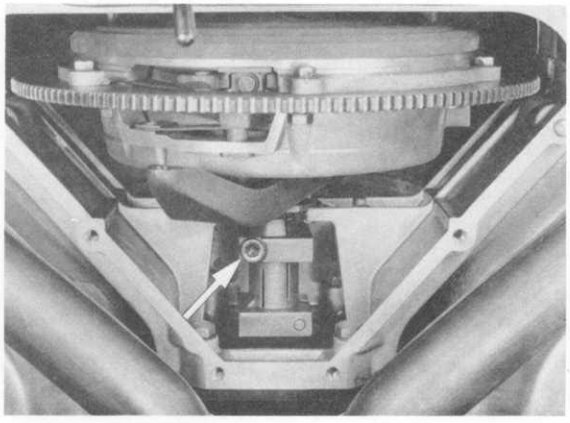
Clutch must not be operated as long as slave cylinder is removed.

5. a) Before 1983 Models
Remove cover for clutch housing with starter and suspend from stabilizer. If applicable, also remove converter (modified shape).

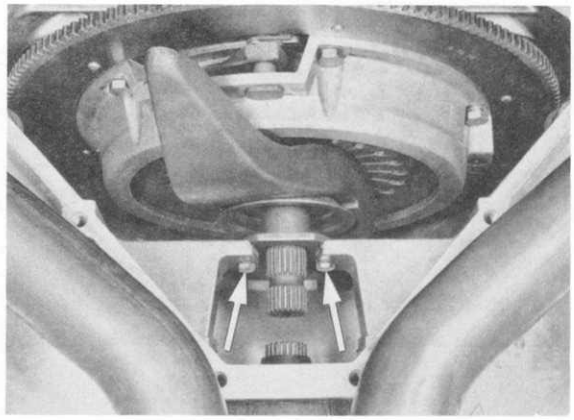


5. b) Since 1983 Models
(Modified Starter Installation)
Remove starter or loosen starter and suspend it from car.
Take off clutch housing cover.
If applicable, also remove catalytic converter.

6. Remove coupling screws and push back coupling on central shaft II. In case of long coupling, remove plug from central tube to unscrew rear bolt.

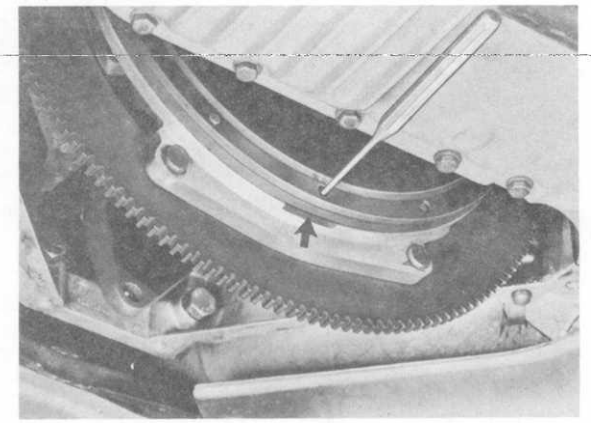


7. Remove release bearing sleeve mounting bolts and push sleeve toward flywheel.



8. Mark position of pressure plate, intermediate plate and flywheel in relation to each other for installation later.
For dowel pin centered clutches drive the cylindrical pins in direction of pressure plate with a punch far enough so that they are beyond the centering bore of the flywheel. Check visually at opening of intermediate plate (arrow).

Beginning with 1984 models one of the three centering pins is stepped (6 mm dia. in area of intermediate ring/pressure plate and 8 mm dia. in flywheel).
Consequently the intermediate ring can only be installed in a certain position to the flywheel (see intermediate ring on page 30 - 16 a).
Remove stepped centering pin (large bore in flywheel) completely.
This is only possible in direction of the flywheel.
Drive the other two centering pins in direction of pressure plate as described above, until they are beyond the centering bore of the flywheel (do not remove completely).

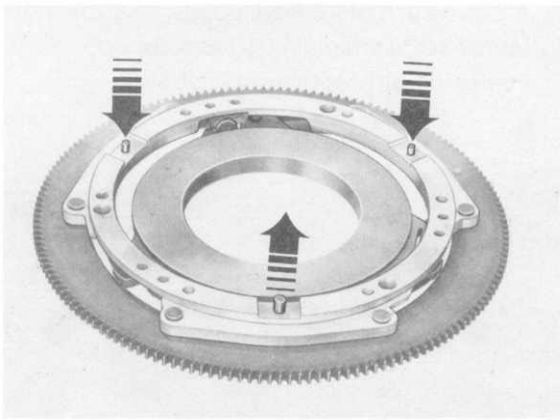


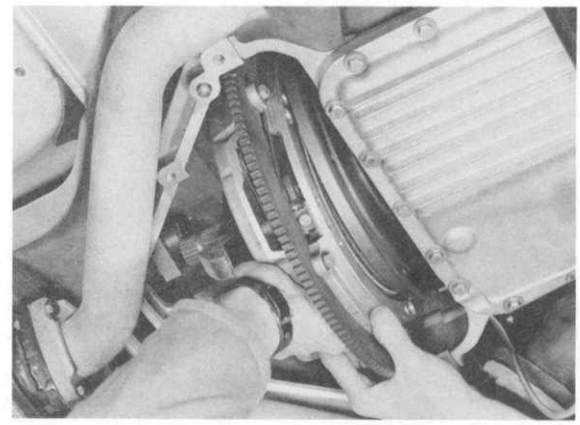
Note:

The pressure plate remains pre-loaded and removal will be easier by using 4 mm thick wire brackets (locally made) underneath the bolt heads before loosening the mounting bolts (less force required/brackets bevelled). In addition, it will not be necessary to unscrew the mounting bolts in steps of 1 to 1 1/2 turns.
Also refer to point 6 on page 30 - 6 and point 2 on page 30 - 17.

Beginning with 1984 models

10. Push back entire clutch (pressure plate, intermediate ring with starter gear ring, both clutch discs, release lever, release bearing sleeve, central shaft I) and remove downward.





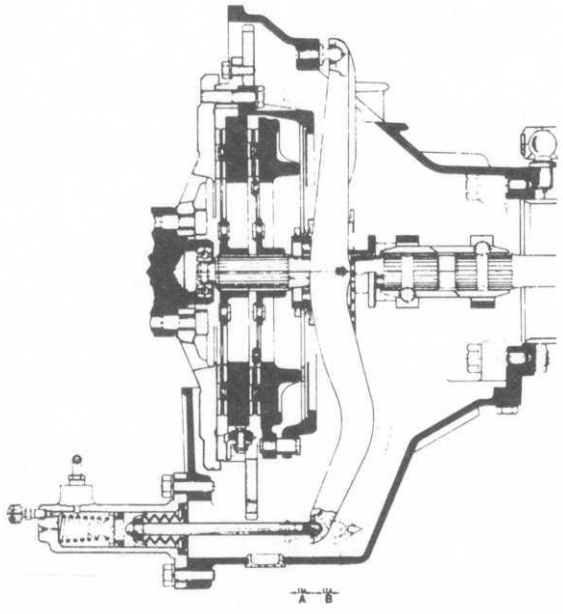
9. Unscrew the clutch mounting bolts one after the other by 1 to 1 1/2 turns until pressure is removed from the pressure plate. Disconnect release lever at ball stud, by pushing the release lever down toward the flywheel. Now remove the mounting bolts.

Installing

1. Check and, if necessary, replace clutch parts prior to installation. Also refer to "Disassembling and Assembling Clutch", "Clutch Control Ball Stud Versions" and "Checking Discs, Pressure Plate and Intermediate Plate".

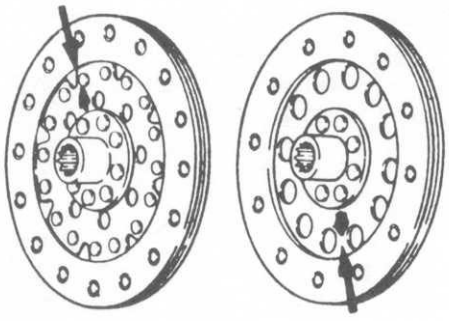
2. Prior to installation push intermediate ring at the three adjusting elements in direction of the release bearing. If applicable, pre-load clutch pressure plate (see page 30 - 17).

3. Assemble clutch (hubs of discs face release bearing, correct location of centering pins from intermediate ring for dowel pin centered clutches – see page 30 - 18). Guide clutch into clutch housing and center discs with drive shaft in grooved ball bearings of crankshaft.



Note:

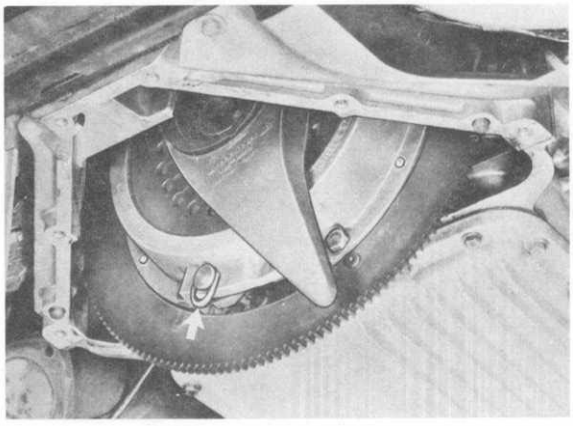
The discs are different. Disc I (sometimes marked with white paint dot) is between flywheel and intermediate ring. Disc II (larger liner springs or longer hub) is between pressure plate and intermediate ring (see page 30 - 14).
When installing discs on short central shaft make sure residual unbalance sides (yellow arrow/black side) are offset 180° opposite each other.



4. Note marks when installing pressure plate, intermediate ring and flywheel.
Guide centering pins of a dowel pin centered clutch into the flywheel.
Beginning with 1984 models guide in far enough that correct position of intermediate ring (missing centering pin) to flywheel (large bore) is given.
Insert mounting bolts.

5. On cars from 1984 models on align stepped centering pin with centering bore in intermediate ring and drive it in from the flywheel side.

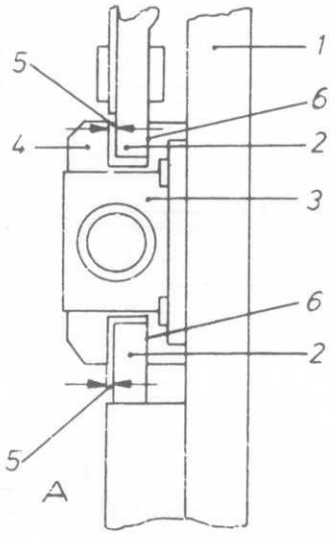
6. Screw in clutch mounting bolts uniformly until the clutch is held tight.
Make sure that central shaft I moves easily.
Then remove the clips from underneath the pressure plate bolt heads. If applicable (since 1984 models), drive stepped centering pin further against stop.



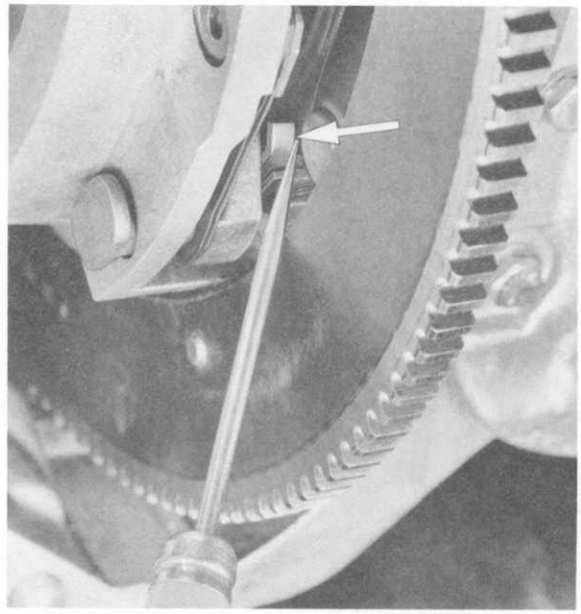
Note:

Differences in tolerances could make it difficult to guide in the dowel pin-centered clutch. Should this apply, position the centering pins as for removal in point 8. Guide in clutch and insert mounting bolts. Drive in centering pins after they have been aligned with the flywheel bores (reposition pressure plate for this purpose). After tightening the mounting bolts, drive in centering pins until they are flush with the pressure plate.

7. The forks of the stop brackets must rest on the stop of the intermediate plate on the flywheel end on both sides. This will produce a gap of 0.7 to 1.0 mm or 1.2 to 1.5 mm (see sketch). Push back the 3 forks of the stop brackets uniformly on both sides with a screwdriver (in direction of pressure plate). This alone will guarantee proper function of the clutch and stop brackets.



1 – Intermediate ring housing
2 – Intermediate ring stop
3 – Adjusting element
4 – Fork
5 – Gap of 0.7 to 1.0 mm or 1.2 to 1.5 mm
6 – Position of fork on stop
A – Release bearing side
S – Flywheel side



8. Mount release bearing sleeve.

9. Connect release lever at ball stud. Place ball stud and ball socket opposite each other and press down release lever toward the rear until the lever engages.

10. First mount coupling on central shaft I. Center bores of coupling on shafts accurately. Install cover for clutch bell housing and slave cylinder.

Note:

Location of slave cylinder piston rod can be checked through inspection hole.

11. Install lower body brace, if applicable, positioning correctly. Protruding support plate on lower body brace must face forward to cover for clutch bell housing.

REMOVING AND INSTALLING SINGLE-DISK CLUTCH

'87 MODELS ONWARD

ENGINE TYPE M 28 .41

Removing

1. Detach ground lead from battery.

2. Remove complete lower engine guard.

3. Unbolt clutch actuating cylinder, disconnect clutch hose holder from oil pan and allow cylinder to dangle with line connected.

Note:

Never depress the clutch with actuating cylinder disconnected.

4. Unbolt starter motor, withdraw and leave on bracket.

5. Unbolt exhaust flanges on left and right manifolds and detach air injector.

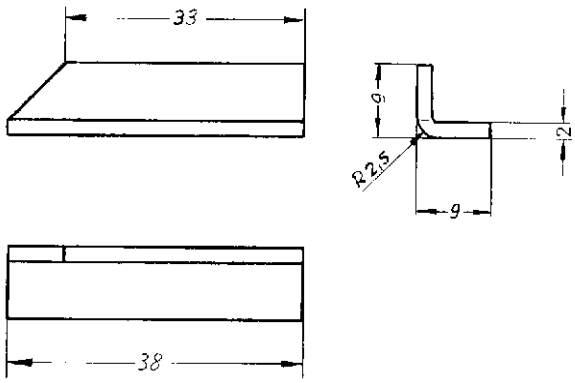
6. Remove cover from clutch housing.

7. Remove clamping sleeve cap screws and push sleeve back along central shaft II. If long clamping sleeve is fitted, remove plug in central tube to permit removal of the rear screw.

8. Remove securing screws for guide tube and push guide tube toward flywheel.

9. Disengage release lever from ball joint by pressing lever down toward flywheel.

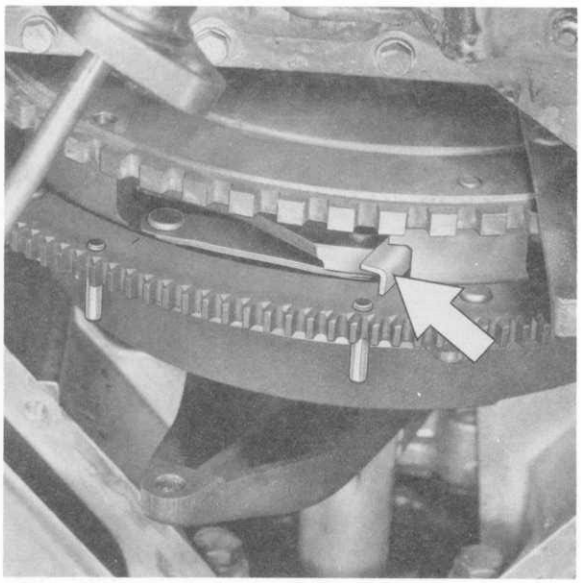
10. Fabricate three sheet-metal angles (2 mm thick), if no angles are installed.



Note:

These improvised angles are used to tension and position the genuine Porsche spare parts.

11. Insert angle in notch of pressure plate and slacken mounting bolts. Drive centering pins out of flywheel toward pressure plate.



12. Remove mounting bolts uniformly one after the other and remove pressure plate from bottom, complete with release lever, guide tube, driven plate and central shaft 1.

Note

1. The straight pins for the TDC sensor must point downward to permit removal of the complete clutch (risk of damage).

2. Lubricant "Optimoly HT" has been replaced by "Optimoly Olista Longtime 3EP". To be used on clamping sleeve, drive shaft, clutch release lever, guide tube and clutch release bearing.

3. As of Model '93, engine type **M 28.49.928 GTS**, the clutch release bearing is fitted with a plastic guide sleeve. Guide tube and guide sleeve are fitted without grease and **must not be greased either** when repairs are made in this area.

Installing

1. Install pre-loaded pressure plate with driven plate in clutch housing, center drive plate with central shaft 1 in deep-groove ball bearing of crankshaft and tighten mounting bolts 1 to 1/2 turns.

2. Fit guide tube. Make sure that the guide tube is seated correctly in the corresponding cutout in the clutch bell housing and that the entire contact surface of guide tube and clutch bell housing is in contact.

3. Engage release lever by placing ball and socket opposite each other and pressing release lever down and back until it is felt to engage.

4. Attach calmping sleeve to central shaft 1 first. Align holes of clamping sleeve on shafts.

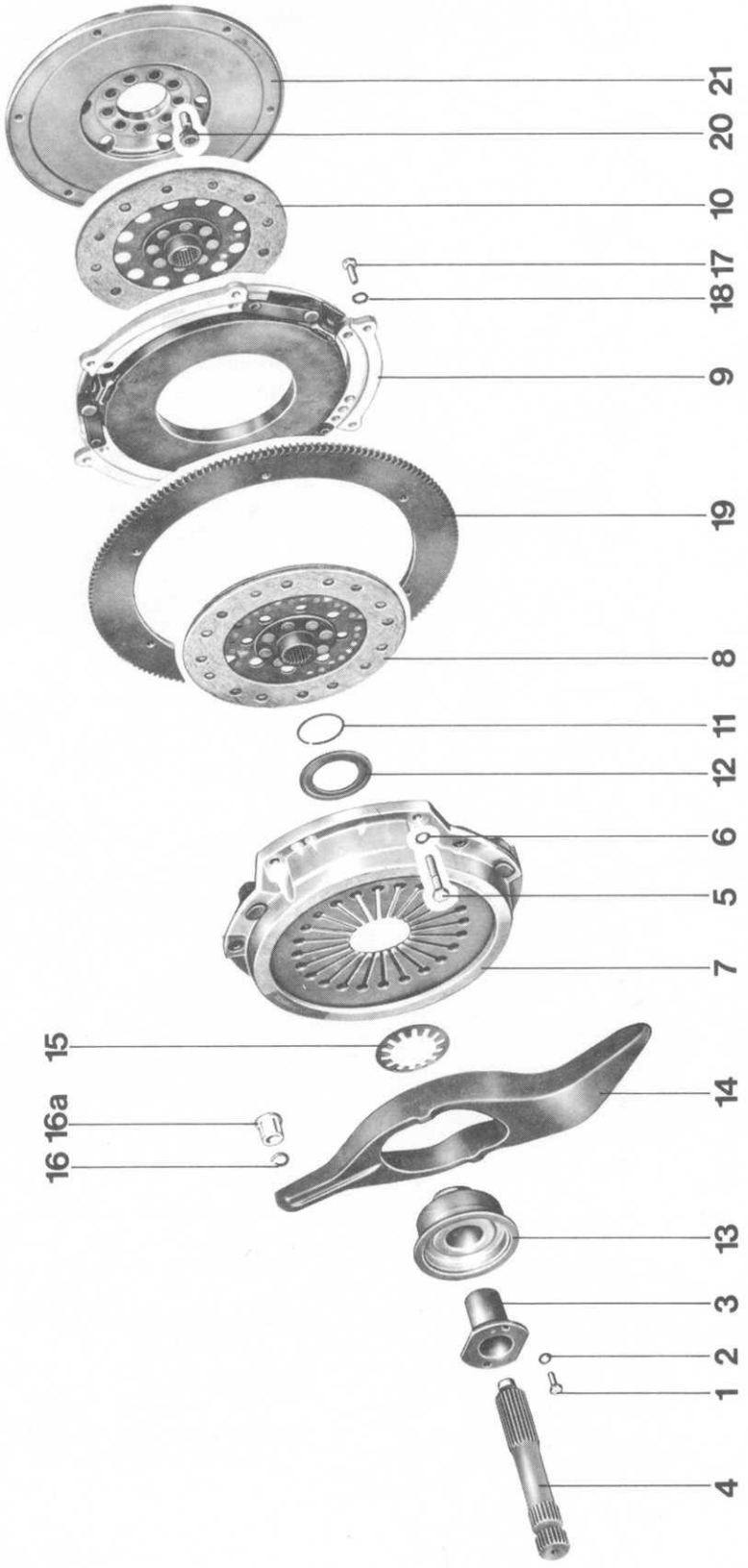
5. Uniformly tighten mounting bolts of presure plate. Tightening torque 22 Nm (16 ftlb) remove angles (3 of).

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6. Check centering pins. Using a depth gauge, measure from the rear of the flywheel (engine side) through the bore to the centering pin (approx. 4 mm).

7. Insert slave cylinder into clutch bell housing and tighten cover. Then fit slave cylinder into place.

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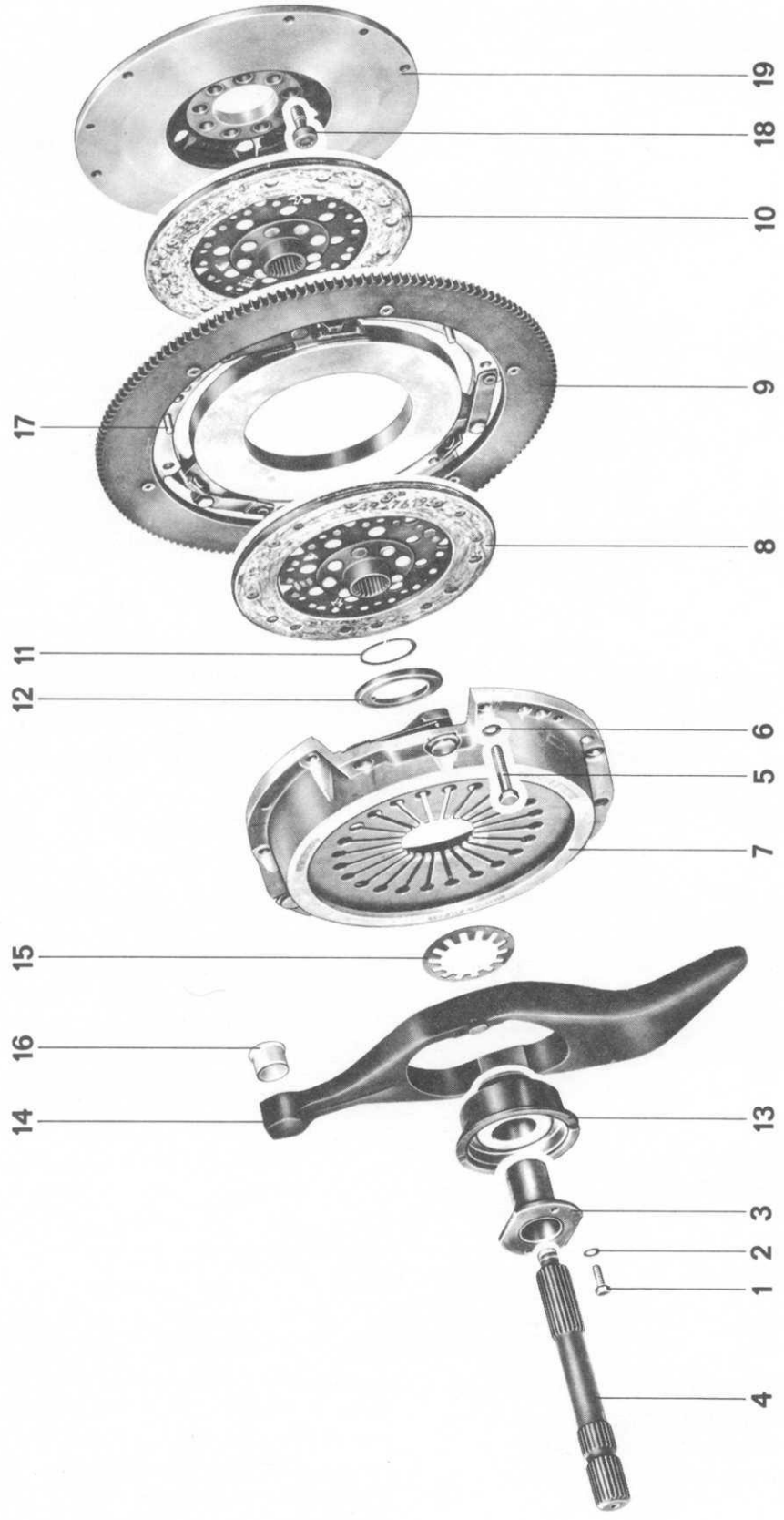
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bolt	2		Tighten to specified torque	
2	Washer	2		Replace if necessary	
3	Guide tube	1		Coat sliding surface for release bearing with MoS_2	
4	Short drive shaft	1		Thin coat of Optimoly HT on splines (use hard brush)	page 30 - 9
5	Bolt	6	Loosen one after the other by 1 to 1 1/2 turns	Screw in uniformly to specified torque. Then remove assembly clip	
6	Washer	6		Replace if necessary	
X 7	Pressure plate	1	See note	Check for wear. Lubricate pre-load washer in area no. 12 and no. 15 with Optimoly HT	
8	Clutch disc II (spring-loaded, 0.85 – 1.15 mm)	1		Inspect; thin coat of Optimoly HT on splines, watch position to no. 10	Hub length: 20 mm page 30 - 9
X 9	Intermediate ring	1	See note	Prior to installing push on 3 adjusting elements toward release bearing	
10	Clutch disc I (not spring-loaded/ or slight spring load, 0 – 0.4 mm)	1		Inspect; thin coat of Optimoly HT on splines; watch position to no. 8	Hub length: 20 mm page 30 - 9
11	Snap ring	1		Important! Install snap ring so that gap is between retainer (turning lock) on release bearing or offset to groove in new version release bearing	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
12	Thrust washer	1		Position correctly	
13	Release bearing	1		Don't wash, only wipe dry. Coat sliding surfaces for guide tube with MoS_2 and in release lever with a white lubricating paste	Note correct combination with release lever
14	Release lever	1		Coat bearing surface for slave cyl. piston rod with white solid lubricating paste and cams for release bearing with MoS_2.	Note correct combination with release bearing and ball stud
15	Washer	1		Position correctly	
16	Snap ring	1		Position correctly	Only for initial version
16A	Ball socket bushing	1		Position correctly. Coat with solid white paste (AOS 1260006). Press in with VW 421	For modified or present version
17	Bolt	6			
18	Washer	6		Replace if necessary	
X19	Starter ring	1	See note	After installing give teeth light coat of Optimoly HT	
20	Bolt	9		Torque: 90 + 5 Nm (65 + 4 ftlb)	
X21	Flywheel with centering collar	1	See note		

Note

The parts marked with a "X" in the chart have been balanced together in manufacturing and must therefore be marked when removing, to guarantee installation in same position later.

Insofar as central shaft I (928.421.235.16) is installed (only possible as from certain chassis numbers/replaces 928.423.235.13 after depletion of stocks). Identification: dull silver, when splines of clutch discs and central shaft I are not coated with Optimoly HT but instead with Optimoly Olista Longtime 3 EP.


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No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bolt	2		Tighten to specified torque	
2	Washer	2		Replace if necessary	
3	Guide tube	1		Coat sliding surface for release bearing with MoS_2	See page 30 - 13
4	Central shaft I	1		Lubricate splines with grease depending on version	See page 30 - 13 and 30 - 16 a
5	Bolt	6	Loosen one after the other and by 1 to 1 1/2 turns	Screw in uniformly and tighten to specified torque. Then remove clip	
6	Washer	6		Replace if necessary	
X7	Pressure plate with three centering bores	1	See note	Check for wear. Give preload washer light coat of Optimoly HT in area of no. 12 and no. 15	
8	Clutch disc II (spring-loaded)	1		Inspect. Lubricate splines acc. central shaft I. Watch position to no. 10	See page 30 - 13 and 30 - 16 a
X9	Intermediate ring with riveted starter ring	1	See note	Prior to installation push three adjusting elements toward release bearing. Thin coat of Optimoly HT on spline of starter ring after installation	See page 30 - 13
10	Clutch disc I (spring-loaded)	1		Inspect. Lubricate splines acc. central shaft I. Watch position to no. 8	See page 30 - 13 and 30 - 16 a

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
11	Snap ring	1		Important! Install snap ring so that gap is between retainer (turning lock) on release bearing or on new release bearings offset to groove in release bearing	
12	Thrust washer	1		Position correctly	
13	Release bearing	1		Don't wash, only wipe dry. Coat sliding surfaces for guide tube with MoS_2 and sliding surface in release lever with solid white paste	
14	Release lever	1		Coat bearing surface for slave cylinder piston rod with solid white paste	Coat contact areas for release bearing with MoS_2
15	Washer	1		Position correctly	
16	Ball socket bushing	1		Position correctly. Coat with solid white paste (AOS 1260006). Press in with VW 421	
17	Centering pin	3		Straighten or replace damaged pins. Protrusion beyond bearing surface of intermediate ring on flywheel 3.5 – 0.5 mm. Must have tight fit	
18	Bolt	9		Torque: 90 + 5 Nm (65 + 4 ftlb)	
X19	Flywheel with centering bores	1			

Note

Parts in table marked with "X" were balanced together in manufacturing and must therefore be marked prior to removing for installation in same position later (also refer to procedures).

CHANGES ON CLUTCH/ INSTRUCTIONS FOR REPLACEMENTS

Clutch discs with symmetric liner springs and a longer hub were introduced as from December, 1980 in standard production to improve engaging behavior.
In conjunction with this changes were also necessary on the clutch intermediate ring, central shaft I and release bearing tube.
From 1984 models on cars have a separate test connection to check the ignition timing. This changed the dowel pin centering of the clutch in such a manner that the intermediate ring can now only be installed in correct position to the flywheel.

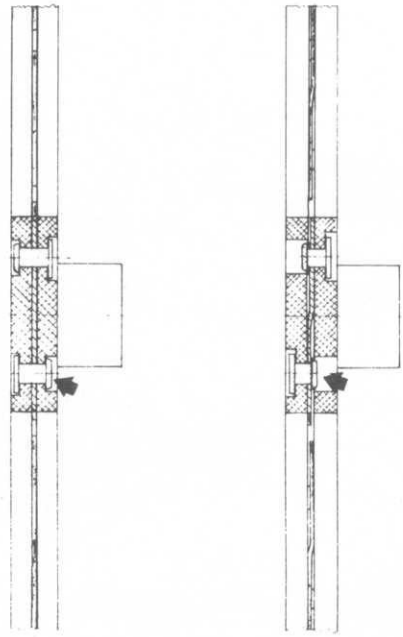
Survey of Changed Parts

Description	Up to Dec., 1980	Changed/Presently
Clutch disc I (front)	928.116.011.23	928.116.011.27 or 928.116.011.33
Clutch disc II (rear)	928.116.011.24	928.116.011.28 or 928.116.011.34
Intermediate ring	928.116.033.17	928.116.033.22 since 1984 mod. 928.116.033.26
Central shaft	928.421.235.12	928.421.235.13 or 928.421.235.16
Release bearing tube	928.116.087.11	928.116.087.13

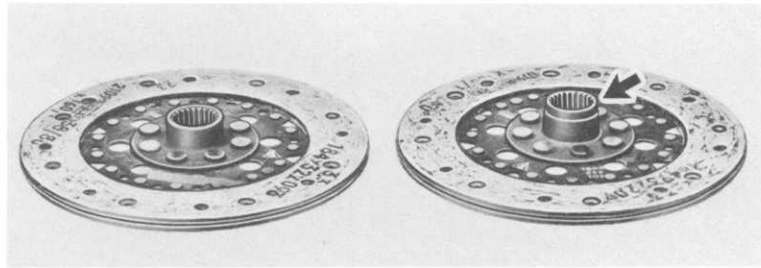
CROSS REFERENCE OF ORIGINAL AND CHANGED / PRESENT PARTS

Part Description	Original Version	Changed/Present Version
1. Clutch disc I (front)	928.116.011.23 Liners riveted tight on both sides with each rivet. Without gap between liners. Slight liner spring load (0.0 . . . 0.4 mm) Hub length: 20 mm	928.116.011.27 or 928.116.011.33 Liners riveted alternately with only every second rivet. Gap between liners. Liner spring load (0.5 . . . 0.8 mm) Hub length: 20 mm





2. Clutch disc II (rear)	928.116.011.24 Liner springs with each 2 spring plates (0.85 . . . 1.15 mm) Hub length: 20 mm	928.116.011.28 or 928.116.011.34 Liner springs with each 1 spring plate (0.5 . . . 0.8 mm) Hub length: 29 mm N o t e : Disc with a hub length of 25 mm were used a short time. They also belong to new version.

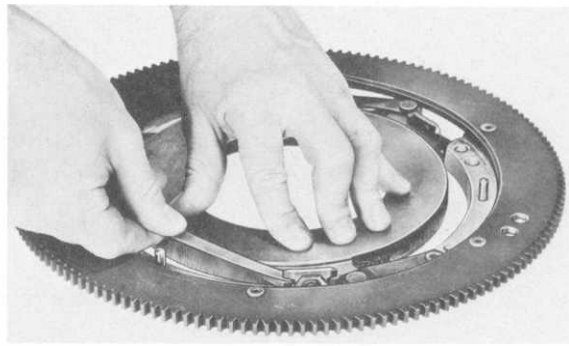


Part Description	Original Version	Changed/Present Version
3. Intermediate ring	928.116.033.17 Travel: 0.7 . . . 1.0 mm Label 3059 008 001	928.116.033.22 Travel: 1.2 . . . 1.5 mm Label 3059 008 101 since '84 models 928.116.033.26 (modified dowel pin centering, page 30 - 16 a)

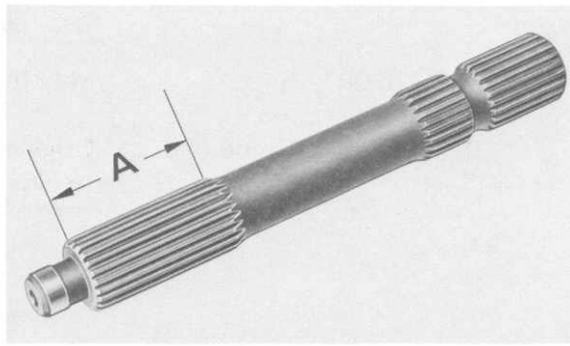
Note:
If the label is missing, the travel could be determined as follows.

Press down clutch ring from starter ring side against stop.
Determine gap distance on guide with a feeler gauge blade.

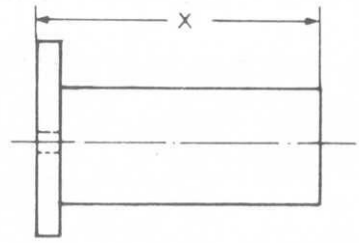
New version – at least 1.2 mm
Old version – at least 1.0 mm



4. Short drive shaft	928.421.235.12 Tooth distance "A" 51 mm	928.421.235.13 (gray/black) or 928.421.235.16 (dull silver) Spline distance "A" 56 mm



5. Guide tube	928.116.087.11 Total length distance "X" 50 mm	928.116.087.13 Total length distance "X" 49 mm



Replacement Procedures:

Intermediate ring, central shaft and release bearing tube are no longer available in the original version.

Clutch discs I and II are still available in original version for the diameter and dowel pin centered clutch.

Parts of the modified/present and original version may not be installed together in one car. See remarks for exceptions.
Check chart below when repairing clutches with modified/present clutch parts (dowel pin centered clutch).

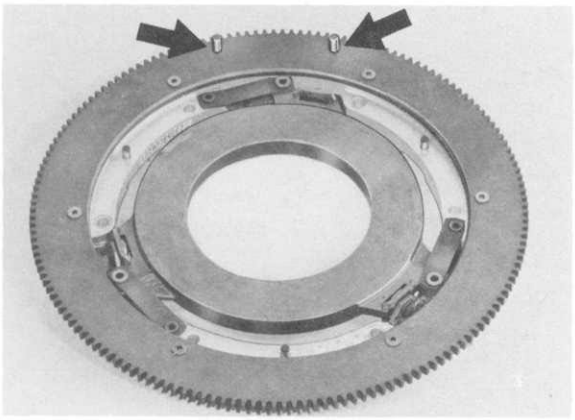
Part Description	Part Number	Version
Clutch disc I	928.116.011.27 or 928.116.011.33	Modified (see remarks) Present
Intermediate ring	928.116.033.22 or 928.116.033.26	Modified Since 1984 models (see remarks)
Clutch disc II	928.116.011.28 or 928.116.011.34	Modified (see remarks) Present
Central shaft I	(928.421.235.12) 928.421.235.13 or 928.421.235.16	Original version Modified version Present version (see remarks)
Release bearing tube	928.116.087.13 or 928.116.087.11 modified	Modified/present Original version (see remarks)

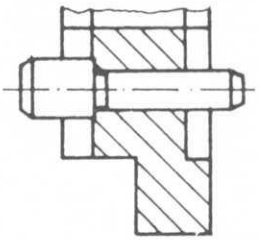
Remarks:

Clutch Discs I and II
Modified clutch discs I, 928.116.011.27, and II,
928.116.011.28, were replaced with clutch discs,
928.116.011.33 and 928.116.011.34 (different liner grade).
Identification: color of liners.
Clutch discs 928.116.011.27 and 928.116.011.28 will not be available after depletion of stocks.
Clutch discs with different type liners should not be installed together in one car.

Intermediate Ring

Beginning with 1984 models there is a separate test connection, which is connected with a TDC sensor, for checking the ignition timing. The TDC sensor signal is triggered by two cylindrical pins which are pressed in the gear ring of the clutch intermediate ring. This makes precise positioning between the intermediate ring and flywheel necessary.
This position is guaranteed, in that one of the three centering pins in the intermediate ring has two different diameters on each end, namely 6 mm and 8 mm. A centering bore in the flywheel now has a 8 mm diameter. Consequently the intermediate ring can only be mounted in one position.





Central Shaft I

The first version of central shaft 928.421.235.12 (no longer available) was sometimes installed together with new clutch parts.
The modified central shaft 928.421.235.13 was replaced with central shaft 928.421.235.16 (hard nicle-plated/same size) as from June of 1983. Central shaft 928.421.235.13 will no longer be available after depletion of stocks.
Axial movement of clutch discs on central shaft I is better after long operating time when using the hard nickle-plated version in conjunction with the specified lubricant.

Identification: 928.421.235.13 gray/black
928.421.235.16 dull silver

Lubricant specifications for splines (central shaft I and clutch discs):

928.423.235.12 and 928.423.235.13	very thin coat of Optimoly HT
928.423.235.16	coat of Optimoly Olista Longtime 3 EP (Part No. 000.043.024.00)

Release Bearing Sleeve

When repairing clutch, the old release bearing sleeve 928.116.087.11 with a total length of 50 mm can be ground off to a length of 49 mm.

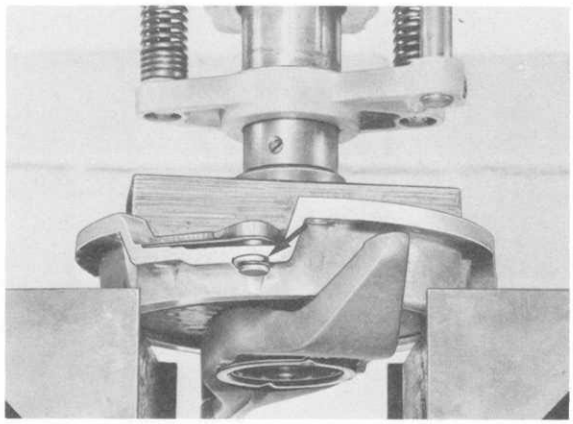
DISASSEMBLING AND ASSEMBLING CLUTCH

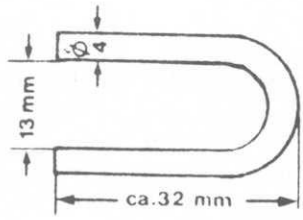
Differences in tolerances could make it necessary to preload the clutch to be able to install the release bearing and release lever.

Disassembling

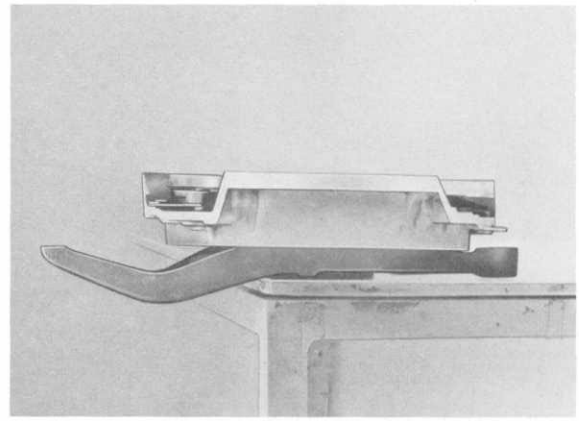
1. Pry the pressure plate off of the intermediate plate uniformly (if a dowel pin-centered clutch).

2. Place pressure plate in a press so that, when preloading, the release lever can be moved out downward without interference. Preload pressure plate carefully until 4 mm thick locally made wire tool can be slid underneath heads of mounting bolts.





3. Place pressure plate and release lever on a workbench. Press down on thrust washer and remove snap ring of release bearing. Bent section of release lever should project over workbench so that pressure plate and thrust washer can move downward and make the snap ring accessible.



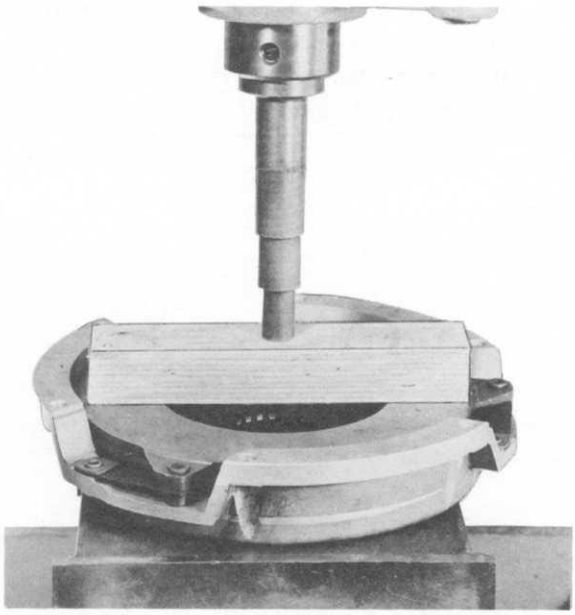
Assembling

1. Install diameter-centered or dowel pin-centered pressure plates and intermediate plates only with the matching flywheel.
See page 30 - 7 for flywheel of diameter-centered clutch.
See page 30 - 10 for flywheel of dowel pin-centered clutch.

2. Inspect parts of clutch and, if necessary, replace (also refer to page 30 - 23/24). Also slide 4 mm thick locally made wire tool underneath bolt heads of new version pressure plate. Place this pressure plate on a level plate in a press for preloading. Bearing surface on pressure plate must not scrape on pressure plate housing while pressing together.

Note

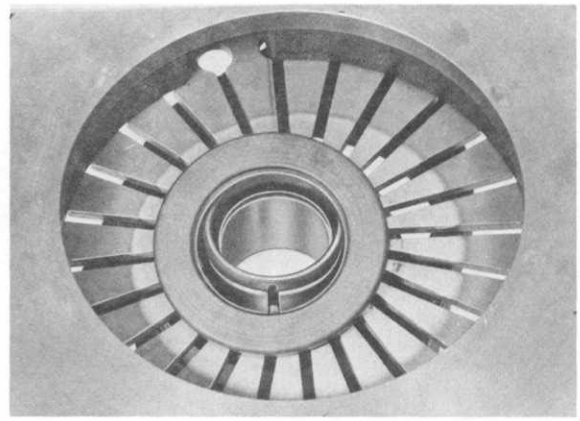
Don't forget to remove wire clip after installation of clutch.



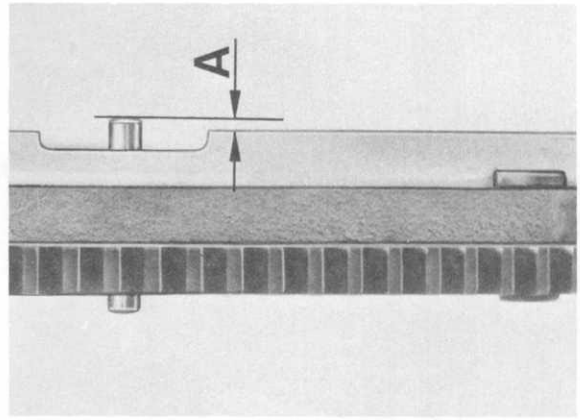
3. Inspect ball socket bushing (snap ring) in release lever. If necessary, install a new ball socket bushing and press in against stop with Special Tool VW 421. Vent hole in release lever must not be covered, otherwise ball socket bushing would spring back when air can't escape.

4. Lubricate bearing surface of release bearing in release lever as well as both sides of preload washer for pressure plate in area of release bearing with Optimoly HT. Mount release bearing with washer and release lever on pressure plate. Gap of circlip should be between retainer on release bearing or offset to groove in release bearing when bearing has an opening.

* Only applicable for the two 6 mm diameter centering pins of cars beginning with 1984 models, since the stepped 6/8 mm diameter pin is removed for installation and removal. Distance A could also not be reached.



5. Check position of centering pins of a dowel pin-centered clutch, correcting if necessary. Protrusion of pins over bearing surface of intermediate plate on flywheel: 3.5 – 0.5 mm (distance A).*



6. Push intermediate plate in direction of release bearing on the three adjusting elements.

7. Assemble clutch, observing the following points:

   a) Yellow arrows on discs are mounted 180° opposite (residual unbalance).

   b) White mark on disc (without spring-loaded liner) faces flywheel.

   c) Hubs of discs face release bearing.

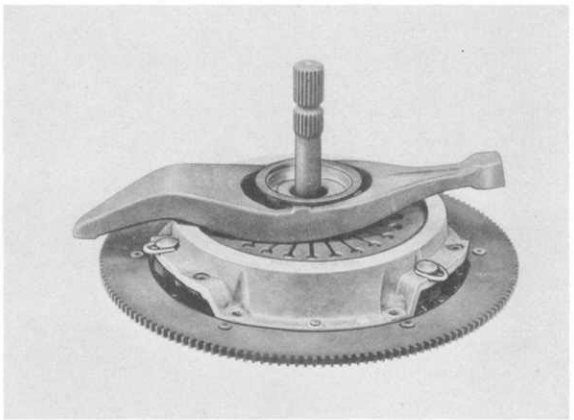
d) Transfer residual unbalance mark of discs (yellow arrows) to engine side of same (facilitates assembly work).

e) Mark pressure plate before installing; drive pressure plate of dowel pin centered clutch on to centering pins or into intermediate plate with a plastic hammer far enough, so that the drive plate located between both can still be moved with short drive shaft (central shaft I).

f) Pressure plate and intermediate plate are also marked with dots of white paint (residual unbalance/heavy side), which are mounted offset 180° (opposite). This must be considered when replacing one or both parts.

g) Recheck protrusion of centering pins on flywheel (3.5 – 0.5 mm), correcting if necessary.

h) Lubricate parts to specifications (see table); however lubricate the starter ring after installation of the clutch. Don't forget to lubricate guide tube for the release bearing.



CLUTCH LINKAGE VERSIONS

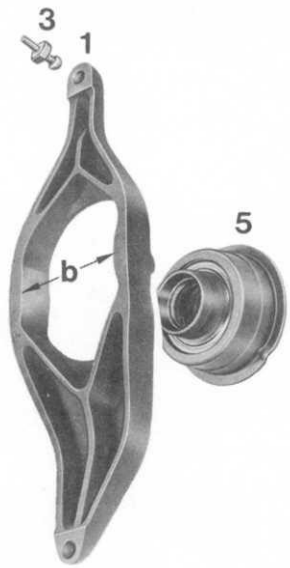
The following modifications have been made to the clutch linkages since the beginning of production.

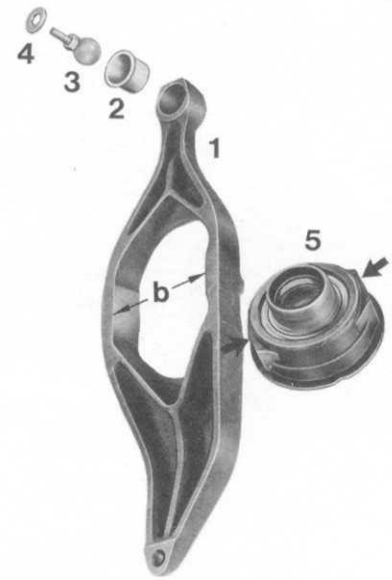
– Ball stud (no. 3) for release lever changed from 10 mm dia. to 19 mm dia.

– Release lever fitted with plastic bushing (no. 2) to take ball stud.

– Release bearing (no. 5) with vulcanized rubber pads to suppress noise and prevent turning.

Part Description	Original Version *	Modified/Present Version
1 Release lever	b = small width	b = large width
2 Bushing	––– (snap ring)	Available
3 Ball stud (see page 30 - 21)	10 mm dia.	19 mm dia.
4 Washer	–––	Available. Ball socket bushing not available for version 2 (see page 30 - 21)
5 Release bearing	Without turning lock	With vulcanized rubber pads as turning locks (won't fit in release lever of original version)





* Parts no longer available. When replacing all parts of either the original or present version must be installed.

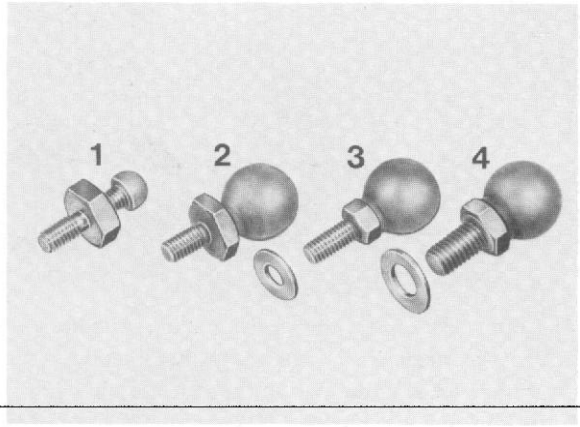
BALL STUD VERSIONS

1 – Original version with 10 mm ball diameter. M 6 threads (originally this version was without threads, also refer to "Replacing Ball Stud").

2 – Modified version, 19 mm ball diameter, M 6 threads without washer (was used briefly in standard production).

3 – Modified version, 19 mm ball diameter, M 6 threads with washer.

4 – Present version, 19 mm ball diameter, M 8 threads with washer.



REPLACING BALL STUD

1. Unscrew ball stud after removing clutch (air cleaner removed).

Note

Ball studs are locked with Loctite so that removal must be done carefully and perhaps turning back and forth several times will be necessary.
Heat a removed clutch housing (up to about 250 °C/480 °F) to facilitate removal of the ball stud.

2. Clean threads with, for example, Loctite Cleaner 0706 prior to screwing in a new ball stud (19 mm dia. instead of 10 mm dia.). Spread a thin coat of Loctite 270 on thread flanks. Screw ball stud version 3 with washer in clutch housing. After depletion of stocks version 3 will no longer be available. Then use ball stud version 4 with washer (tap M 8 threads in clutch housing).

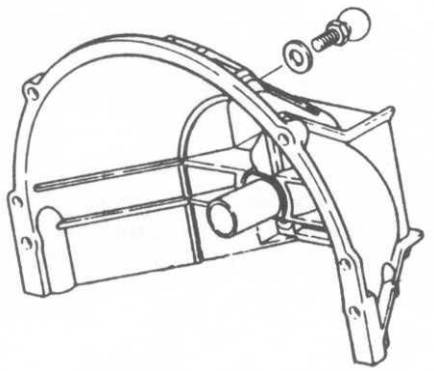
The ball stud in cars prior to Chassis Number

928 820 0491

is not screwed, but pressed in. On these cars the replacement of the ball stud will require installing a M 6 threaded insert in the bore, e. g. Helicoil.

For ball stud version 4 (after depletion of version 3 stocks) the clutch housing has 8 mm threads (without a threaded insert).

These jobs can only be performed after removal of the clutch housing.



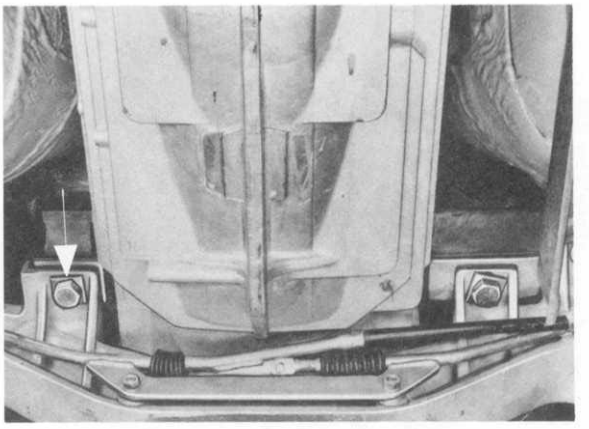
REMOVING AND INSTALLING CLUTCH HOUSING

Removing

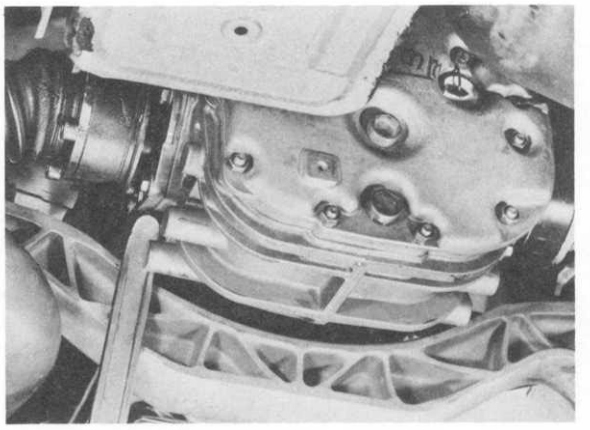
1. Remove front exhaust lines.

2. With clutch removed unscrew mounting bolts for central tube to clutch housing and clutch housing to engine.

3. Remove both mounting bolts of transmission mounts on rear axle cross member.



4. Apply tire iron on transmission and rear axle cross member. Push back transmission and central tube far enough so that the clutch housing can be removed.



Installing

Installation in reverse order.
Watch specified torque.

CHECKING CLUTCH DISCS

1. Inspect splines. Clutch discs must slide easily on short drive shaft. Slight radial play is designed in and is not important.

2. Inspect rivets. Replace clutch disc when in doubt.

3. Inspect clutch linings. If clutch linings are covered with oil, burnt, damaged or worn locally, install a new clutch discs.

4. Check lining thickness of clutch discs. Measure distance from lining to highest point (rivet) on all four linings. Replace clutch discs when less than 0.3 mm.

Note:

See page 30 - 14 for former version clutch discs.

Since clutch discs will be subject to different degrees of wear in operation, the lining thickness will vary. On unsprung disc the flywheel end lining between the flywheel and intermediate plate (white dot of paint) will be considerably thinner.

5. Check clutch discs with lining for lateral runout. Max. permissible lateral runout at 190 mm dia.: 0.4 mm.

CHECKING CLUTCH PRESSURE PLATE

Clutch pressure plates have not been designed to permit overhauling or repairing. Checking is limited to dry cleaning and removing of dust with compressed air and emery cloth as well as a thorough visual inspection.

1. Clean clutch. Clean bearing surface of pressure plate with emery cloth, if necessary. Then blow out entire mechanism thoroughly with compressed air.

2. Check tips of diaphragm springs for traces of wear from clutch release bearing. Scoring to a depth of 0.3 mm is not significant.

3. Inspect bearing surface of pressure plate for cracks, burnt spots and wear. Check deflection with a steel ruler. Pressure plates with up to 0.3 mm deflection inward (measured with a feeler gauge blade) can still be used.

4. Inspect spring connections between pressure plate and cover for cracks. Check tightness of rivets. Replace pressure plates with damaged or loose rivets.

CHECKING CLUTCH INTERMEDIATE PLATE

Clutch intermediate plates have not been designed to permit overhauling or repairing. Checking is limited to dry cleaning and removing of dust with compressed air and emery cloth as well as a thorough visual inspection.

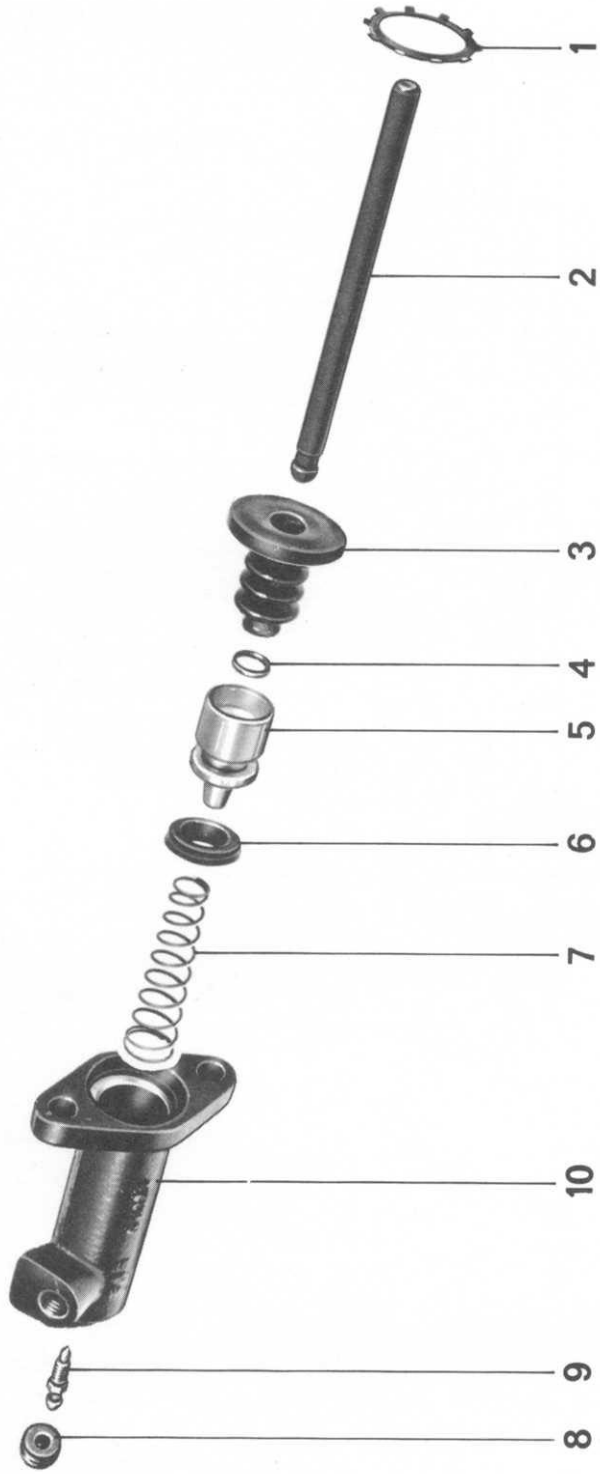
1. Clean intermediate plate. Clean bearing surfaces with emery cloth when necessary. Polish out burnt spots. Blow out entire mechanism with compressed air.

2. Check bearing surfaces for cracks, burnt spots and wear. Check deflection with a steel ruler. Intermediate plates with up to 0.3 mm deflection inward (measured with a feeler gauge blade) can still be used.

3. Inspect spring connection between intermediate plate and intermediate plate housing for cracks. Inspect rivets for tight fit and adjusting elements for damage, replacing intermediate plate if necessary.

4. Check tight fit of centering pins in intermediate plate of dowel pin centered clutch. Straighten or replace bent or damaged centering pins.

OVERHAULING CLUTCH SLAVE CYLINDER



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Circlip	1		Replace, concave side faces in, make sure of proper fit	
2	Push rod	1			
3	Rubber cover	1		Replace	
4	Retaining ring	1			
5	Piston	1			
6	Dust cover	1		Replace, coat very slightly with brake cylinder paste	
7	Spring	1		Position correctly	
8	Dust cap	1			
9	Bleeder screw	1			
10	Clutch slave cylinder	1		Clean thoroughly with gasoline. Apply a very thin coat of brake cylinder paste to cylinder bore	

Checking clutch disc for wear

Clutch disc is removed

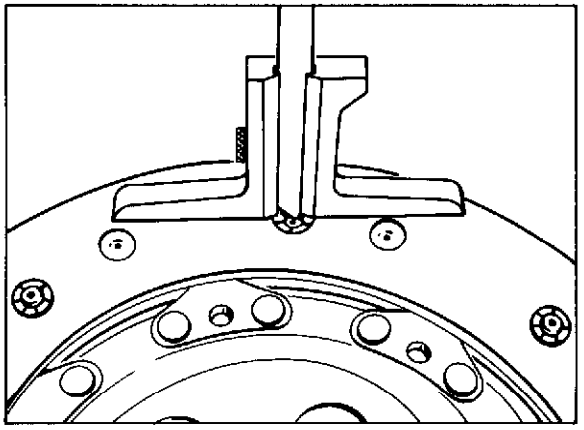
Checking:

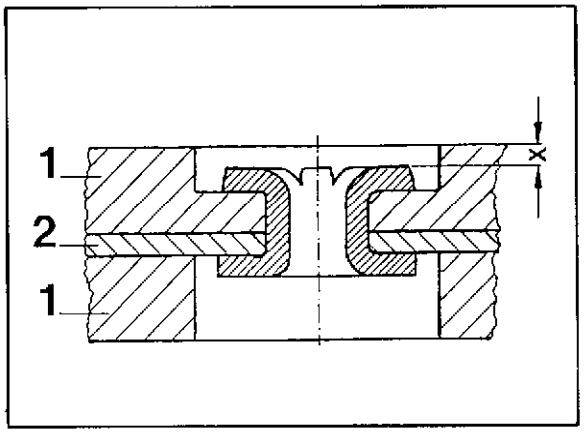
Using a depth gauge, check thickness of lining to rivet head (dimension X).

Note

Measure only on flared rived head side.

Dimension X is approx. 1.4 mm for new clutch discs.
If **dimension X** is down to **0.3 mm**, the clutch disc is worn and must be replaced.
Please note that **lining wear is not linear** over the entire life of the clutch.
Wear decreases considerably as the clutch mileage increases.

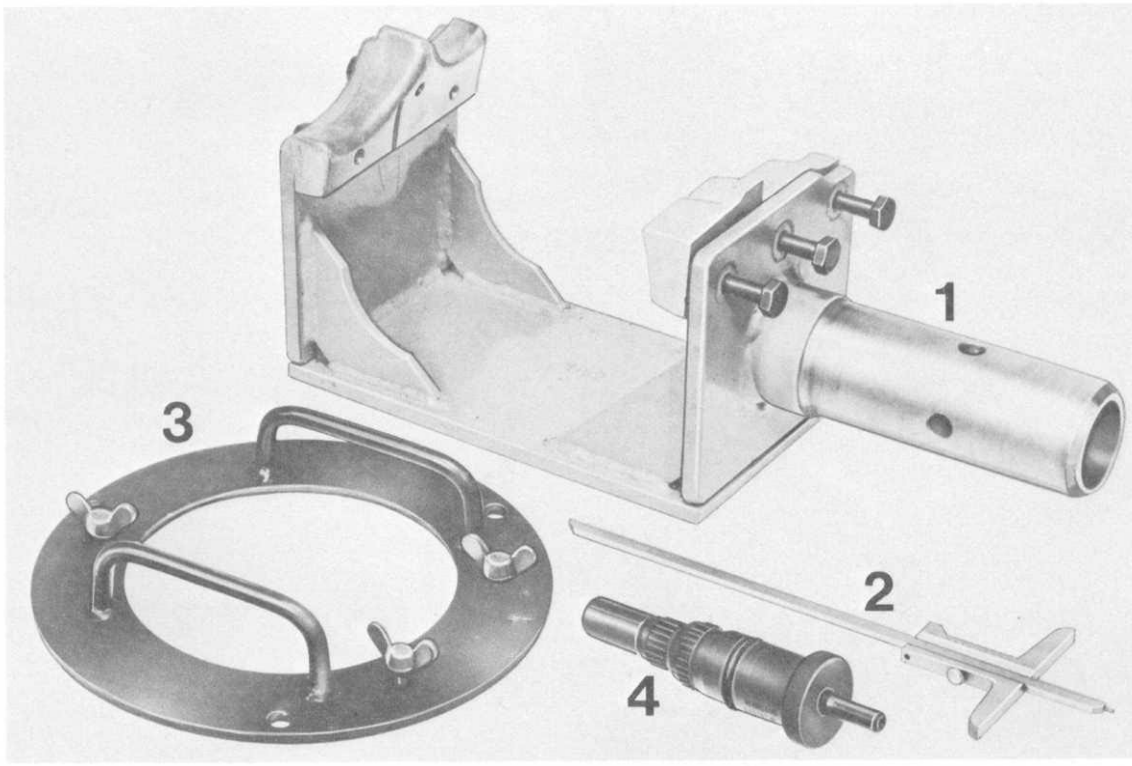




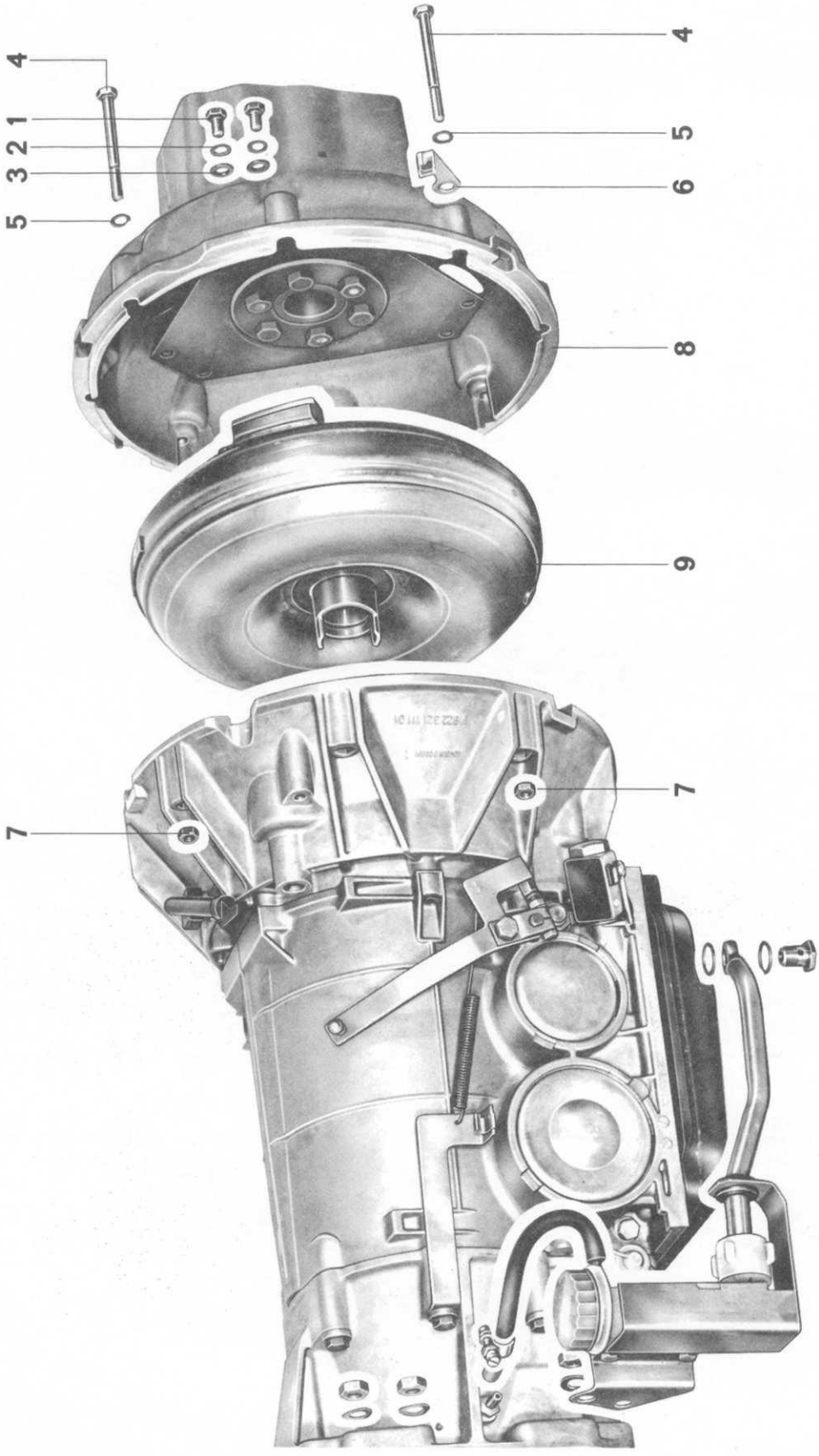
1 - Lining
2 - Clutch disc/lining spring

Printed in Germany – XXIX, 1992

TOOLS



No.	Description	Special Tool	Remarks
1	Transmission holder	9162	
2	Depth gauge	---	Standard tool
3	Grip plate	9301	
4	Mandrel	9310	


4
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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	6		Tighten to specified torque	
2	Washer	6			
3	Washer	6			
4	Bolt	8		Tighten to specified torque	
5	Washer	8			
6	Vacuum line holder	1			
7	Nut	8			
8	Front converter housing	1			
9	Torque converter	1	Remove upward carefully with Special Tool 9301	Replace when wear is excessive or ATF has metal particles. Lubricate input flange and shaft/bearing journals with a multi-purpose grease containing MoS_2. Place transmission upright and run in carefully with Special Tool 9301.	

REMOVING AND INSTALLING TORQUE CONVERTER

Removing

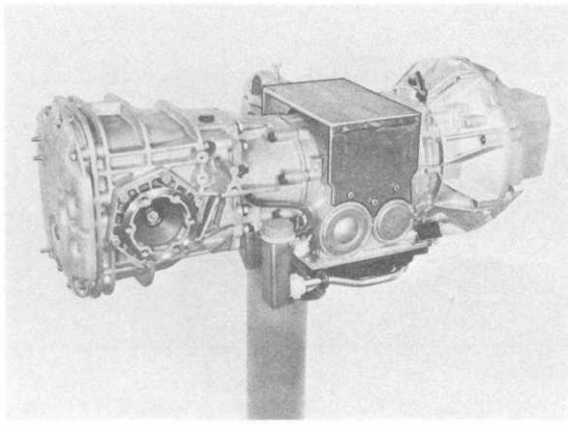
1. Remove transmission.

2. Take off control pressure lever.

Note

Be careful not to place any force on lever shaft when loosening or tightening the mounting bolt, to prevent damage to shaft in transmission. Always counterhold with a wrench when loosening or tightening (see page 37 - 14).

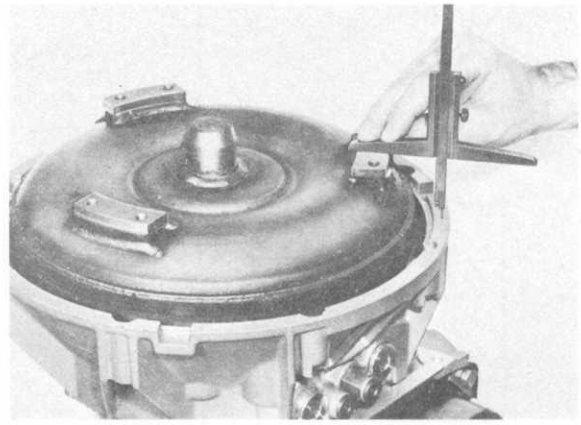
3. Install transmission in assembly stand with Special Tool 9162.



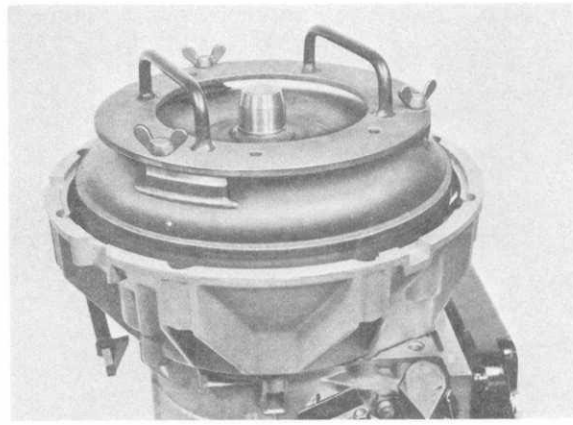
4. Position transmission upright and remove converter mounting bolts through openings in converter housing.

5. Remove front converter housing.

6. Note installed depth of converter (about 49 mm) for reinstalling.



7. Mount Special Tool 9301 on torque converter and lift out converter carefully.

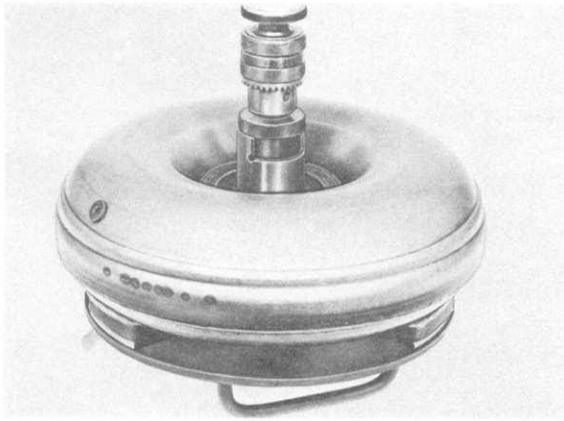


Installing

Note

If ATF contains clutch plate/brake band facing particles, clean inside of torque converter with Special Tool 9310 (flushing mandrel). Fill converter with about 1 liter/quart of kerosene, install flushing mandrel and turn same with a drill running at slow speed. Repeat these procedures twice and let the fluid drain through the drain plug.

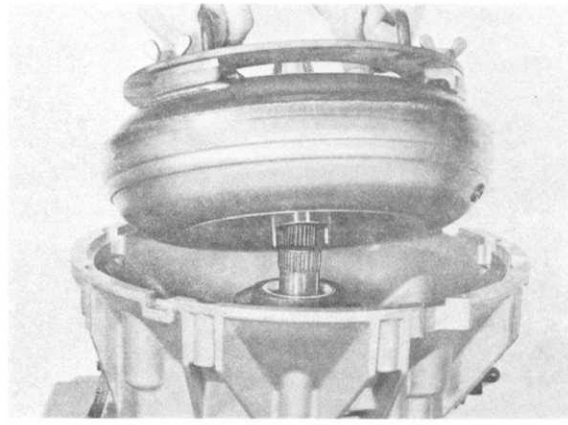
If there are metal particles in oil sump of transmission, torque converter will have to be replaced.



1. Mount Special Tool 9301 on converter.

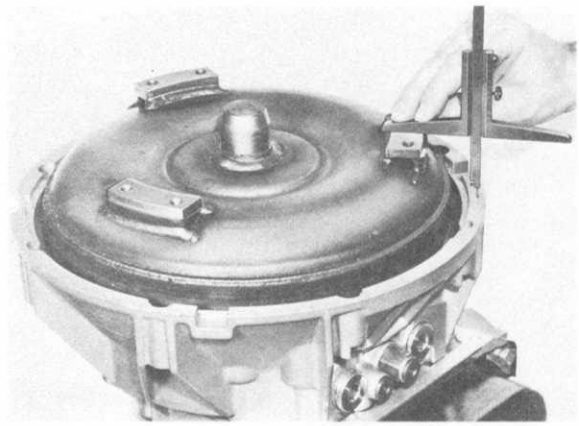
2. Lubricate input flange and bearing journal of converter with a multi-purpose grease containing MoS_2 additives.

3. Place transmission upright. Position drive dog on converter input flange opposite impeller for engagement.



4. Run in conveter carefully, turning it back and forth slightly. Also be careful not to damage seal while running in converter.

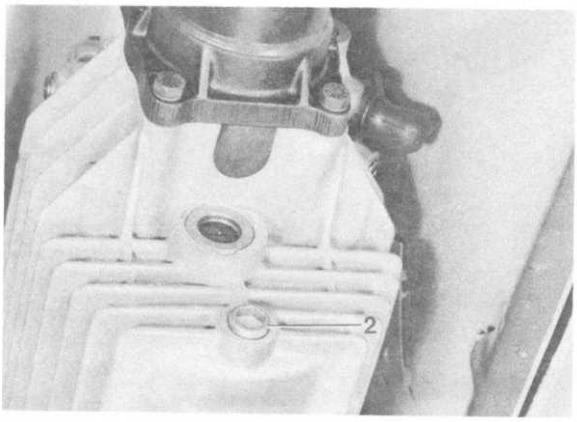
5. Measure installed depth (about 49 mm) of converter, to make sure that converter is positioned correctly. Install front converter housing.

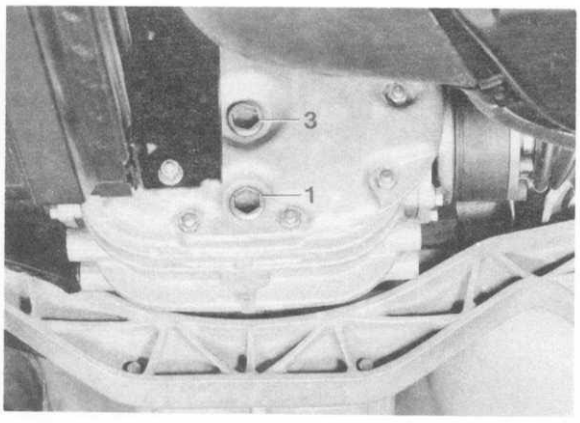


CHANGING TRANSMISSION OIL

Filling capacity approx. 3.8 liters/8 US pints of hypoid oil SAE 90, MIL-L-2105 B; API Classification GL 5

1. Drain oil when transmission has reached operating temperature. Oil has to be drained from transmission and differential separately.





2. Clean filler plug, drain plug for manual transmission and also magnetic drain plug for differential, and tighten them to torque of 1.9 to 2.3 mkg (14 to 17 ft lb).

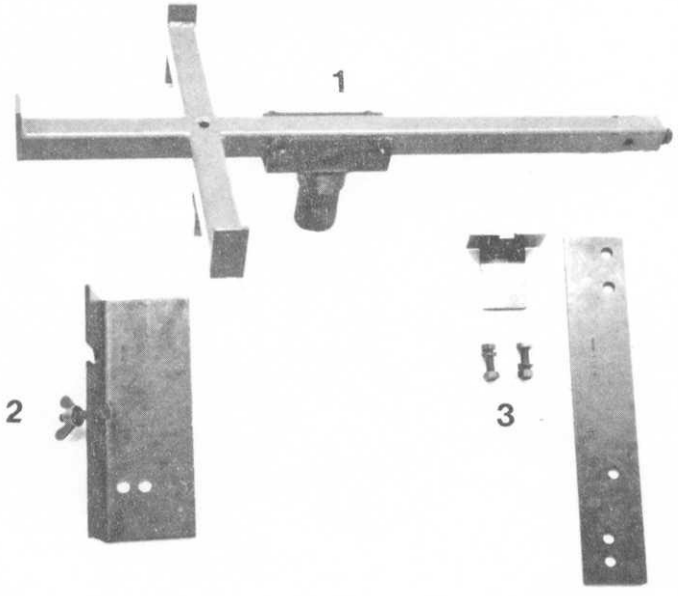
3. Add transmission oil with car on level surface until oil flows out of filler plug opening (approx. 3.8 1/8 US pints).

1 - Drain plug

2 - Magnetic drain plug

3 - Filler plug

TOOLS



No.	Description	Special Tool	Remarks
1	Transmission support	US 618	
2	Support bracket	US 618/2	
3	Support bracket	US 618/4	

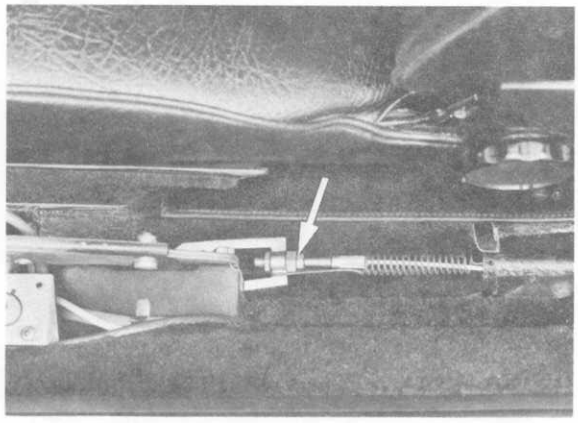
REMOVING AND INSTALLING TRANSMISSION

Removing

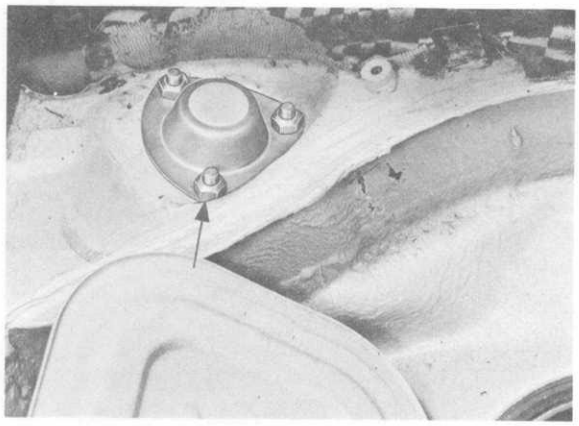
1. Disconnect ground strap at battery.

2. Loosen rear wheels. Engage 5th gear.

3. Loosen parking brake cable at connector. Unscrew locknut and pull out cable toward rear (only for cars with welded battery console).

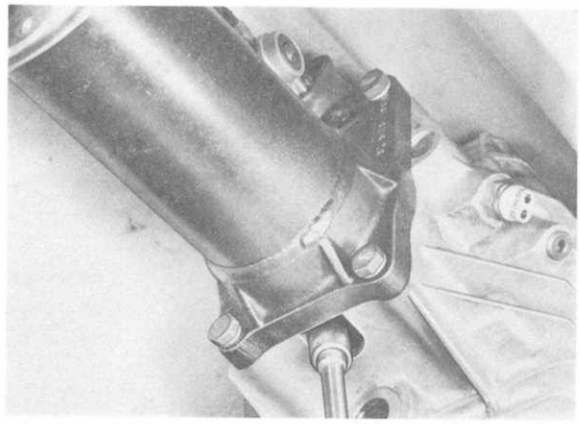


4. Remove nuts on spring struts in luggage compartment.



5. Remove battery (only for cars with bolted battery console).

6. Turn one rear wheel (holding wheel on opposite side) to position coupling bolt between input shaft and drive shaft, and remove bolt.

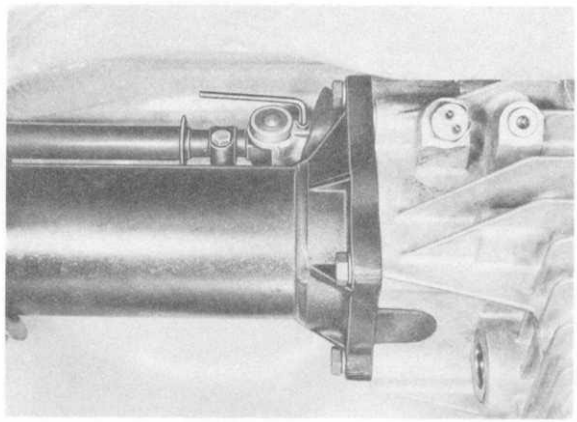


7. Move shift lever to neutral and remove rear wheels.

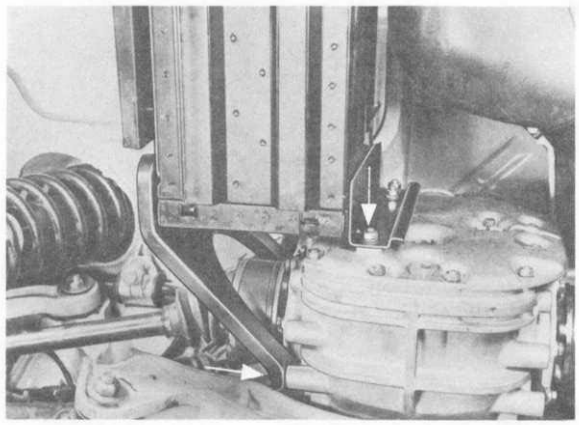
8. Detach brake calipers and suspend on wire so that brake hoses are without tension.

9. Remove exhaust assembly after catalytic converter and remove heat shield.

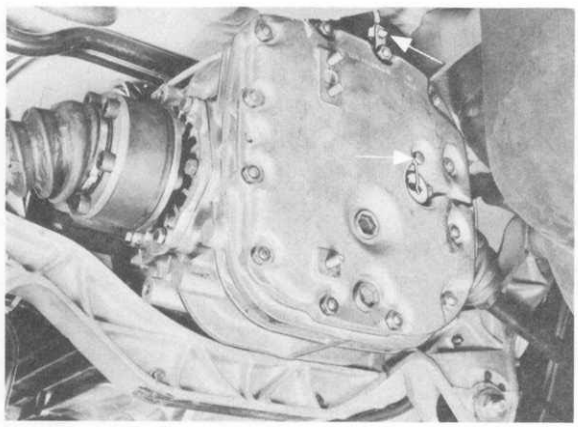
10. After stripping back the dust cover, remove set screw from shift rod coupling. Detach shift rod by pushing it off of main shift rod.



11. Remove battery console (only for cars with bolted battery console).



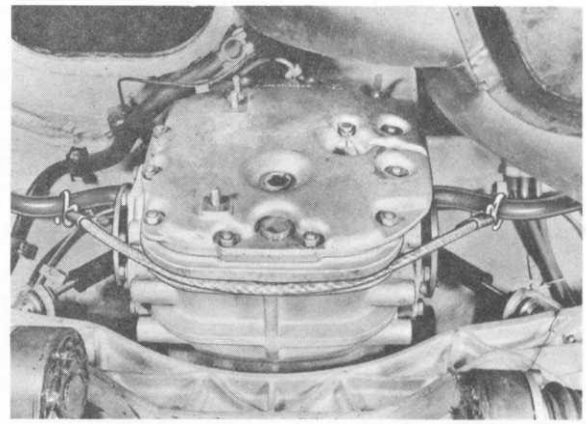
12. Pull off wires on backup lights. Remove pulse transmitter for speedometer and both wires from mounting clips.



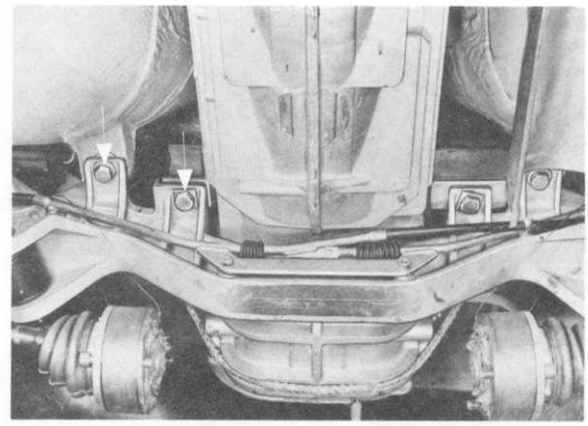
13. Detach axle shafts at transmission end and suspend from rear axle cross member in horizontal position.

14. Disconnect stabilizer bar at lower control arm.

15. Support transmission with special tool US 8031 attached to stabilizer bar.



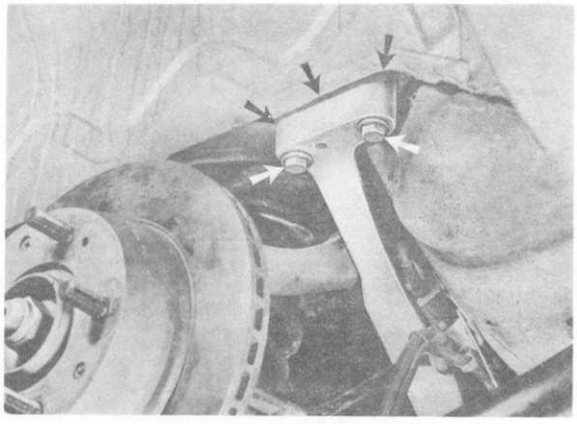
16. Remove both bolts of transmission mounts on rear axle cross member as well as 2 bolts between rear axle cross member and frame.



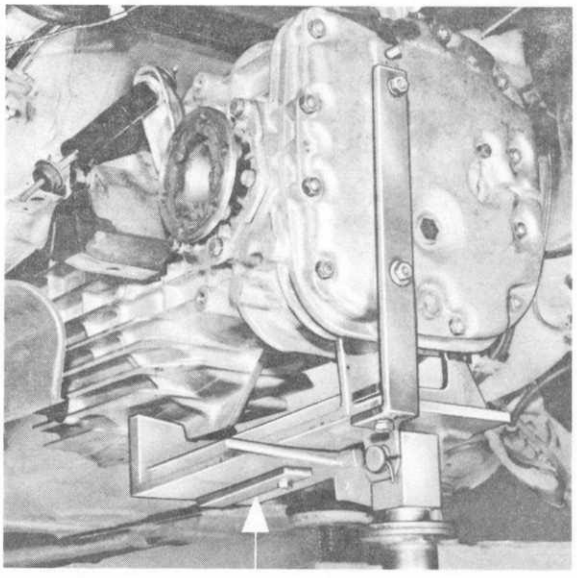
Note

To improve the insulating effect of transmission mounts, (since March of 1980) the gap between the transmission mounts and rear axle cross member is measured during assembly and eliminated by installing shims.
For this reason the shims must be marked for installation later.

17. Place floor crane underneath rear axle cross member. Mark position of rear axle cross member. Remove last 4 bolts on rear axle cross member. Tilt rear axle carefully, making sure that spring struts or control arms do not twist. Support rear axle in tilted position to keep the entire weight off of the lower control arm link pins.

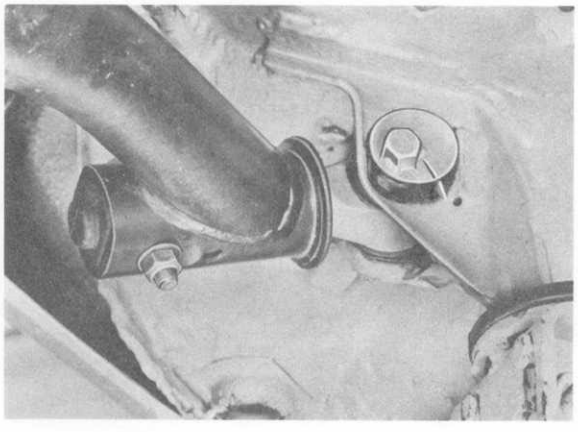


18. Mount transmission support/bracket on transmission. Remove 6 bolts between central tube and transmission, as well as Special Tool US 8029. Pull back transmission to one side and lower.



Note

Entire rear axle assembly of cars with a welded battery console must be removed. Mark toe eccentric for installation later and remove eccentric bolts.



Installing

1. Install the marked spacers or spacers of determined thickness between the transmission mounts and rear axle cross member (see page 34 - 8 a).

2. Watch marks of toe eccentric and cross member to body when installing the rear axle.

3. Adjust parking brake (see page 46 - 8).

4. Observe the specified torque values.

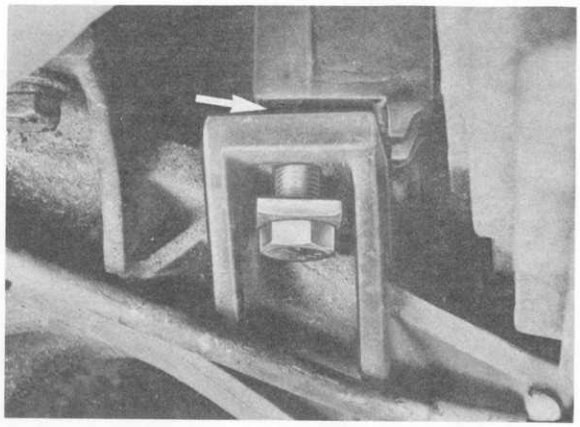
ADJUSTING TRANSMISSION SUSPENSION

To prevent stress in transmission suspension and to provide good insulation, transmission mounts have to be adjusted.

1. Install transmission and rear axle. Tighten transmission mount to transmission case bolts to specified torque.

2. Screw in cross member to transmission mount bolts several turns.

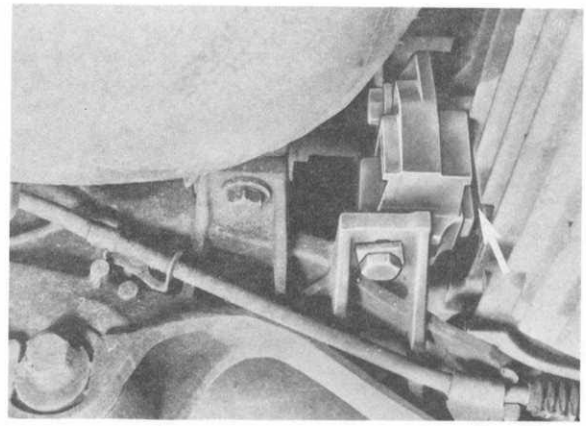
3. Lift transmission at center of case enough so that there is a gap between both transmission mounts and the cross member. Measure this gap on both sides and take up difference with shims.

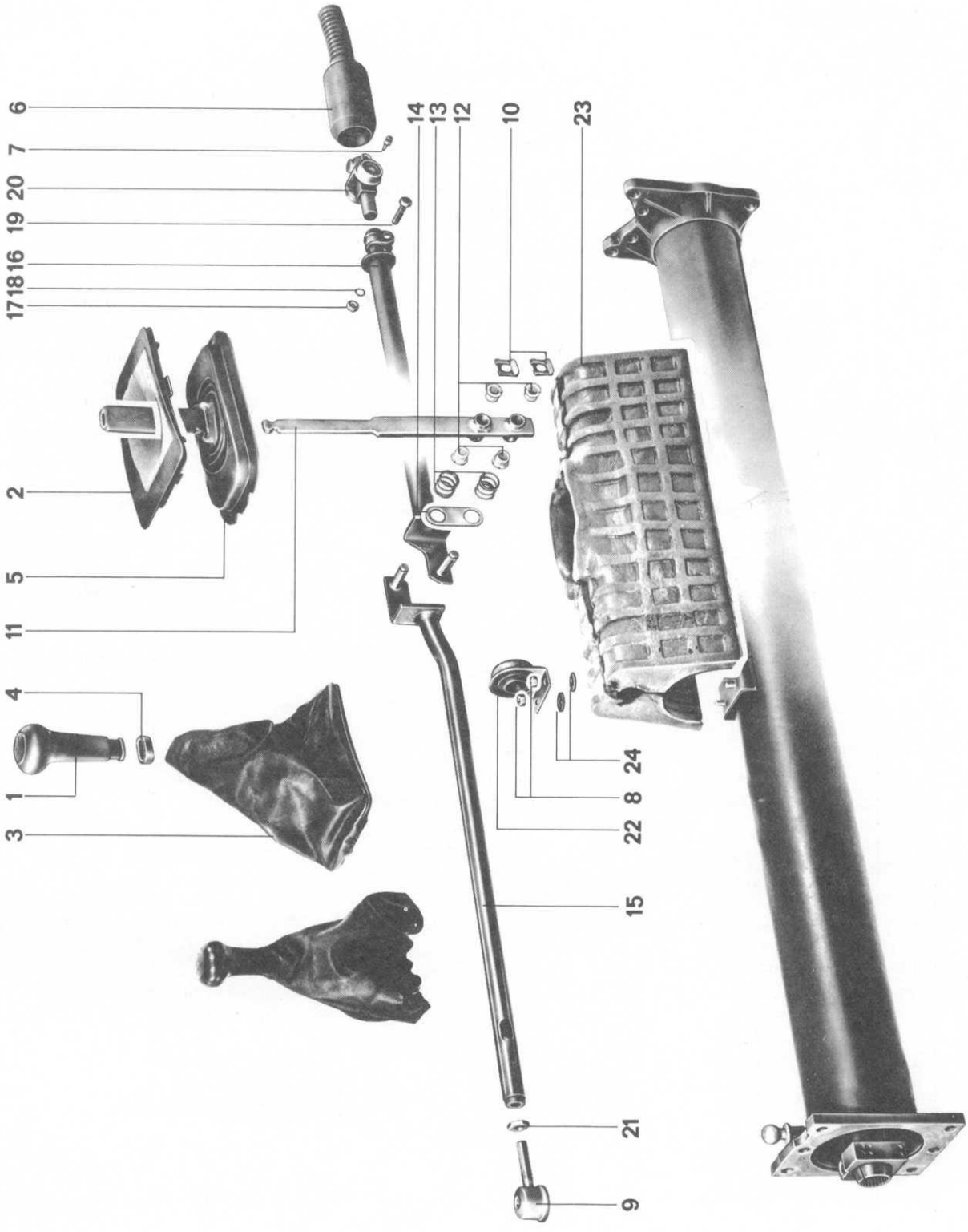


4. Place shims of determined thickness between the transmission mount and cross member, lower transmission and tighten transmission mount to cross member bolts to specified torque.

Note

There must be at least 1 mm clearance between transmission case and side stop on transmission mount after tightening the mounting bolts.




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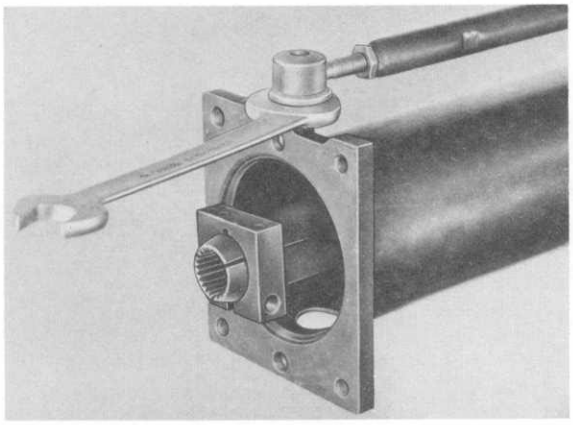
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Shift knob	1	Pull off of selector lever together with leather cover and frame	Install with glycerine/gasoline mixed 1 to 1	Other version with leather cover no. 3 (pulled over)
2	Frame	1	Disengage retainers in center console	Position correctly	
3	Leather cover	1			
4	Rubber ring	1			Not for one piece version (shift knob with leather cover pulled over)
5	Sleeve	1			
6	Dust cover	1			
7	Screw	1		Self-locking, replace if necessary	2 versions: self-locking (polyamide plug); not self-locking use Loctite 270
8	Locknut	2		Replace if necessary	
9	Ball socket	1	Lift off with fork wrench. Readjust shift if locknuts are loosened or ball socket is turned in relation to guide tube	Slight play between ball socket and ball head because of noise	
10	Circlip	2		Replace if necessary	
11	Selector lever	1		Welded seam on bushings on left side looking forward	
12	Plastic bearing	4		Replace if necessary. Insert with white paste (AOS 1260006)	
13	Spring	2			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
14	Friction plate	1		Lubricate with white paste (AOS 1260006)	
15	Guide rod	1		In neutral shift lever must be inclined toward rear by $2.5 \pm 2^{\circ}$. Adjust by turning ball socket. Lubricate all bushings with white paste (AOS 1260006)	
16	Shift rod	1			
17	Nut	1		First adjust shift lever lateral angle and then tighten nut to specified torque.	
18	Lockwasher	1		Replace, if necessary	
19	Bolt	1			
20	Shift rod coupling	1		Push in shift rod flush. Adjust shift lever cross angle.	
21	Nut	1		Align ball socket and shift lever prior to tightening	
22	Guide rod bracket	1			Mounted to body or on central tube
23	Insulation	1		Held on central tube with tape. Use tire paste, e.g. Contifix, to facilitate.	
24	Washer	2		Replace, if necessary	

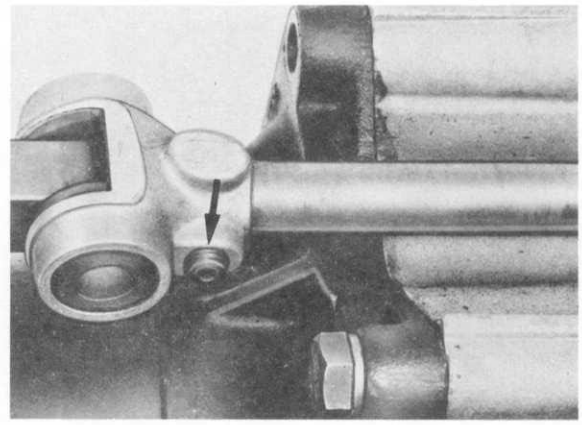
DISASSEMBLING AND ASSEMBLING SELECTOR LINKAGE

Disassembling

Pry ball socket off of ball head. Disconnect bracket, in so far as it is mounted on the frame tunnel, to remove the central tube (see "Removing and Installing Central Tube").



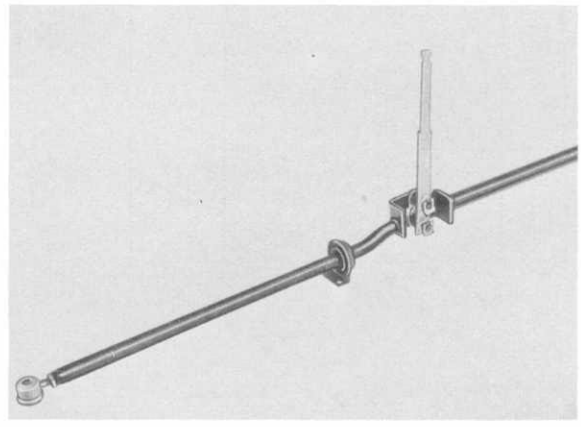
2. Mount bearing unit (selector rod coupling) on interior selector rod of transmission with tapered bolt. If applicable, use Loctite No. 270 (see page 34 - 8 d).



3. Assemble guide tube with bracket (guide tube bearing) and ball socket. Assemble selector lever, selector rod and guide tube, lubricating all bearing surfaces with white paste (AOS 1260006). Don't tighten locknut for ball socket or selector rod to bearing unit (selector rod coupling) mounting bolt at this point.

Assembling

1. Place transmission on a workbench and apply a piece of wood underneath rear end so that transmission is approximately horizontal. Bolt on central tube with 2 bolts and support from underneath with an universal transmission lift.

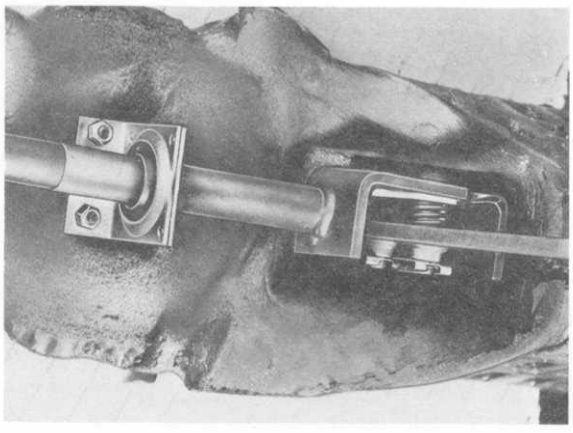


4. Adjust shift to guarantee correct shift travel. Keep to the order of selector lever axial and then lateral inclination.

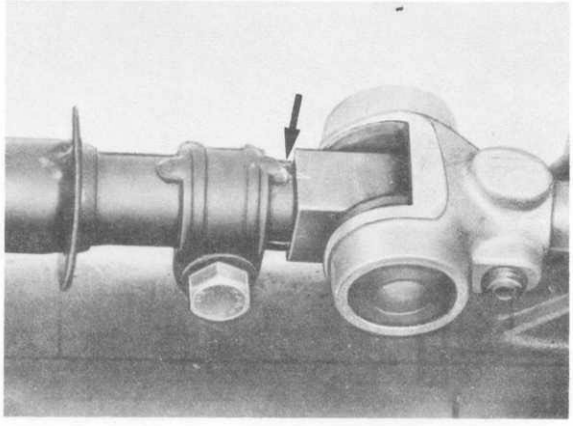
   The adjustment differs according to the mounting of the bracket. It is bolted on the central tube or body.

Bracket Mounted on Central Tube (Present Version)

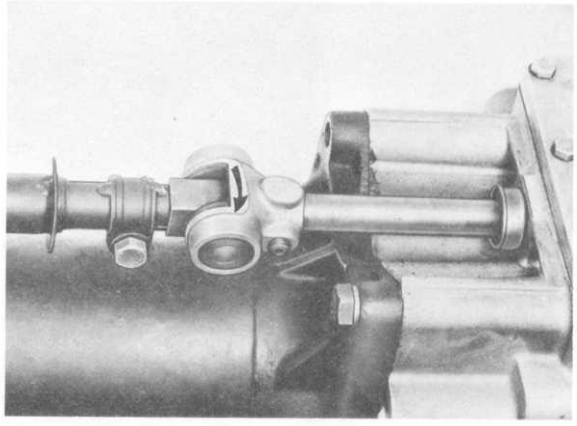
a) Place insulation sheet on central tube and mount bracket (guide tube mount) on the central tube.

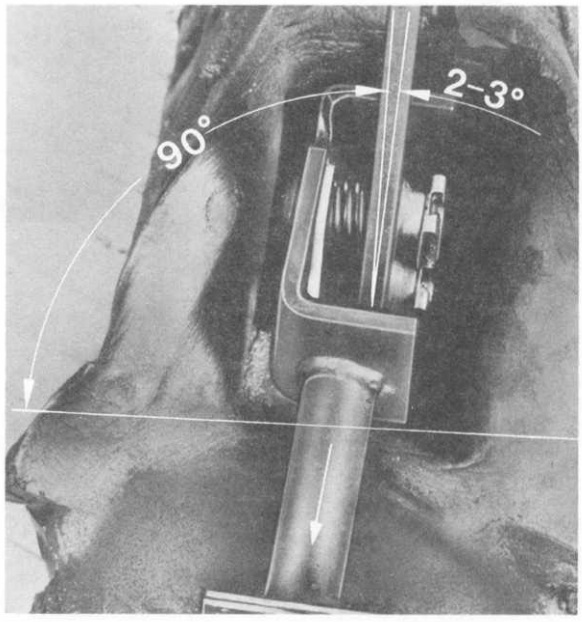


b) With transmission in neutral position push selector rod on to bearing unit (selector rod coupling) against the stop.



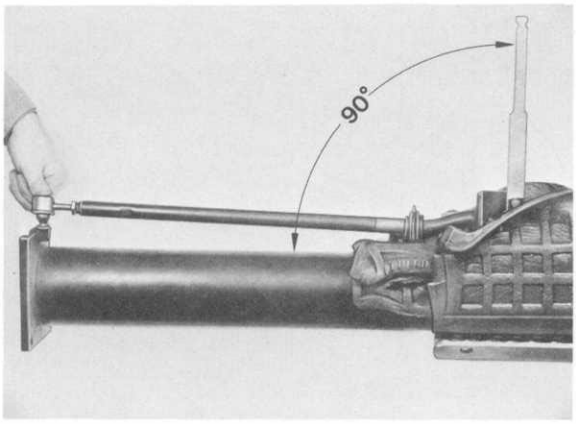
c) Adjust selector lever lateral inclination. With transmission in neutral position turn bearing unit anticlockwise against stop and hold. Turn selector rod with selector lever until the selector lever is inclined to the left by 2 to 3°. Clamp selector rod flush with the bearing unit in this position (arrow = forward direction).



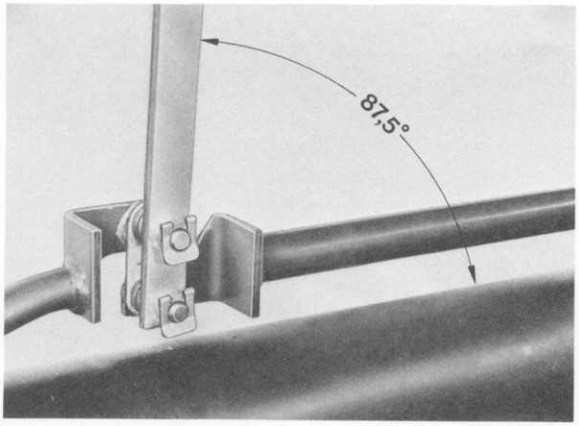


d) Adjust shift lever longitudinal inclination to $87,5 \pm 2^{o}$ ($2,5 \pm 2^{o}$ toward rear). First center the shift lever in neutral, since there is play in the interior shift rod of the transmission as well as in the shift rod coupling by design.

Turn ball socket until the shift lever is upright (90°) with the ball socket mounted on the ball stud.



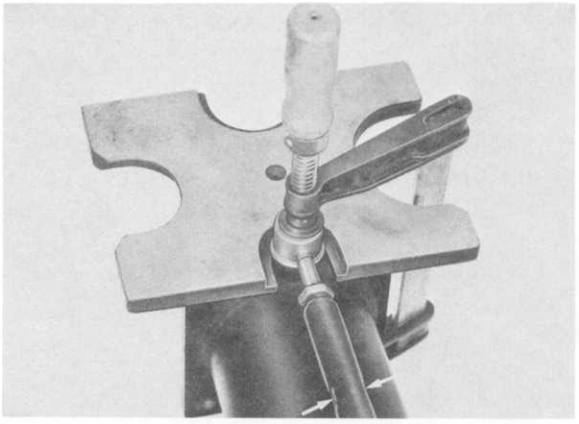
e) From this position unscrew the ball socket about 2 turns (lengthening the guide rod) and mount on central tube (plastic hammer). The shift lever longitudinal inclination should be $87,5 \pm 2^{o}$ after compensation for the design play. If necessary, turn the ball socket accordingly.



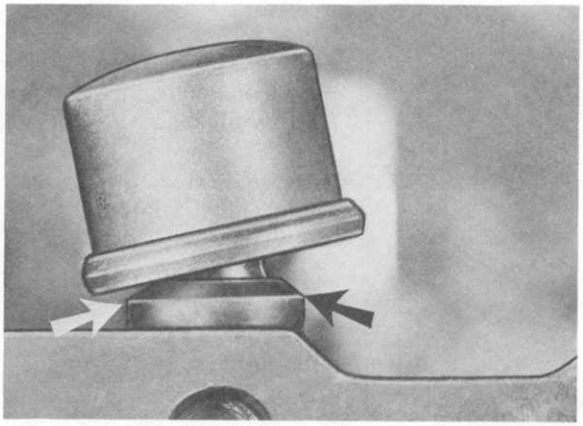
f) To exclude shift problems or damage to the ball socket, hold guide rod in correct position to the ball socket while tightening the locknut (ball socket horizontal, shift lever with guide rod on stop of reverse or 1st gear lock).

Horizontal Ball Socket Position:
Slide special tool VW 402 between central tube flange and ball socket, and hold ball socket with a clamp. Don't apply excessive force.

Guide Rod Position:
Apply open-end wrench on surface (arrow) of guide rod provided for this purpose. Use openend wrench to turn shift lever with guide rod counterclockwise against stop in neutral in 2nd - 3rd plane and hold tight while tightening locknuts.
Watch torque value.



g) In neutral position turn shift lever against left and right stops, making sure ball socket does not rest on collar of ball stud. If there is no gap (clearance) on one side, the guide rod had been turned while tightening the locknut. In this case unscrew the locknut again and repeat point f) carefully.



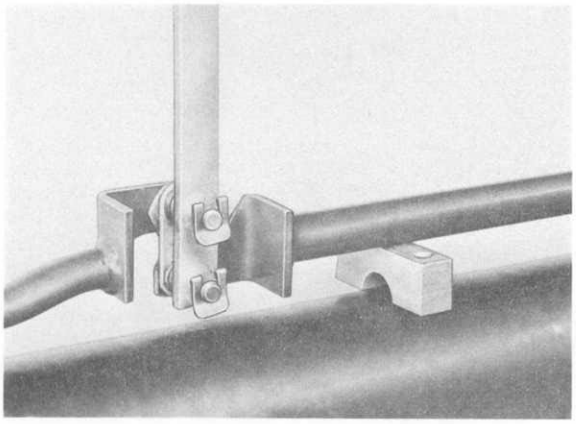
Guide Rod Bracket Mounted on Body

a) Adjusting procedures are identical with those for bracket version mounted on the central tube except for the following points.

b) Point a) omitted.

c) After point b) separate special tool VW 40-204 or 40-204 A due to missing mounting of guide rod bracket and apply section of special tool without pin close to the shift lever with the radius on the central tube.

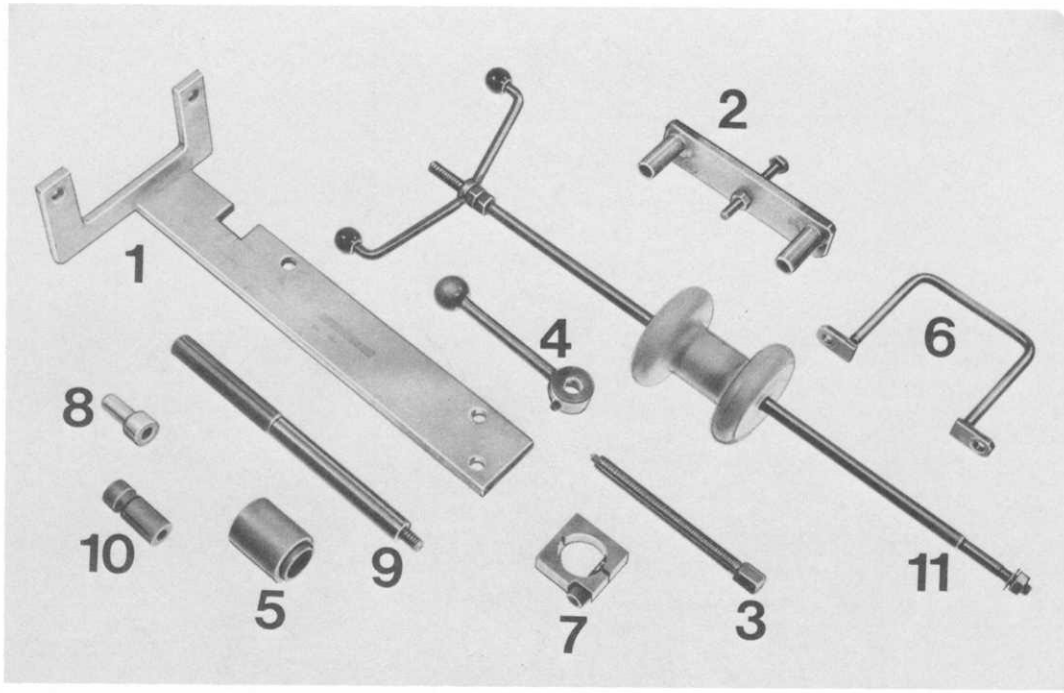
Some other support could also be used. Requirement: shift rod approximately parallel to central tube. This is equal to a distance of about 25 to 30 mm.



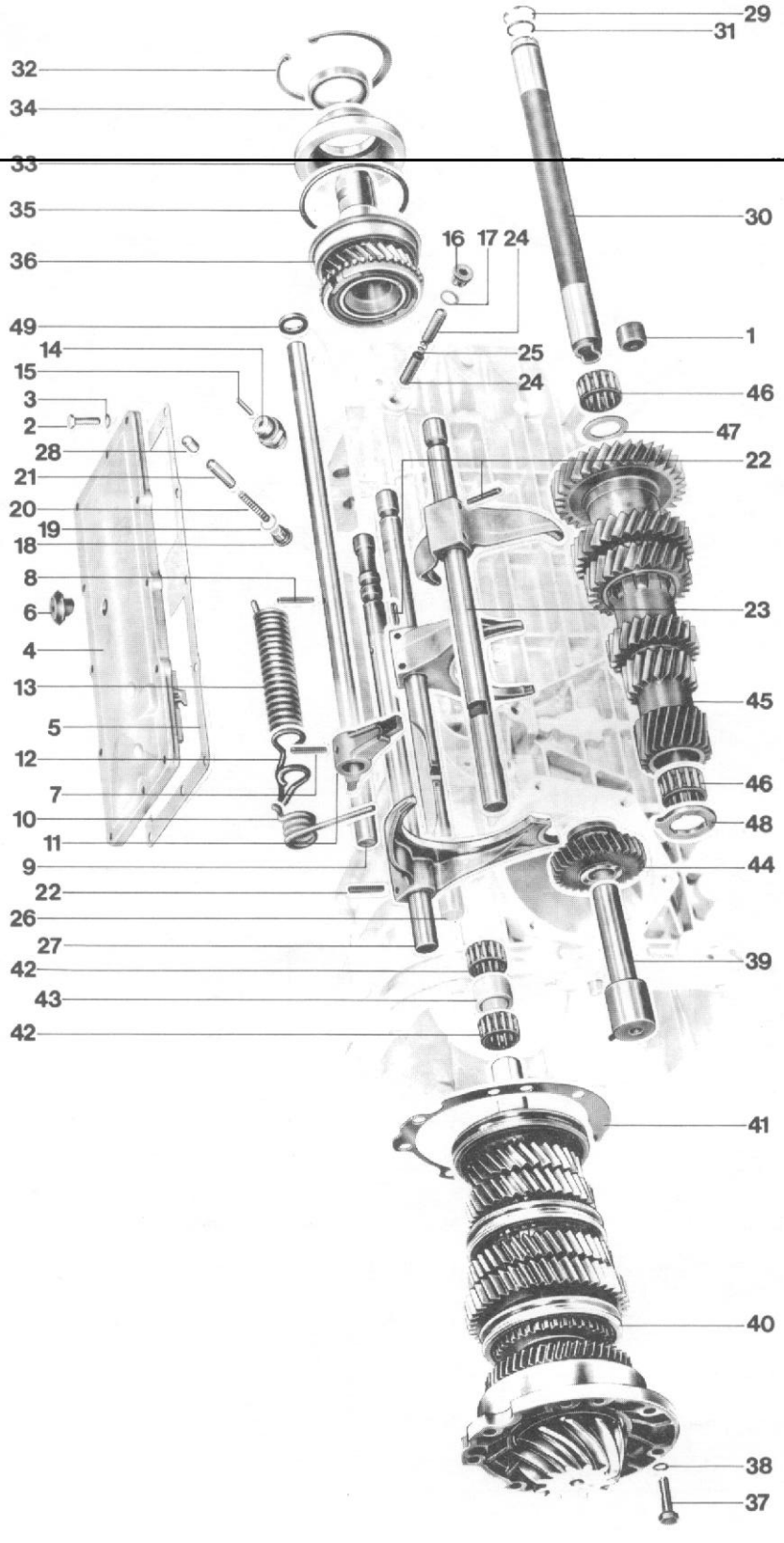
d) Leave support underneath the shift rod during the entire adjusting procedures. Due to the missing bracket hold the shift linkage to keep it from sliding off of the support.
It could be necessary to center out the shift linkage more often.

e) Place insulation sheet on central tube after adjusting.

TOOLS



No.	Description	Special Tool	Remarks
1	Support	9149	
2	Extractor	9148	
3	Spindle	US 1078	
4	Operating lever	9155	
5	Press tool	P 263	
6	Holder	9144	
7	Coupling	–	Spare part
8	Arbor	US 8050/9	
9	Pin	US 8050	
10	Puller, input shaft	9140	
11	Slide hammer	VW 771	


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No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Plug (magnetic)	1		Torque: 22 Nm (16 ftlb)	
2	Bolt M 6 x 22 – 8.8 M 6 x 22 – 12.9	12		 Torque: 9 Nm (7 ftlb) Torque: 16 Nm (12 ftlb)	
3	Washer	12			Plain washers are used instead of these washers for transm. with reverse gear lock
4	Case cover	1			
5	Gasket	1			
6	Vent	1			
7	Roll pin	1	Engage 5th gear and drive out		
8	Split pin	1	First drive out roll pin no. 7		
9	Internal selector rod	1		Position correctly, depression for set screw must face left	
10	Spring				Only for transm. with reverse gear lock
11	Shift finger	1			
12	U-spring	1		Convex side faces down	
13	Lockout spring	1			
14	Backup light switch	1			
15	Plunger	1		Stepped end faces switch	
16	Plug	1		Torque: 19 Nm (14 ftlb)	
17	Seal	1		Replace	

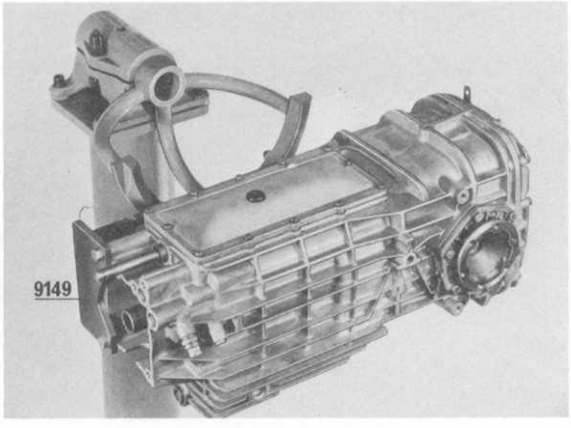
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
18	Plug	1		Torque: 19 Nm (14 ftlb)	
19	Seal	1		Replace	
20	Spring	1			
21	Locking sleeve	1			
22	Clamping sleeve	6			
23	Selector rod (with selector fork for 4th and 5th gears)	1	Remove toward rear		
24	Locking sleeve	2			
25	Spring	1			
26	Selector rod (with selector fork for 2nd and 3rd gears)	1	Remove toward rear		
27	Selector rod (with selector fork for 1st and reverse gears)	1	Remove toward rear		
28	Detent	1			
29	Circlip	1			
30	Countershaft	1			
31	O-ring	1		Replace, coat with transmission oil	
32	Circlip	1			
33	Bearing cap	1	Pull out by turning and pulling		
34	Seal	1			
35	O-ring	1		Replace, coat with transmission oil	
36	Input shaft	1	Pull out with special tools 9140 and 9148, but first lower cluster gear	Drive in with piece of suitable pipe	

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
37	Bolt	7		Torque: 30 Nm (22 ftlb)	
38	Lock washer	7 *		Hollow side faces bearing cover	
39	Reverse shaft	1	Turn and remove bearing unit with VW 771		
40	Pinion shaft assy.	1	Press out with 9148 and P 263	Insert with 9144	
41	Shim	X	Note quantity and thickness for installation later	If necessary, determine again. Position correctly	
42	Needle cage	2			
43	Thrust washer	1			
44	Reverse gear wheel	1			
45	Cluster gear	1			
46	Needle cage	2			
47	Washer	1			
48	Thrust washer	1		Torsional lock faces case opening, stick on case with a little grease	
49	Seal	1		Drive in with special tool US 8050/9	

DISASSEMBLING AND ASSEMBLING MANUAL TRANSMISSION

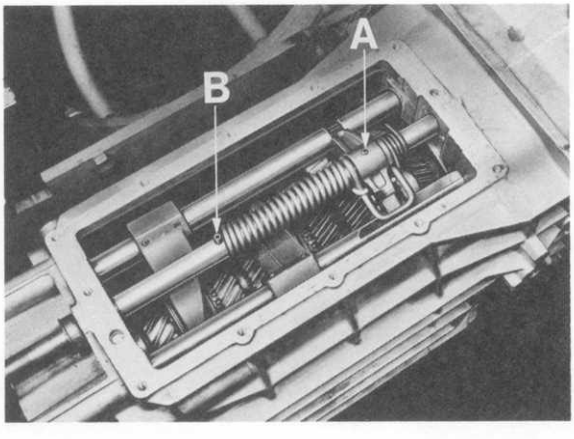
Disassembling

1. Mount transmission on assembly stand with special tool 9149 and drain transmission oil.

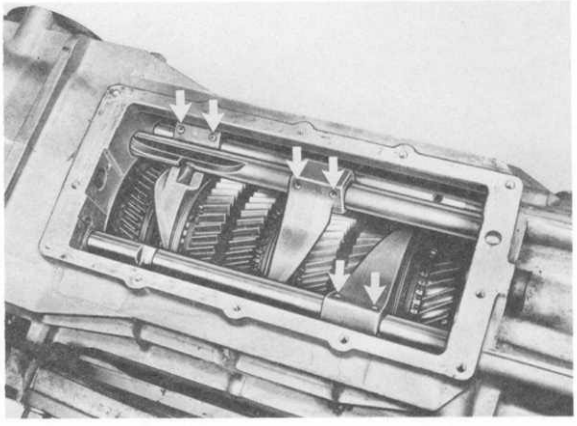


2. Remove differential (see page 39 - 1).

3. Engage 5th gear, drive out roll pin (A) for shift finger and only then (when spring is relaxed) split pin (B) for spring support.
Disassembling order is important, since otherwise the accelerated split pin (B) could cause injury.



4. Drive out split pins for selector forks and remove selector rods toward rear (toward differential).



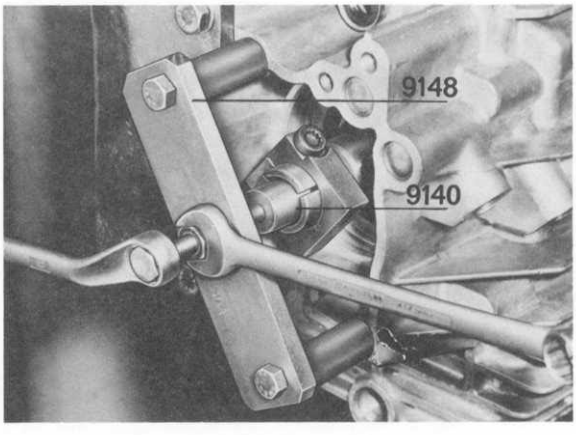
5. Remove circlip for countershaft and take out countershaft.

6. Remove circlip for input shaft.

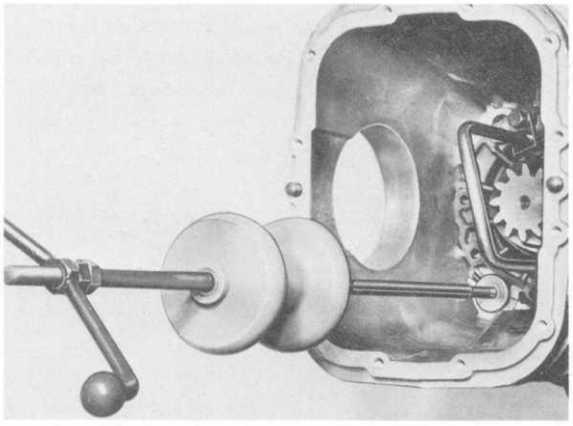
7. Remove bearing cover by turning and pulling. Remove O-ring and pull out input shaft with special tools 9140 and 9148.

Note

Always first remove the countershaft and lower cluster gear to bottom of transmission.



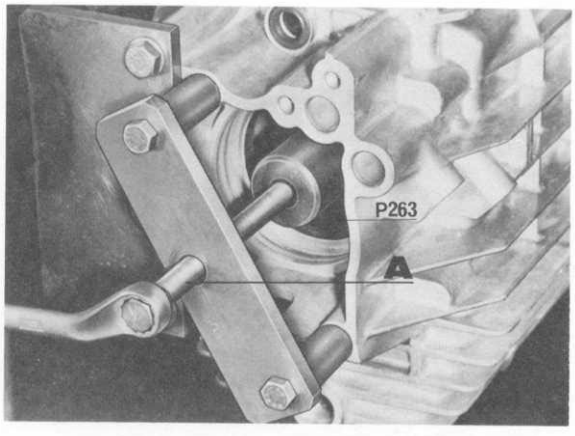
8. Remove pinion shaft mounting bolts, mount special tool 9144 on the bearing unit and turn this unit until reverse shaft can be removed with special tool VW 771.



Note

Reverse shafts without threads are driven out from the inside with a suitable mandrel after removal of the pinion shaft.

9. Press out pinion shaft with special tools 9148 and P 263.



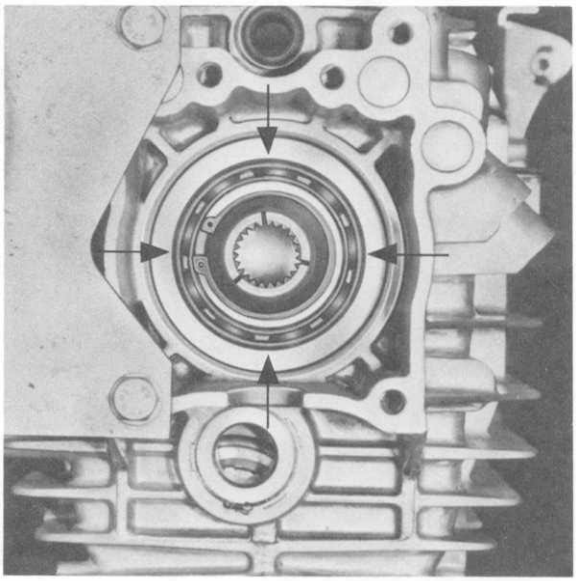
A – US 1078 or 40 - 19

Assembling

1. Stick thrust washer for cluster gear on case with a little grease.

2. Place assembled cluster gear in case.

3. Drive in assembled input shaft without synchromesh parts over outer race of grooved ball bearing against stop with a suitable piece of pipe or mandrel, applied alternately.



4. Insert O-ring for bearing cover and lubricate lightly with oil.

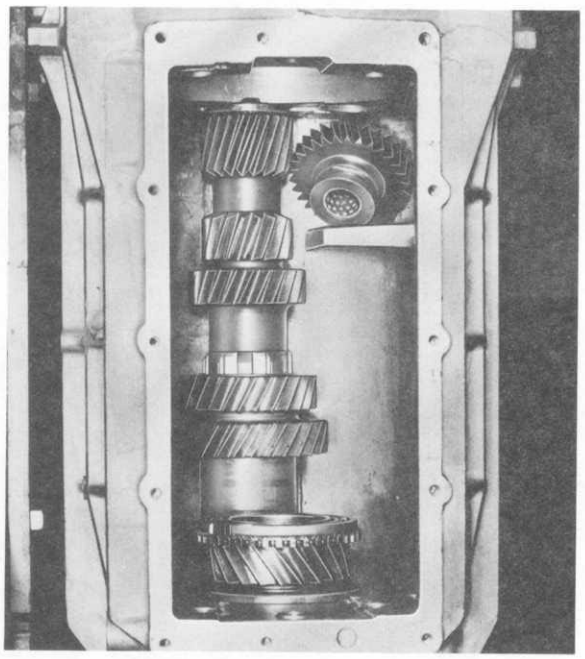
5. Install bearing cover and circlip.

6. Swing transmission on assembly stand so that input shaft faces down.

7. Insert needle cage and thrust washer in input shaft.

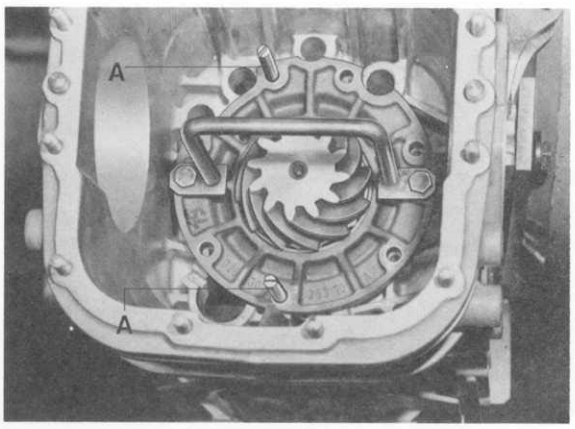
8. Place synchromesh parts for 5th gear on clutch unit.

9. Place reverse gear wheel in case as shown in figure.



10. Screw centering pins (locally made) for installation of pinion shaft in case and install shims S_3 of determined thickness and quantity.

11. Mount special tool 9144 on pinion shaft bearing cover and guide in pinion shaft carefully. Watch out especially for the 5th gear synchromesh parts and reverse gear wheel.

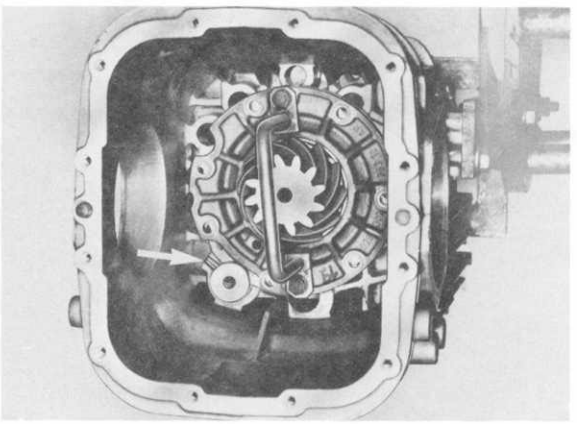


A – Centering pins (locally made)

Note:

Engage 4th gear to prevent operating sleeve for 4th and 5th gears from slipping.

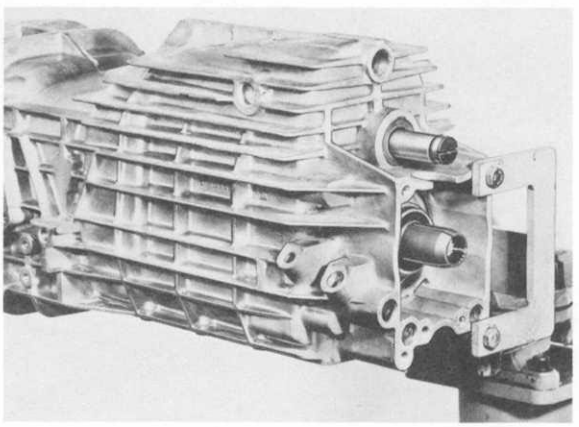
12. Position reverse gear wheel correctly with a suitable screwdriver, unscrew centering pins for bearing unit and turn latter together with the shims until the reverse shaft can be installed.



13. Turn bearing unit with shims S_3 to installed position, remove special tool 9144 and torque mounting bolts to 30 Nm (22 ftlb).

14. Measure distance "Z" between input shaft and pinion shaft (see page 35 - 15).

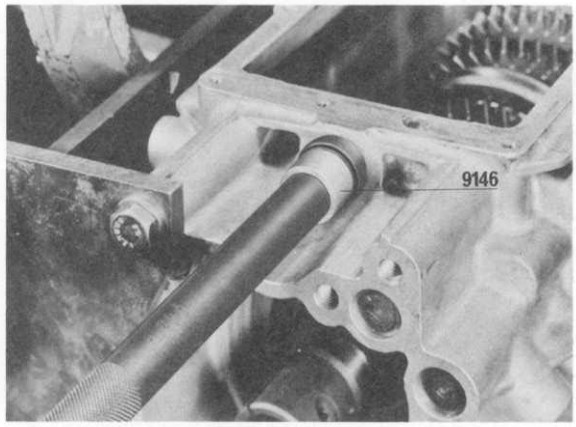
15. Move countershaft to installed position and install shaft with O-ring, which is given a light coat of oil. Install snap ring.



Note:

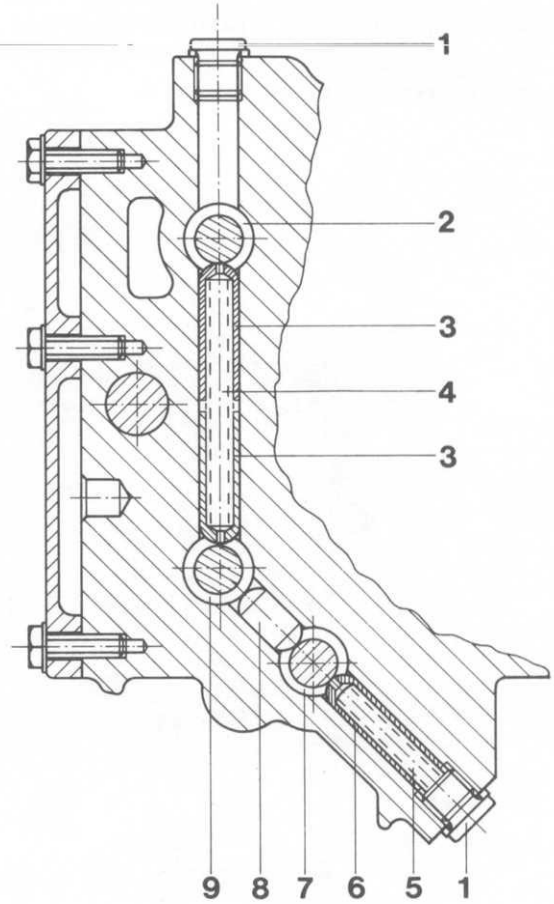
Assembly can be made easier by turning transmission in the assembly stand until the cluster gear falls into its installed position under its own weight.

16. Drive in seal for internal selector rod with Special Tool US 8050/9.



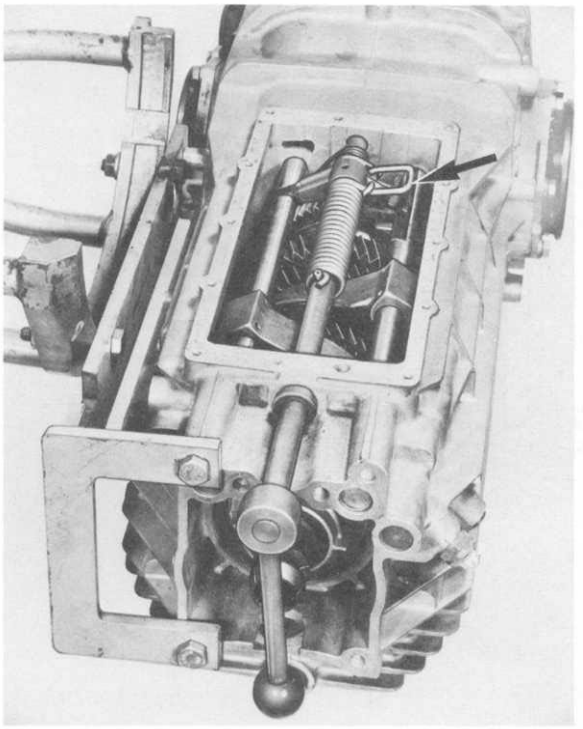
17. Engage neutral.

18. Install selector rods, selector forks and shift interlock components.

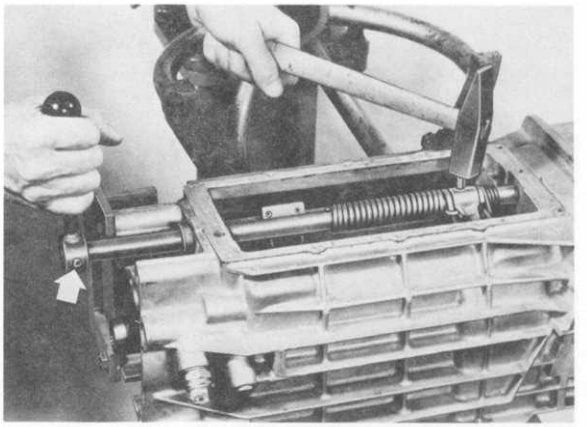


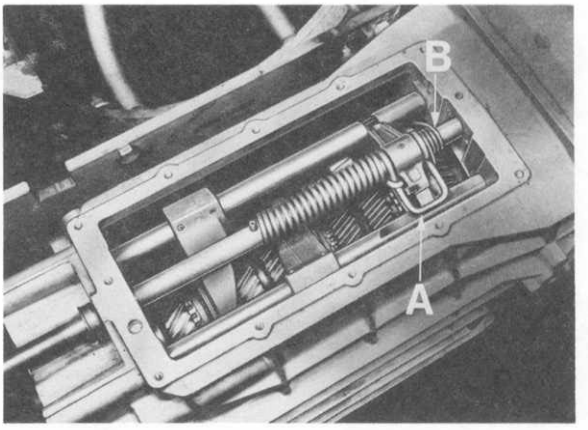
1 – Plug
2 – Selector rod, 4th and 5th gear
3 – Detent plunger
4 – Spring
5 – Spring
6 – Detent plunger
7 – Selector rod, 1st and reverse gear
8 – Interlock pin
9 – Selector rod, 2nd and 3rd gear

19. Install internal selector rod with shift finger and springs as shown in figure. Concave surface of spring faces down to selector rod.



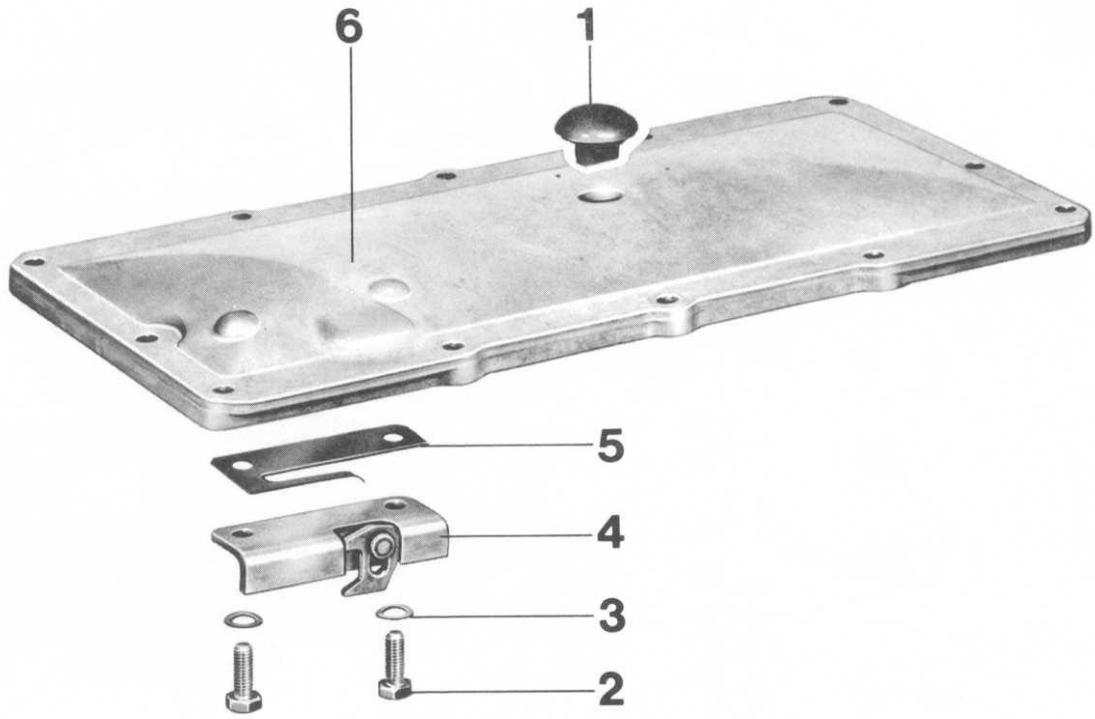
20. Turn internal selector rod 180° with Special Tool 9155 and install pin for shift finger. The torsion spring will be under tension in this position and cavity for pointed screw in internal selector rod faces left (looking forward).





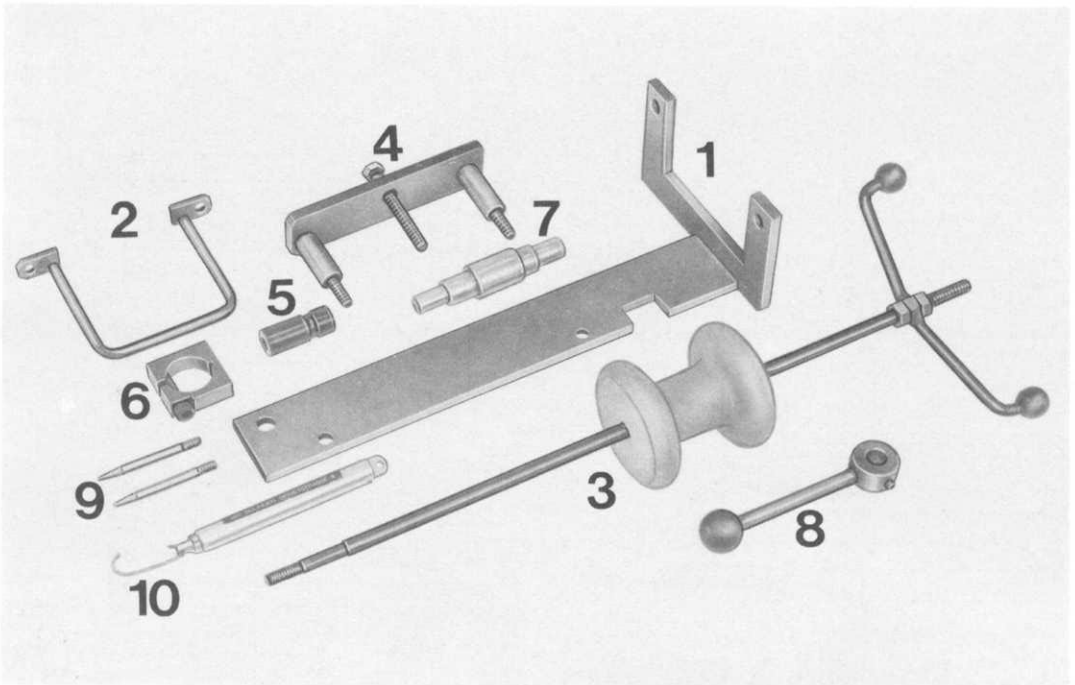
A – Spring (concave surface faces down)
B – Spring (only for transmissions with reverse gear shift lock)

21. Check by shifting through all gears with Special Tool 9155.



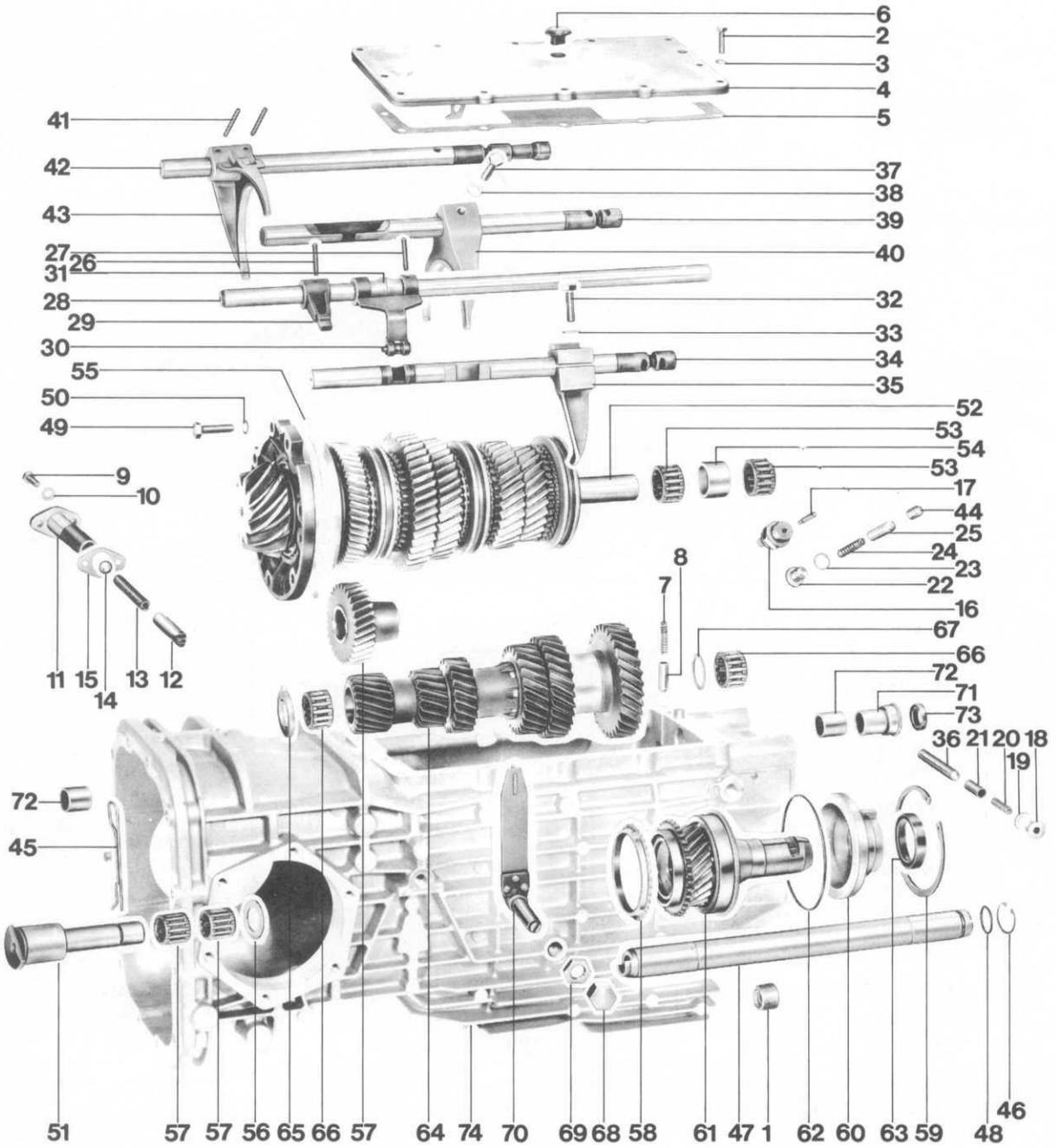
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Vent	1			
2	Bolt	2		Torque: 9 Nm	
3	Washer	2			
4	Gear lock	1		Check locking pawl for easy movement	
5	Leaf spring	1		Position correctly	
6	Case cover	1			

TOOLS



No.	Description	Special Tool	Remarks
1	Holding plate	9149	
2	Bracket	9144	
3	Impact tool	VW 771	
4	Extractor	9148	
5	Extractor	9140	
6	Clamping sleeve	-	Spare part
7	Driver	9223	
8	Operating lever	9155	
9	Centering pins	9321	
10	Spring scale	-	Standard, 0...50 N

DISASSEMBLING AND ASSEMBLING TRANSMISSION



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Drain plug (magnetic plug)	1		Torque: 22 Nm (16 ftlb)	
2	Bolt	12		Torque: 9 Nm (7 ftlb)	
3	Washer	12			
4	Case cover	1			
5	Gasket	1		Replace	
6	Vent	1			
7	Spring	1			
8	Locking sleeve	1		Lubricate thoroughly	
9	Bolt	2		Torque: 10 Nm (7 ftlb)	
10	Washer	2			
11	Guide sleeve	1			
12	Lockpin	1		Position correctly	
13	Spring	1			
14	Ball	1			
15	Gasket	1		Replace	
16	Backup light switch	1		Torque: 22 Nm (16 ftlb)	
17	Plunger	1		Stepped end faces switch	
18	Plug	1		Torque: 19 Nm (14 ftlb)	
19	Gasket	1		Replace	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
20	Spring	1			
21	Locking sleeve	1		Lubricate thoroughly	
22	Plug	1		Torque: 19 Nm (14 ftlb)	
23	Gasket	1		Replace	
24	Spring	1			
25	Locking sleeve	1		Lubricate thoroughly	
26	Pin	1	Engage 5th gear and drive out, counterholding shift rod with suitable tool.	Counterhold shift rod with suitable tool.	
27	Key	1	Engage 4th gear and drive out, counterholding shift rod with suitable tool.	Counterhold shift rod with suitable tool.	
28	Interior shift rod	1		Position correctly, cavity for pointed screw must face left.	
29	Shift arm	1			
30	Preselector lever	1			
31	Shift cam	1			
32	Bolt	1		Torque: 25 Nm (18 ftlb)	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
33	Washer	1			
34	Shift rod (4th and 5th gears)	1	Pull out toward rear		
35	Shift fork (4th and 5th gears)	1		Adjust	
36	Lock (long)	1		Lubricate thoroughly	
37	Bolt	1		Torque: 25 Nm (18 ftlb)	
38	Washer	1			
39	Shift rod (2nd and 3rd gears)	1	Pull out toward rear		
40	Shift fork (2nd and 3rd gears)	1		Adjust	
41	Lock	2			
42	Shift rod (1st and reverse gears)	1	Pull out toward rear		
43	Shift fork (1st and reverse gears)	2			
44	Lock (short)	1		Install with grease	
45	Clamp	1			
46	Circlip	1			
47	Countershaft	1			
48	O-ring	1		Replace, lubricate with light coat of oil	
49	Bolt	7		Torque: 30 Nm (22 ftlb)	

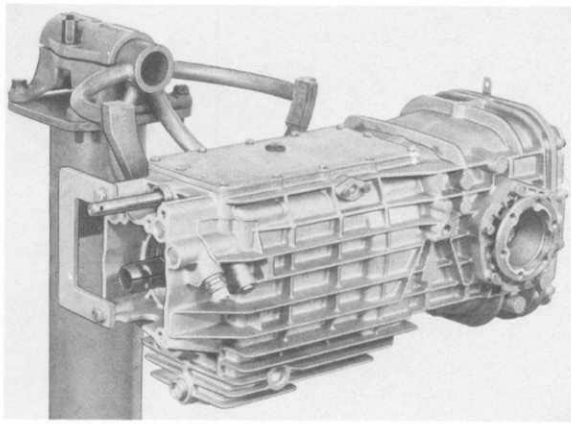
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
50	Lock washer	7		Hollow side faces bearing cap	
51	Reverse idler shaft	1	Turn bearing assembly and remove with VW 771		
52	Drive pinion	1	Remove with 9144	Install with 9144	
53	Needle cage	2			
54	Thrust ring	1			
55	Shim	X	Note number and thickness for reassembly	If necessary, determine again	
56	Thrust washer	1			
57	Needle cage	2			
58	Synchromesh ring	1	Mark for reassembly	Check for wear; mount on same gear	
59	Circlip	1			
60	Bearing cap	1	Pull out together with input shaft		
61	Input shaft	1	Pull out with 9140 and 9148		

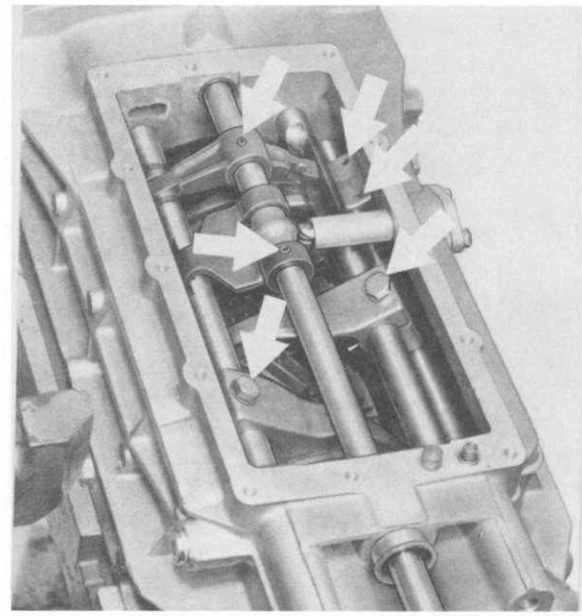
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
62	O - ring	1		Replace, lubricate with light coat of oil	
63	Seal	1			
64	Countershaft	1			
65	Thrust washer	1		Turning lock faces case opening; stick on case with a little grease	
66	Needle cage	2			
67	Washer	1			
68	Cap nut	1		Torque: 50 Nm (36 ftlb)	
69	Nut	1		Torque: 50 Nm (36 ftlb)	
70	Preselector spring with stud	1			
71	Take-up sleeve	1		Drive in with 9223	
72	Bearing	2	Drive out with suitable mandrel	Drive in with 9223	
73	Seal	1		Drive in with 9223	
74	Transmission case	1			

DISASSEMBLING AND ASSEMBLING TRANSMISSION

Disassembling

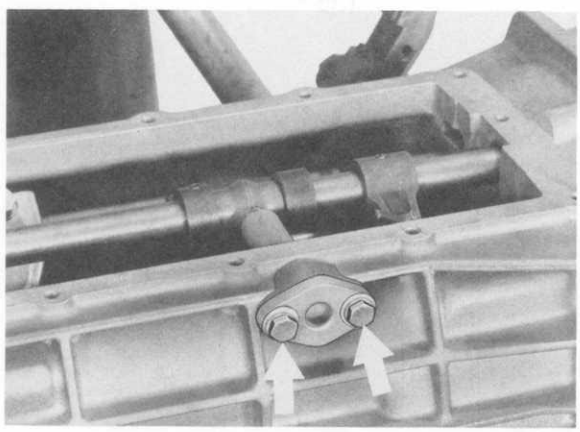
1. Mount transmission on assembly stand with Special Tool 9149 and drain oil.





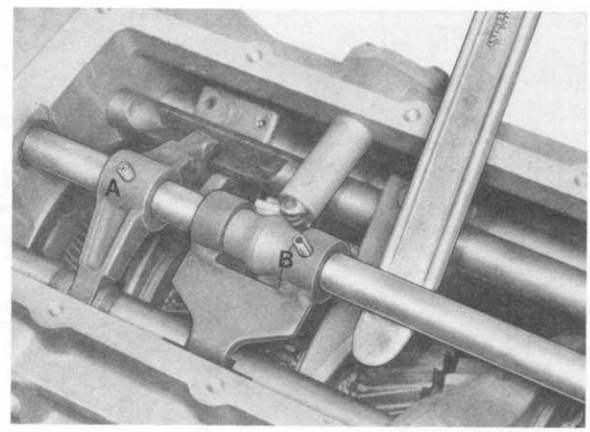
2. Remove differential (see page 39 - 201).

3. Remove shift rods, shift forks and locks.

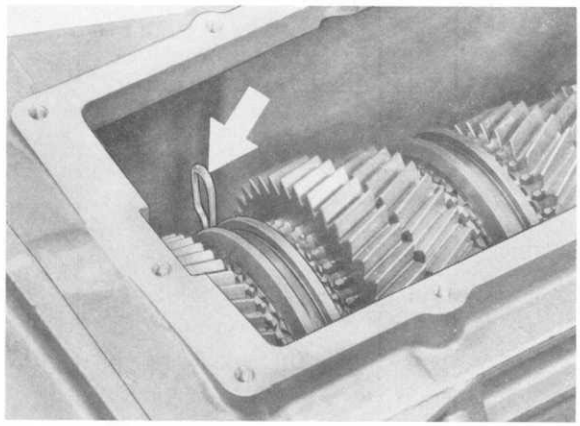


Note

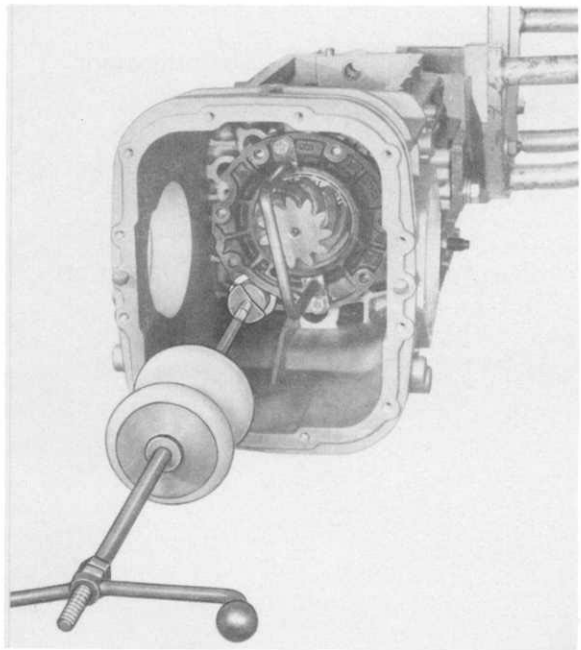
Always counterhold on interior shift rod with a suitable tool when driving out pins and keys.



4. Pull out clamp for reverse gear with a suitable pliers.



5. Unscrew drive pinion mounting bolts, mount Special Tool on bearing assembly and turn until reverse gear shaft can be removed with Special Tool VW 771.

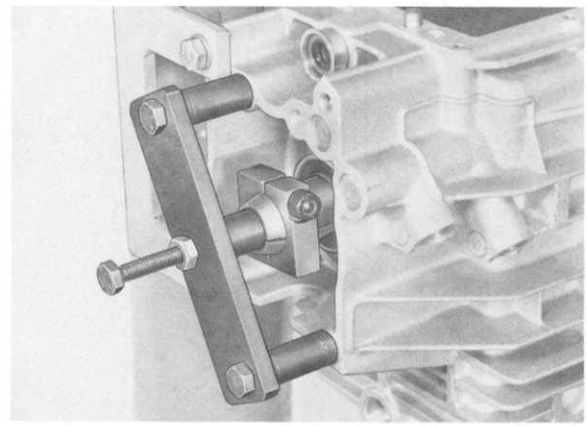


6. Remove circlip for input shaft.

7. Pull out input shaft and bearing cap with Special Tools 9140 and 9148

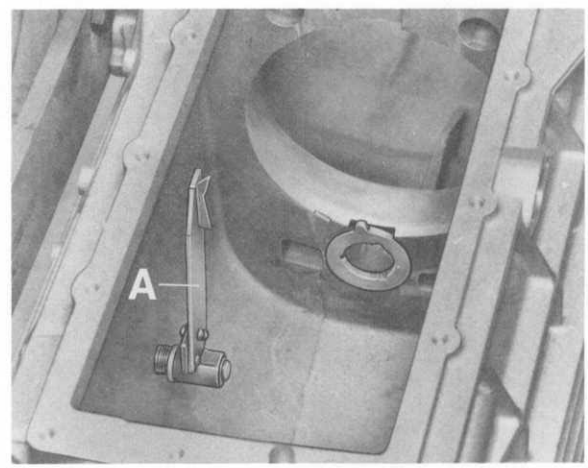
Note

Always first remove countershaft and lower countershaft to bottom of transmission.



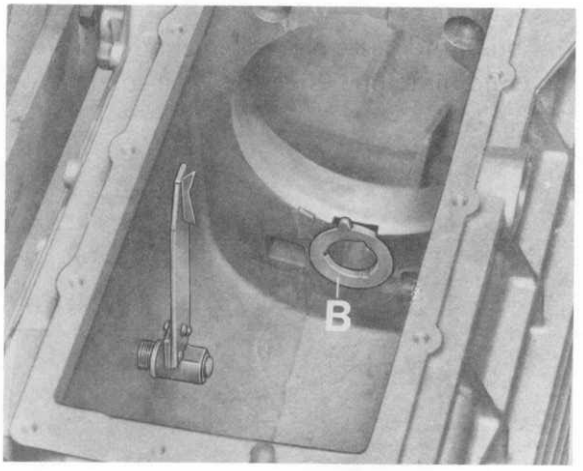
Assembling

1. Screw in preselector spring with stud from inside to outside.



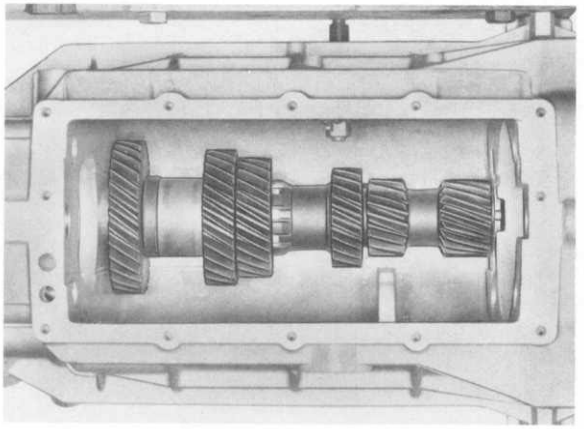
A = Preselector spring

2. Stick thrust washer for countershaft in case with a little grease.

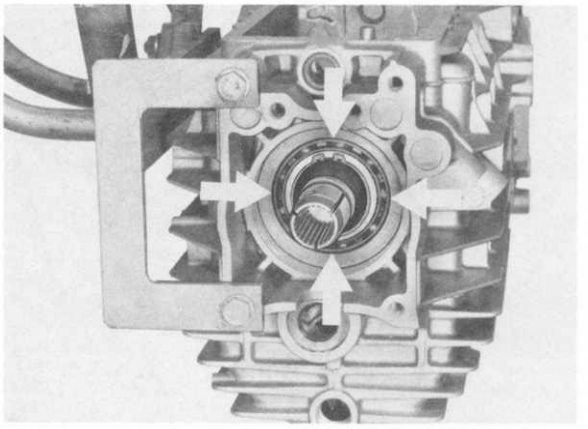


B = Thrust washer

3. Place complete countershaft in case.



4. Drive in complete input shaft over bearing outer race against stop alternately with a piece of suitable pipe or a mandrel.



5. Insert O-ring for bearing cap and lubricate with a light coat of oil.

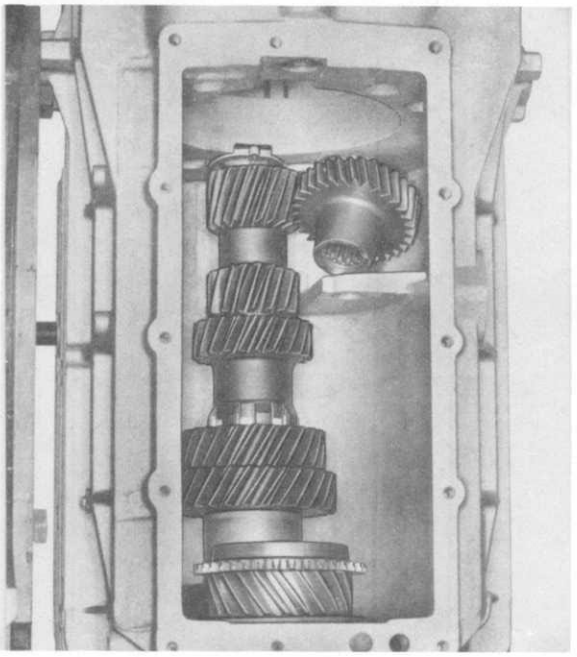
6. Mount bearing cap and circlip.

7. Swing transmission on assembly stand to have input shaft face down.

8. Install needle cages and thrust ring in input shaft.

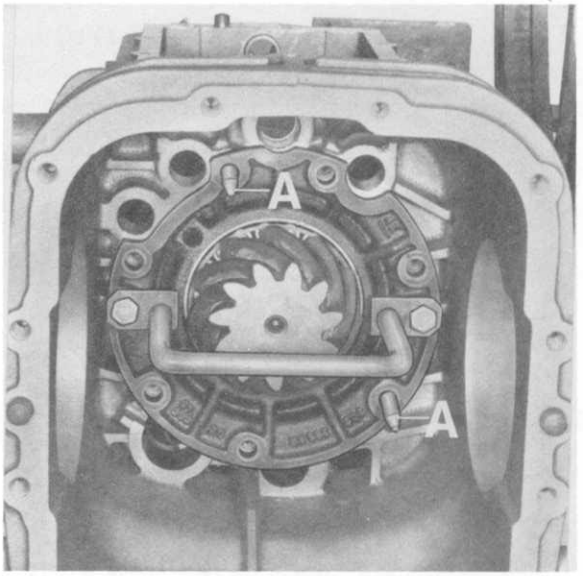
9. Place synchromesh ring for 5th gear on clutch body.

10. Place reverse gear and needle cages in case as shown in the picture.



11. Screw centering pins, Special Tools 9321, in case for installation of drive pinion and install shims S_3.

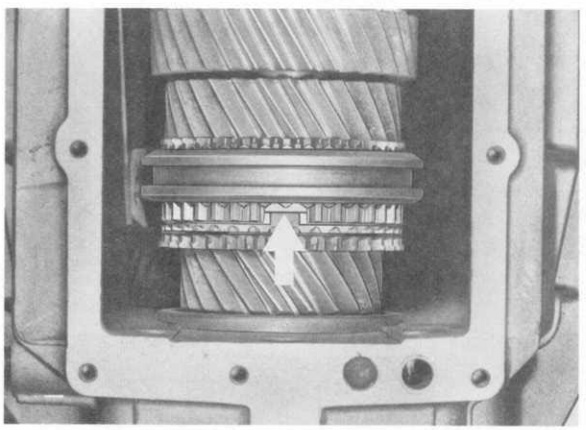
12. Mount Special Tool 9144 on drive pinion bearing cap and move in drive pinion carefully (with 4th gear engaged). Check that reverse gear is positioned correctly.



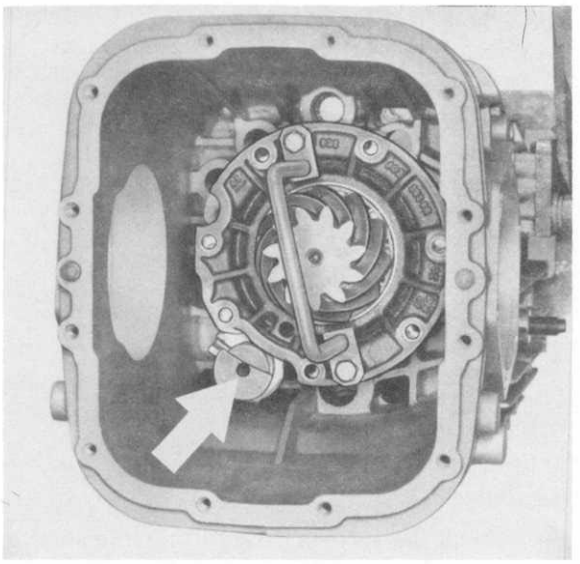
A = Special Tool 9321

Note

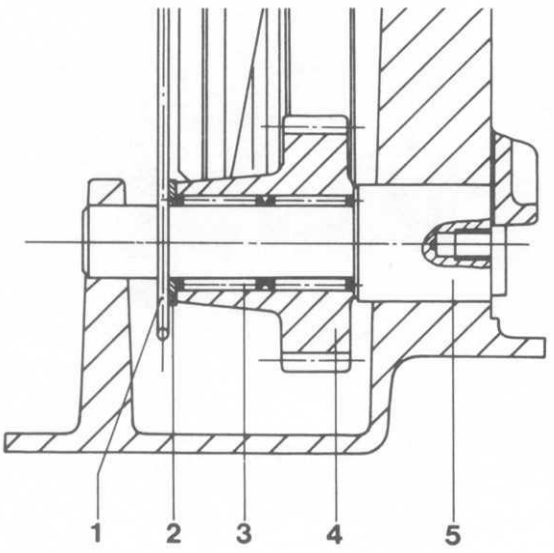
When installing the drive pinion make sure that pins of synchromesh ring (5th gear) engage in openings of guide sleeve.



13. Move reverse gear to correct installed position with a suitable tool, remove centering pins 9321 for bearing assembly and turn latter together with shims until the reverse gear shaft can be mounted.

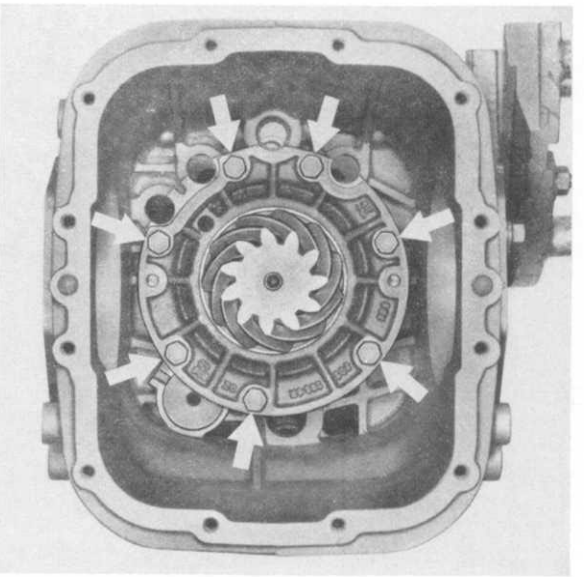


14. Drive in reverse gear shaft only far enough that thrust washer can be installed. Then drive in reverse gear shaft to correct installed position and install clamp.



1 = Clamp
2 = Thrust washer

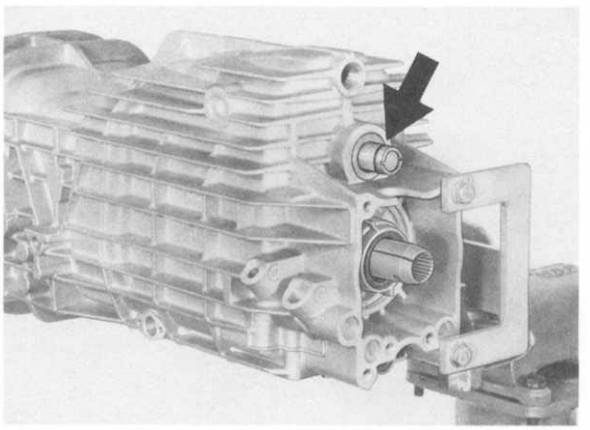
15. Turn bearing assembly and shims S_3 to installed position, tighten mounting bolts to torque of 30 Nm and remove Special Tool 9144.



16. Move countershaft to correct installed position and install shaft with O-ring (O-ring coated lightly with oil).

N o t e

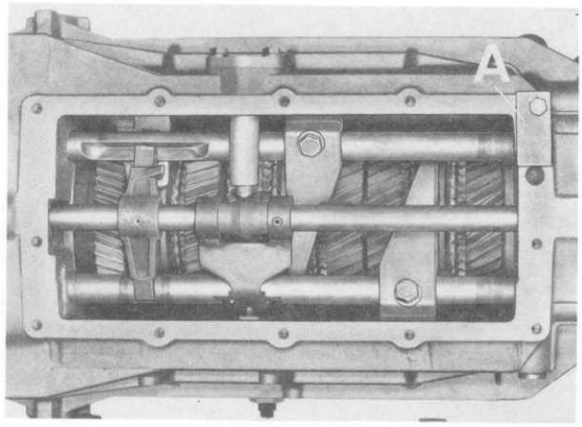
Facilitate installation by turning transmission on assembly stand until countershaft falls into correct installed position on its own weight.

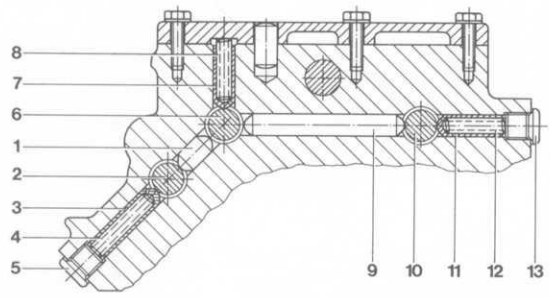


17. Install circlip.

18. Turn on idle.

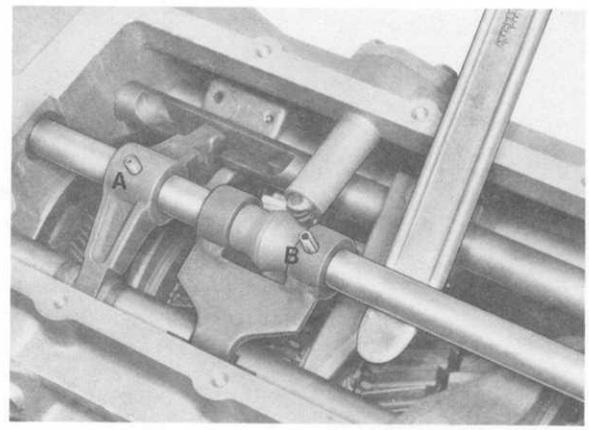
19. Install shift rods, shift forks and locks.





1 - Lock (short)
2 - Shift rods (1st and reverse gears)
3 - Locking sleeve (long)
4 - Spring (long)
5 - Plug
6 - Shift rod (2nd and 3rd gears)
7 - Locking sleeve (short)
8 - Spring
9 - Lock (long)
10 - Shift rod (4th and 5th gears)
11 - Locking sleeve (short)
12 - Spring (short)
13 - Plug

20. Mount interior shift rod with preselector lever and shift arm, counterholding on shift rod with a suitable tool.

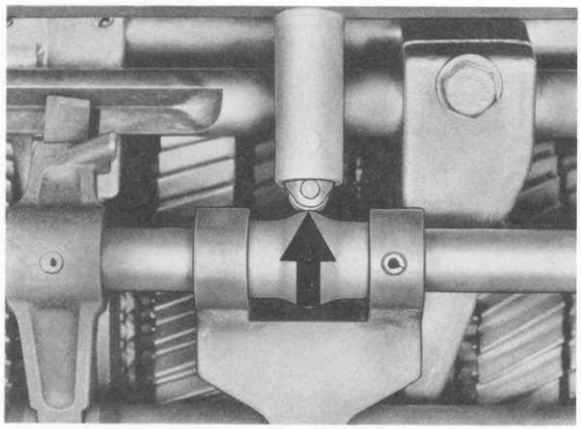


A = Pin
B = Key

Note

Cavity for pointed screw in interior shift rod must face left (in forward direction).

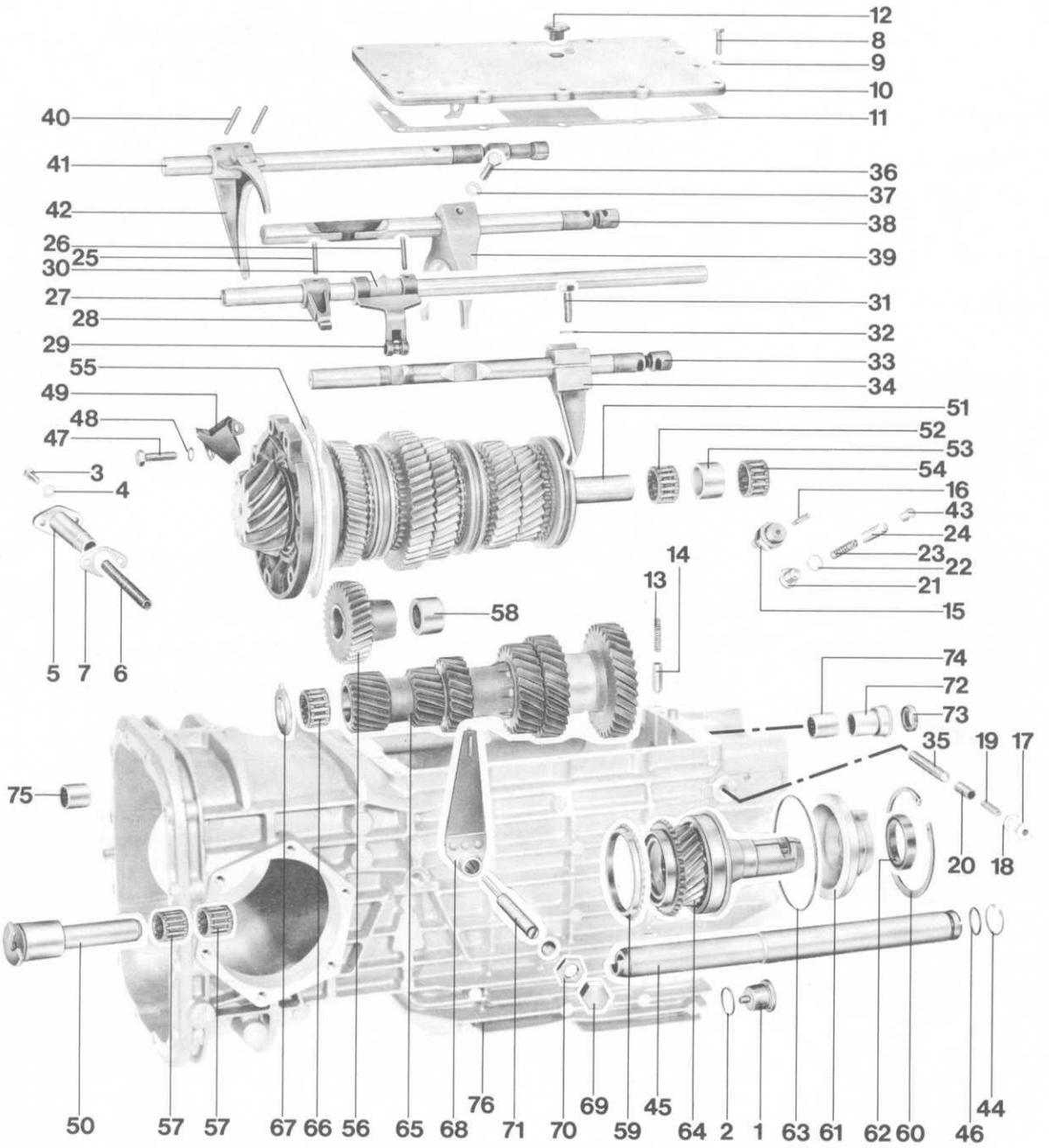
21. Install lockpin in correct position.



22. Adjust preselector spring and shift forks (see page 34 - 215).

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DISASSEMBLING AND ASSEMBLING MANUAL TRANSMISSION ('87 MODELS ONWARD)



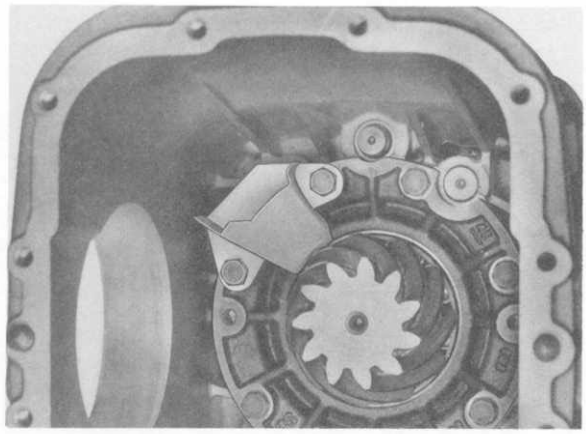
No.	Description	Qty.	Note when: Removing	Note when: Installing
1	Threaded plug (with magnet)	1		Clean, tightening torque 22 Nm (16 ftlb)
2	Sealing ring	1		Replace
3	Hex bolt	2		Tightening torque: 10 Nm (7 ftlb)
4	Washer	2		
5	Guide sleeve	1		
6	Compression spring	1		
7	Gasket	1		Replace
8	Hex bolt	12		Tightening torque: 9 Nm (6.6 ftlb)
9	Spring washer	12		
10	Case cover	1		
11	Gasket	1		Replace
12	Breather*	1		
13	Compression spring	1		
14	Locking sleeve	1		Oil well
15	Back-up light switch	1		Tightening torque: 22 Nm (16 ftlb)
16	Tappet	1		Offset side toward switch
17	Threaded plug	1		Tightening torque: 19 Nm (13.9 ftlb)
18	Sealing ring	1		Replace
19	Compression spring	1		
20	Locking sleeve	1		Oil well

* Transmission housing fitted with new breather as of MY '92 (refer to page 34 - 214m)

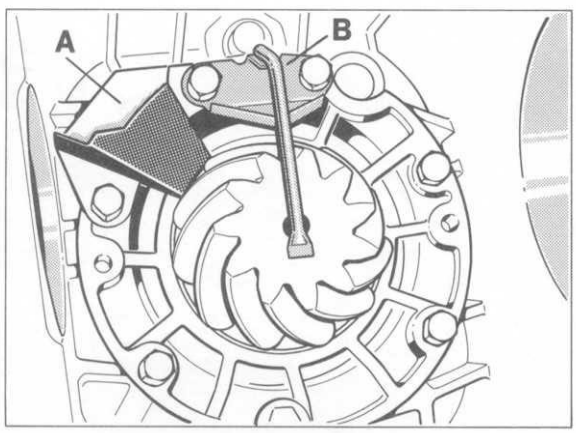
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Note

Once the selector rodas are in position, secure the oil funnel at mounding holes "A".



Modification as of MY '92
As of MY '92, an oil catcher spray tube is fitted in addition to the oil catcher cone.



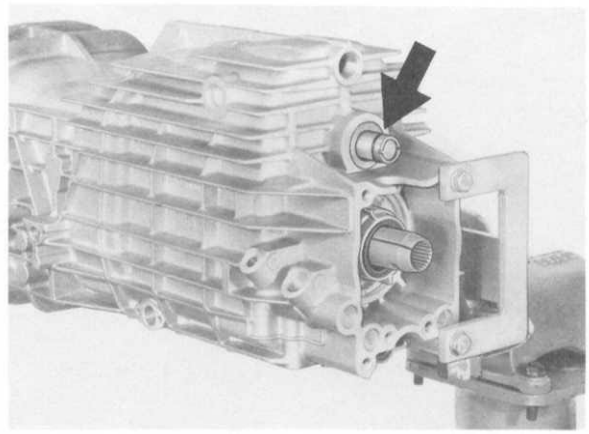
1338-34

A = Oil catcher cone
B = Oil catcher spray tube

14. Place layshaft in installation position and install axle with O-ring (lightly oil O-Ring).

Note

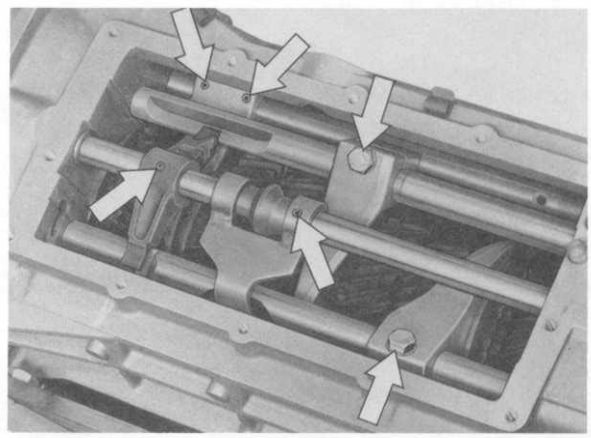
to faciliatate assembly, turn the transmission on the support until the weight of the layshaft causes ist to fall into the installation position.



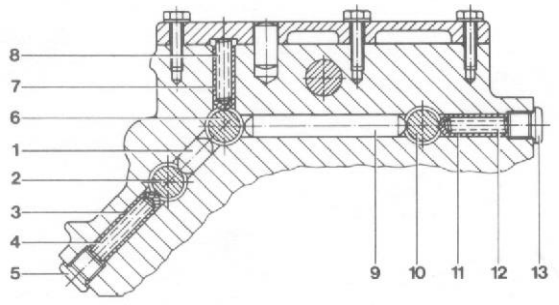
15. Install circlip.

16. Select neutral.

17. Install preselect spring, selector rods, selector forks and detente.

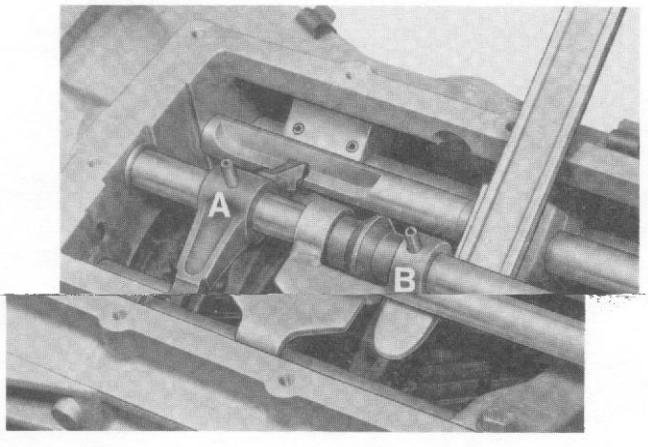


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1 - Lock, short
2 - Selector rod, 1st and reverse gear
3 - Locking sleeve, long
4 - Compression spring, long
5 - Threaded plug
6 - Selector rod, 2nd and 3rd gear
7 - Locking sleeve, short
8 - Compression spring
9 - Lock, long
10 - Selector rod, 4th and 5th gear
11 - Locking sleeve, short
12 - Compression spring, short
13 - Threaded plug

18. Install internal selector arm with preselect lever and selector finger. Hold selector rod with a suitable tool.



A = Tensioning pin
B = Tensioning sleeve

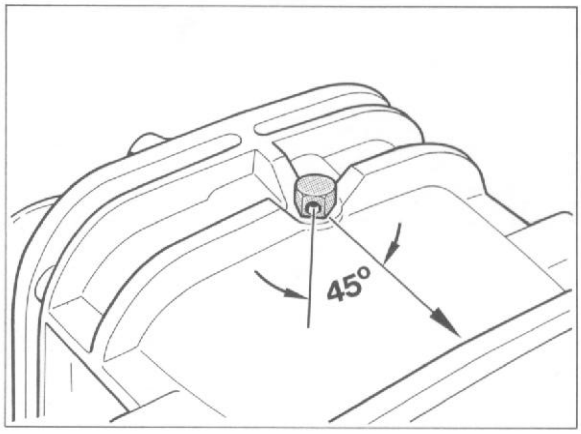
Note:

The blind hole for the tapered bolt in the internal selector arm must face left (as viewed in the forward direction of travel).

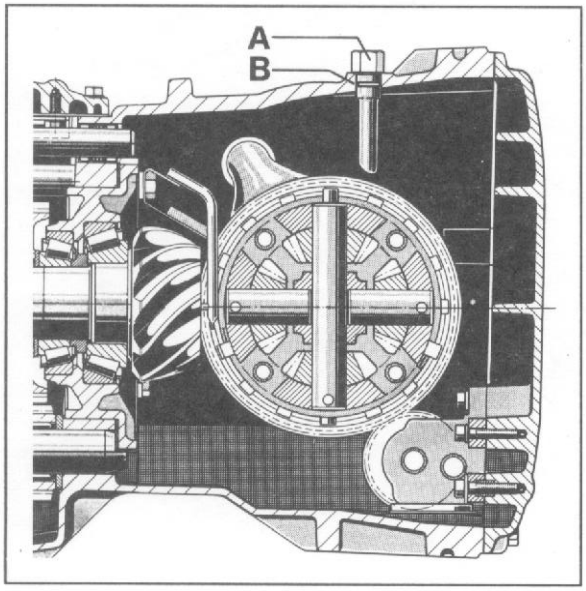
19. Adjust preselect spring and selector forks (see Page 34 - 215)

Modifications as of Model Year '92

The transmission breather in the upper transmission cover has been deleted. The new breather is located in the transmission housing and is sealed with an O-ring.



1334-34



1335-34

A = Breather
B = O-ring (apply a thin coat of transm. oil)

Note

Observing correct position, push breather into the housing until it is seated against the stop. The breather bore must then point forward at an angle of 45 deg. to the direction of travel.

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No.	Description	Qty.	Note When: Removing	Installing
21	Threaded plug	1		Tightening torque: 19Nm (13.9 ftlb)
22	Sealing ring	1		replace
23	Compression spring	1		
24	Locking sleeve	1		Oil well
25	Tensioning pin	1	Select 5th gear and drive out. Hold selector rod with suitable tool while driving out.	Hold selector rod with suitable tool.
26	Tensioning sleeve	1	Select 4th gear and drive out. Hold selector rod with suitable tool while driving out.	Hold selector rod with suitable tool.
27	Internal selector arm	1		Blind hole for taper bolt must point to left.
28	Selector finger	1		
29	Preselect lever	1		
30	Selector cam	1		
31	Hex bolt	1		Tightening torque: 25 Nm (18 ftlb)
32	Spring washer	1		
33	Selector rod (4th and 5th gear)	1		Withdraw toward rear
34	Selector fork (4th and 5th gear)	1		Adjust
35	Lock (long)	1		Oil well

No.	Description	Qty.	Note When: Removing	Installing
36	Hex bolt	1		Tightening torque: 25 Nm (18 ftlb)
37	Spring washer	1		
38	Selector rod (2nd and 3rd gear)	1		Withdraw toward rear
39	Selector fork (2nd and 3rd gear)	1		Adjust
40	Tensioning sleeve	2		
41	Selector rod (1st and reverse gear)	1		Withdraw toward rear
42	Selector fork (1st and reverse gear)	1		
43	Lock (short)	1		Grease before installing
44	Circlip	1		
45	Layshaft	1		
46	O-ring	1		Replace, oil lightly
47	Hex bolt	7		Tightening torque: 30 Nm (22 ftlb)
48	Locking washer	7		Hollow side toward bearing cover
49	Oil funnel	7		Note installation position
50	Reversing shaft	1	Turn bearing assembly and remove with VW 771	
51	Drive pinion	1	Remove with Special Tool 9144	Install with Special Tool 9144

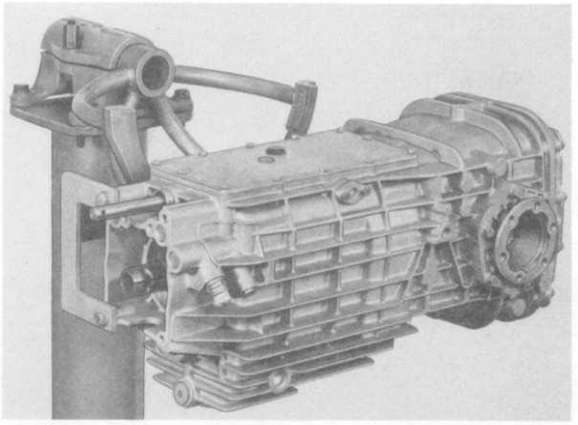
No.	Description	Qty.	Note When: Removing	Installing
52	Needle cage	1		
53	Thrust ring	1		
54	Needle bearing	1		
55	Shim "S_3"	X	Note number and thickness for reassembly	Recalculate if necessary
56	Reverse idler	1		
57	Needle cage	2		
58	Spacer	1		
59	Synchromesh ring	1	Mark for reassembly	Check for wear, install with original gear
60	Circlip	1		
61	Bearing cover	1	Withdraw with two flat pliers	
62	Sealing ring	1		Oil sealing lip
63	O-ring	1		Replace, oil lightly
64	Input shaft	1	Lower layshaft on to base of transmission and withdraw with Special Tools 9140 and 9148	
65	Layshaft	1		
66	Needle cage	1		
67	Thrust washer	1		Anti-twist lock toward recess in case, hold in place with blob of grease on case.

No.	Description	Qty.	Note When: Removing	Installing
68	Preselect spring	1		Adjust
69	Acorn nut	1		Tightening torque: 50 Nm (37 ftlb)
70	Hex nut	1		Tightening torque: 50 Nm (37 ftlb)
71	Stud bolt	1		
72	Locating sleeve	1		Press in with Special Tool 9223
73	Sealing ring	1		Press in with Special Tool 9223
74	Bearing	1	Drive out with suitable mandrel	Press in with Special Tool 9223
75	Bearing	1	Drive out with suitable mandrel	Press in with Special Tool 9223
76	Transmission case	1		

NOTES ON ASSEMBLING AND DISASSEMBLING

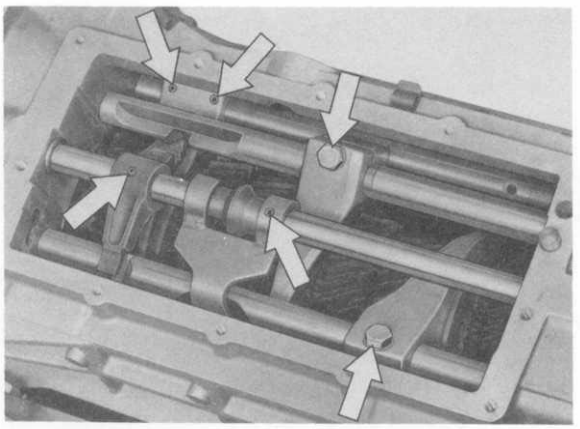
Disassembling

1. Secure transmission to assembly support with Special Tool 9149 and drain oil.



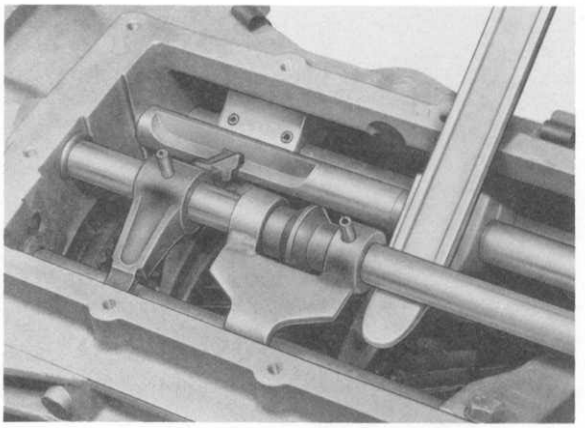
2. Installing differential, see page 39 - 201.

3. Remove selector rods, selector forks and detente.

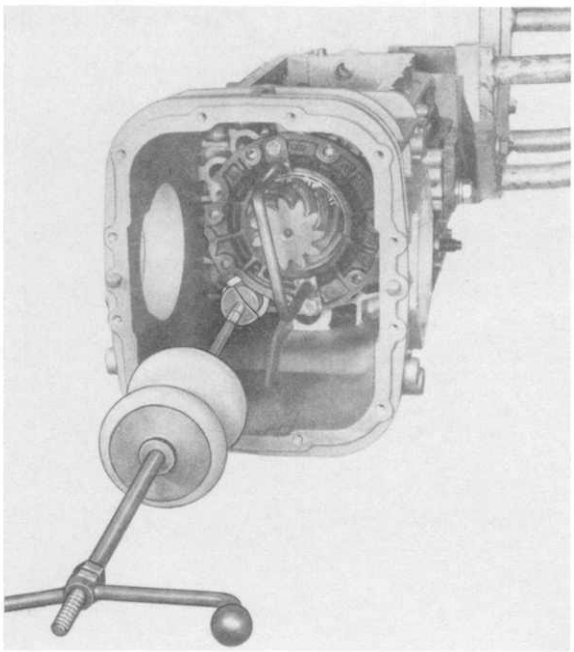


Note:

When driving out tensioning pin and tensioning sleeve, it is essential to hold internal selector arm with a suitable tool.



4.Remove mounting bolts for drive pinion, secure Special Tool 9144 to bearing assembly and turn the latter with shims "S_3" until the reverse idler shaft can be removed with Special Tool VW 771.



5.Remove circlip for bearing cover and remove cover with two suitable flat-nosed pliers.

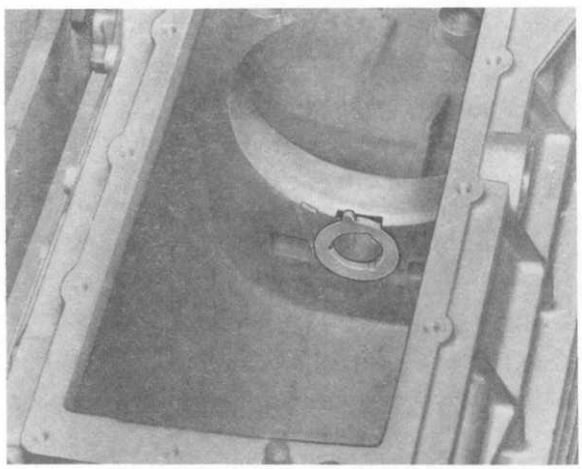
6.Withdraw drive pinion with Special Tools 9140 and 9148.

Note:

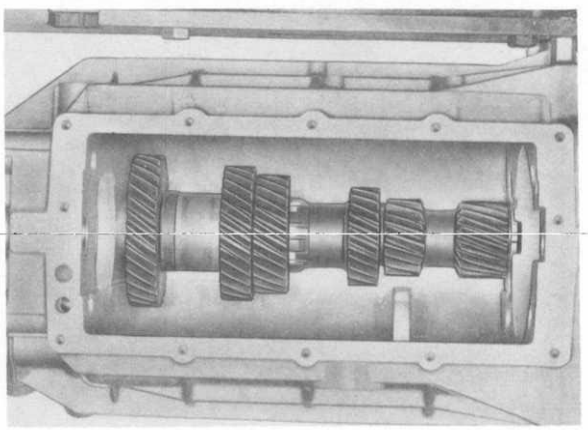
It is essential to remove the layshaft axle beforehand and lower layshaft to bottom of transmission.

Assembling:

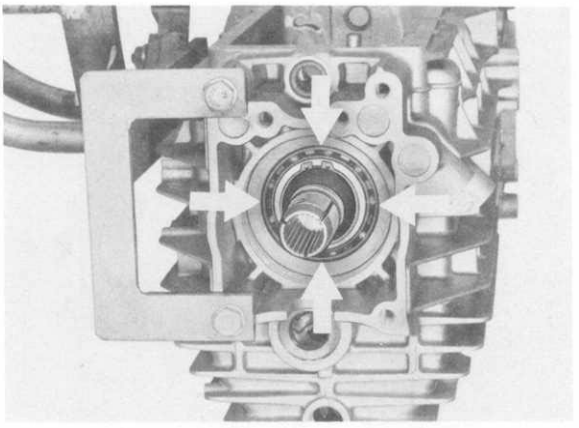
1.With a blob of grease, fix thrust washer for layshaft to case.



2.Place fully assembled layshaft in case.



3.Working on each side alternately, use a suitable piece of pipe or a mandrel to drive fully assembled input shaft over bearing outer race as far as it will go.



4.Insert O-ring for bearing cover, oil lightly.

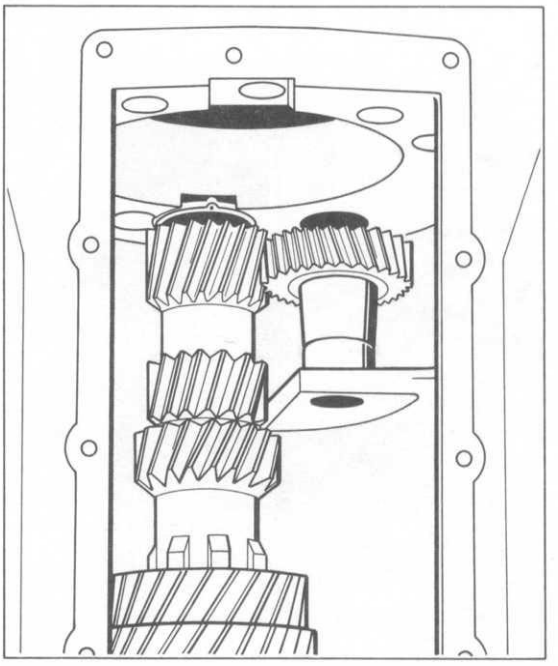
5.Install bearing cover and circlip.

6.Swivel transmission on support until input shaft points downward.

7.Install needle cage and thrust washer in input shaft.

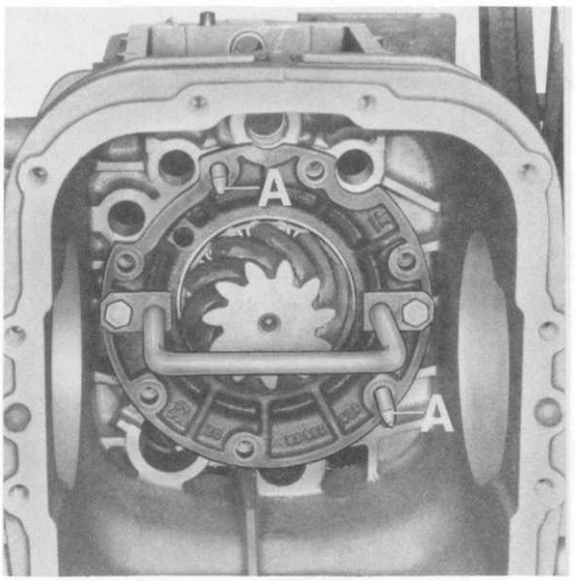
8.Place synchromesh ring for 5th gear on clutch body.

9.Place reverse idler with needle cages and spacer in case as illustrated.



10.Screw centering pins 9321 for installation of the drive pinion into case and place shims "S_3" in position.

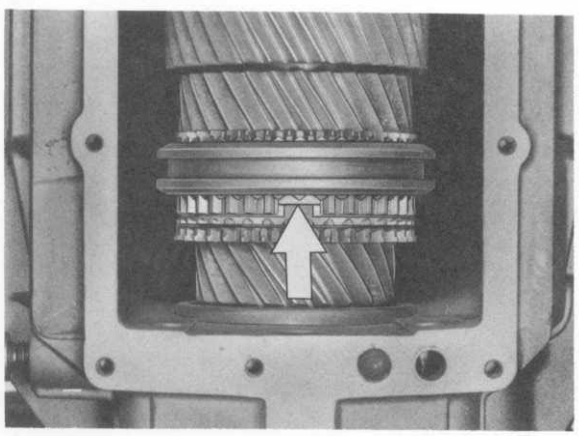
11. Attach Special Tool 9144 to drive-pinion bearing cover and carefully insert drive pinion (with 4th gear selected). Note position of reverse idler.



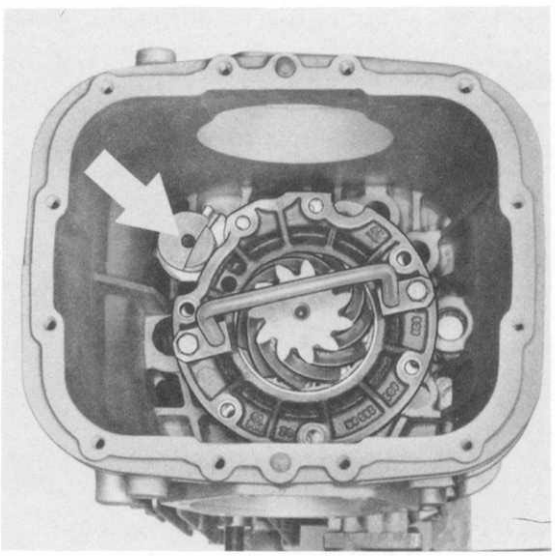
A = Special Tool 9321

Note:

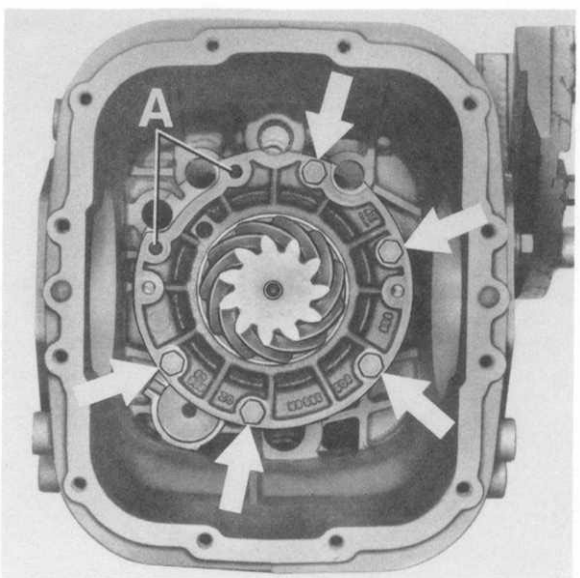
When installing drive pinion, it is essential to ensure that the dogs of the synchromesh ring (5th gear) engage the recesses of the guide sleeve.



12. With a suitable tool, move reverse idler to installation position, remove centering pins 9321 for bearing assembly and turn the latter with shims until the reverse idler shaft can be installed.



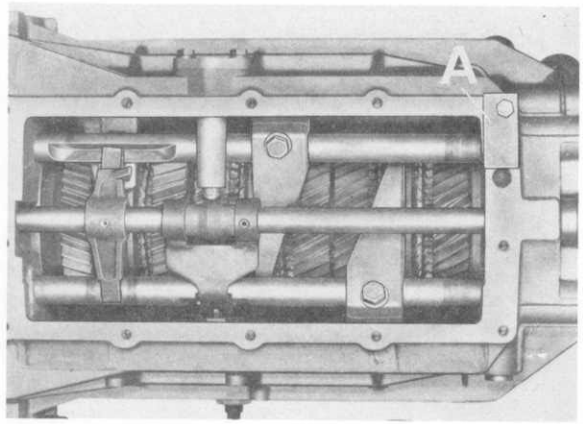
13. Turn bearing assembly with shims "S_3" to assembly position, tighten mounting bolts to 30 Nm (22 ftlb) and remove Special Tool 9144.



ADJUSTING SHIFT FORKS

Note

Insert locking sleeve and spring for no-play arrest of 2nd and 3rd gear rod and move to correct installed position with a locally manufactured holder.



A = Locally manufactured holder made of 10 x 20 x 45 mm flat steel, with 6,5 mm dia. mounting hole and 2.5 mm chamfer in area of locking sleeve.

1. Adjust operating sleeves with the shift forks that they are exactly in the middle between synchromesh rings in neutral position.

2. Tighten mounting bolts with torque of 25 Nm (18 ftlb).

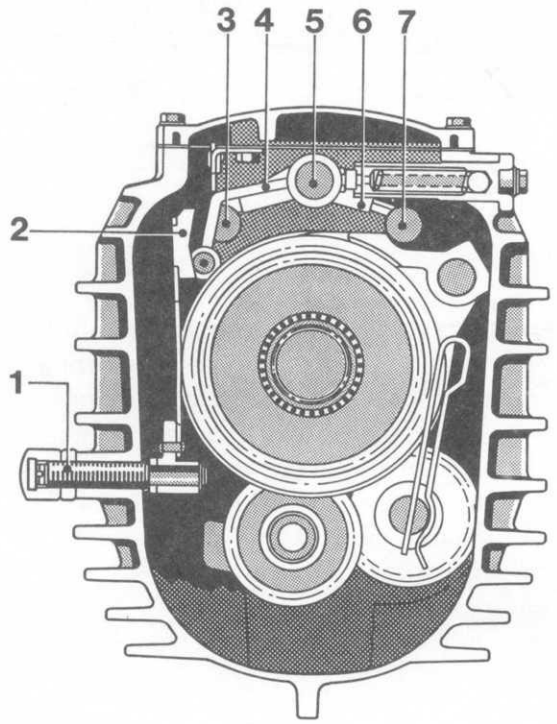
Note

Deviations in adjustments must be corrected after checking the shifting, since perfect synchronization depends on this.

ADJUSTING SHIFTS

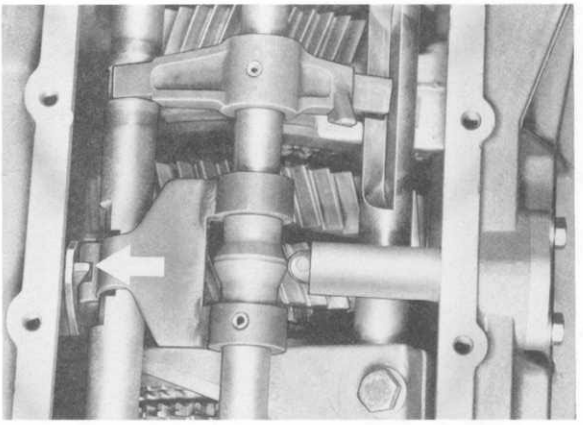
Note

Insert locking sleeve and spring for no-play arrest of 2nd and 3rd gear shift rod and move to correct installed position with a locally manufactured holder (see page 34 - 215).

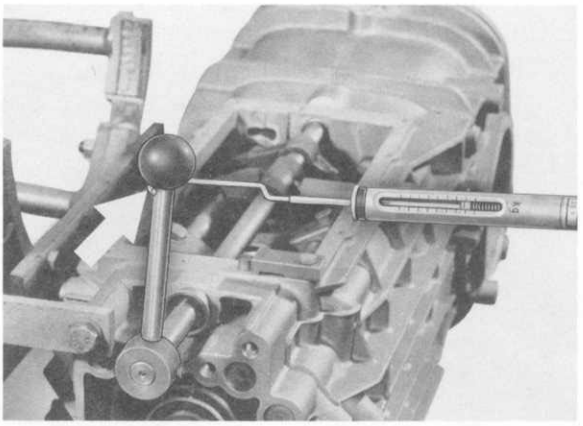


1 - Adjusting pin
2 - Preselector spring
3 - Shift rod, 4th and 5th gears
4 - Preselector lever
5 - Interior shift rod
6 - Shift arm
7 - Shift rod, 2nd and 3rd gears

1. Adjust preselector spring (2) with adjusting pin (1) enough that it just barely touches the roller of preselector lever (4). In this position shift arm (6) and preselector lever (4) will engage in openings of 4th and 5th gear shift rod.

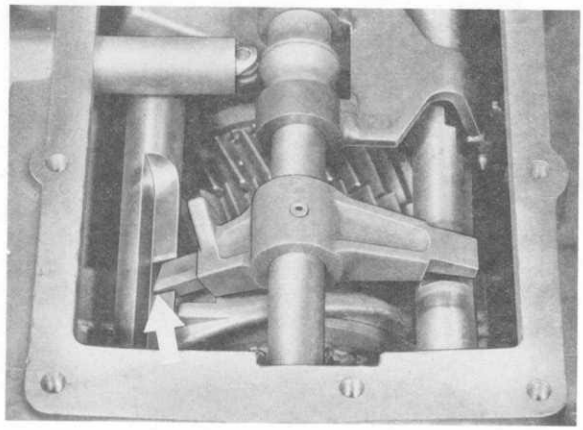


2. Measure force of preselector spring.
   Nominal value: 22 N.
   Mount Special Tool 9155 on interior shift rod, attach a conventional spring scale (0.....50 N) below ball, pull interior shift rod and shift arm into 2/3 shift plane and read spring force from spring scale.

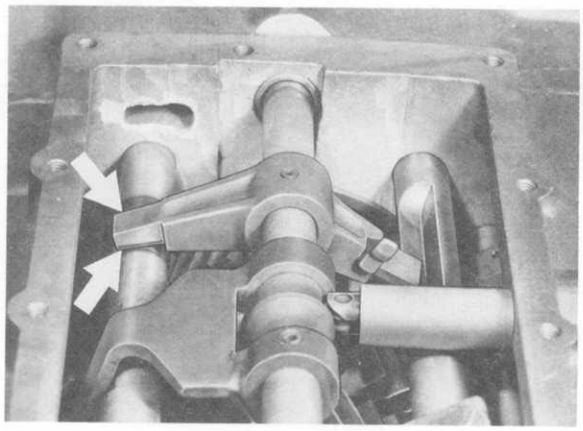


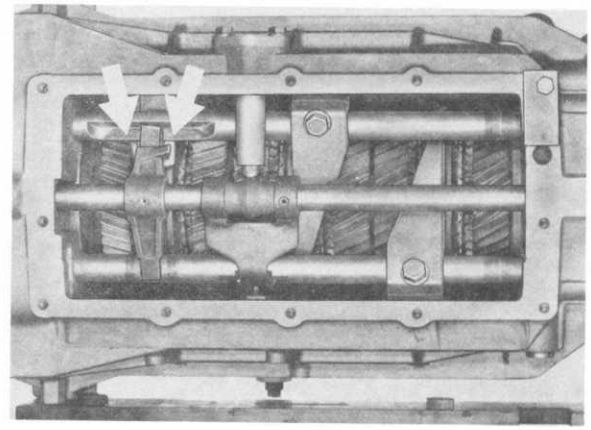
3. If necessary, adjust force of preselector spring to 22 N by turning the adjusting pin.

4. Move shift arm into 2/3 shift plane and adjust it by turning adjusting pin (approx. 1/2 turn clockwise or anticlockwise) that it does not protrude completely into opening of 2nd / 3rd gear shift rod.



5. Check by shifting in and out of all gears carefully with Special Tool 9155 (turning drive pinion if necessary) and note, whether shift arm has access to 4th/5th gear shift rod and 1st/reverse gear shift fork in 2/3 shift position as well as access to 2nd/3rd gear shift rod in 4/5 shift position





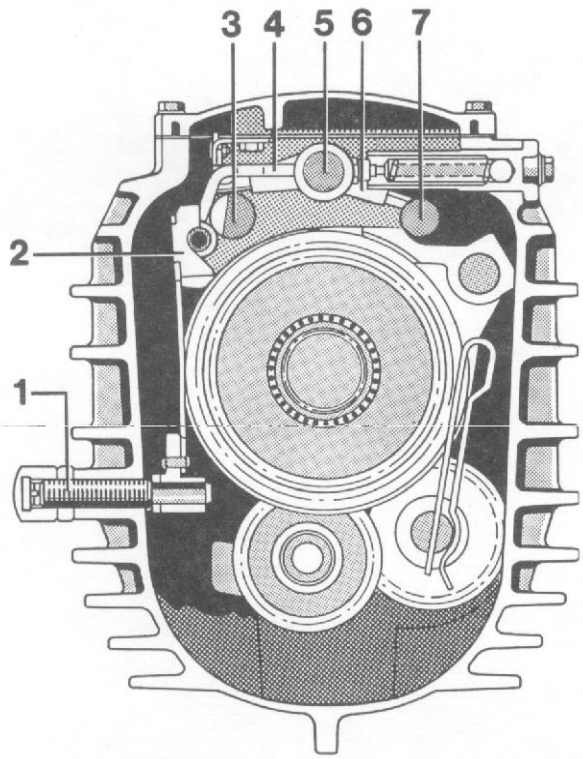
Note

Deviations must be corrected accurately after checking shifts, since perfect shifting depends on correct adjustment. Turning the adjusting pin (1) will change the force of preselector spring (2), so that turning the adjusting pin for corrections should be kept to a minimum (approx. 1/2 turn clockwise or anticlockwise).

ADJUSTING GEARSHIFT ('86 MODELS ONWARD)

Note:

To lock the 2nd and 3rd gear selector rod in its zero position, install locking sleeve and compression spring and bring to installation position with improvised holder (see page 34 - 215).



'86 Models

1 - Adjusting pin

2 - Preselect spring

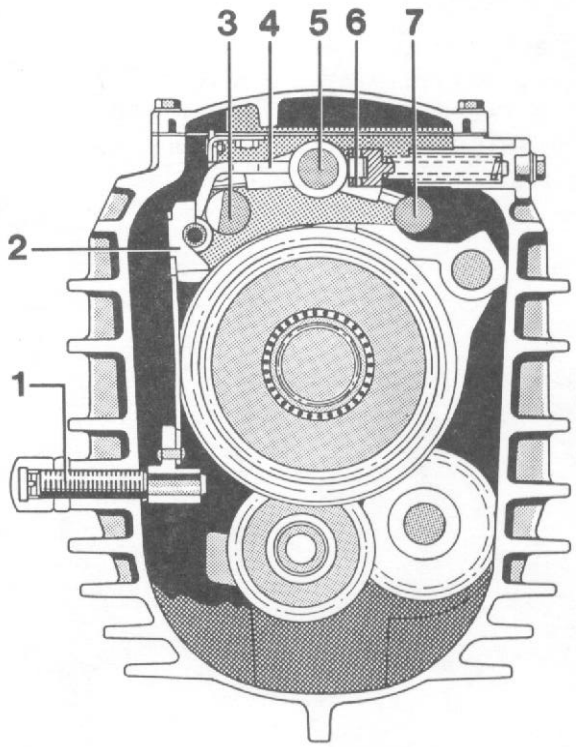
3 - Selector rod, 4th and 5th gear

4 - Preselect lever

5 - Internal selector arm

6 - Selector finger

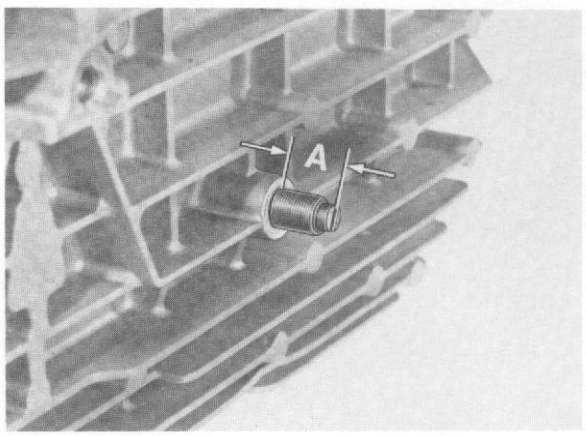
7 - Selector rod, 2nd and 3rd gear



'87 models onward

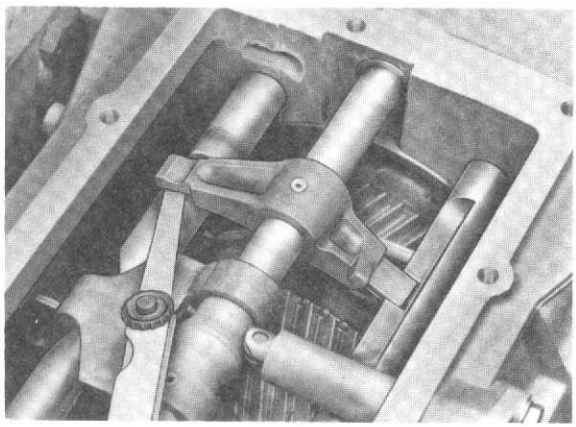
1.Select neutral.

2.Carry out rough adjustment of preselect spring (2). To do so, screw adjustor pin (1) into case until approx. 20 mm project.

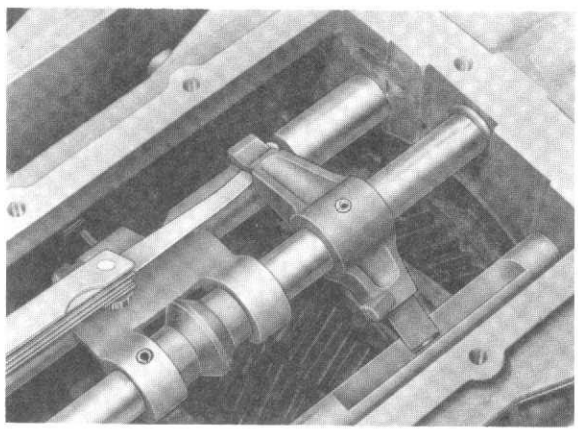


A = approx. 20 mm

3. Select 3rd gear and with a feeler gage, adjust play s = 0.2 + 0.1 mm between selector finger and 4/5 selector rod. Adjustment is by means of adjuster pin (1).

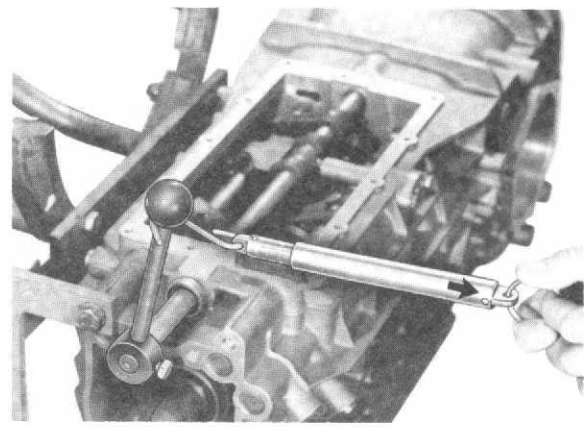


'86 models

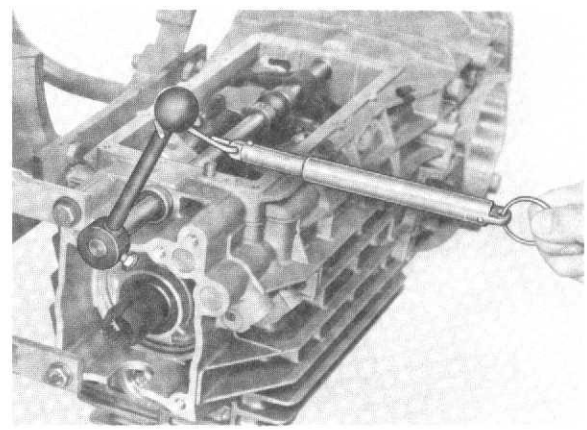


'87 models

4. Measure spring force of preselect spring. Specified force 60...80N. To measure, attach Special Tool 9155 to internal selector arm, attach commercially available spring balance (0...100N) beneath ball, pull internal selector arm with selector finger to 1/R shift level and read spring force from spring balance.



'86 models



'87 models onward

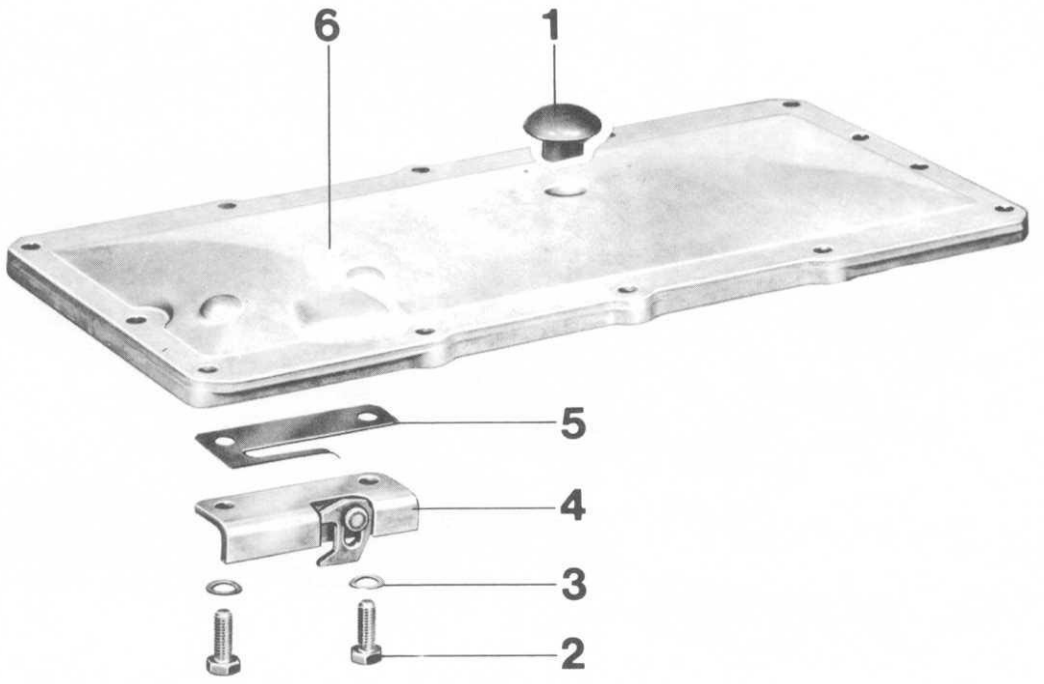
5. If necessary, turn adjusting pin to set force of preselect spring to specified value.

Note:

If the spring force is changed, recheck the clearance s = 0.2 + 0.1 mm between selector finger and selector rod and readjust if necessary (see Step 3).

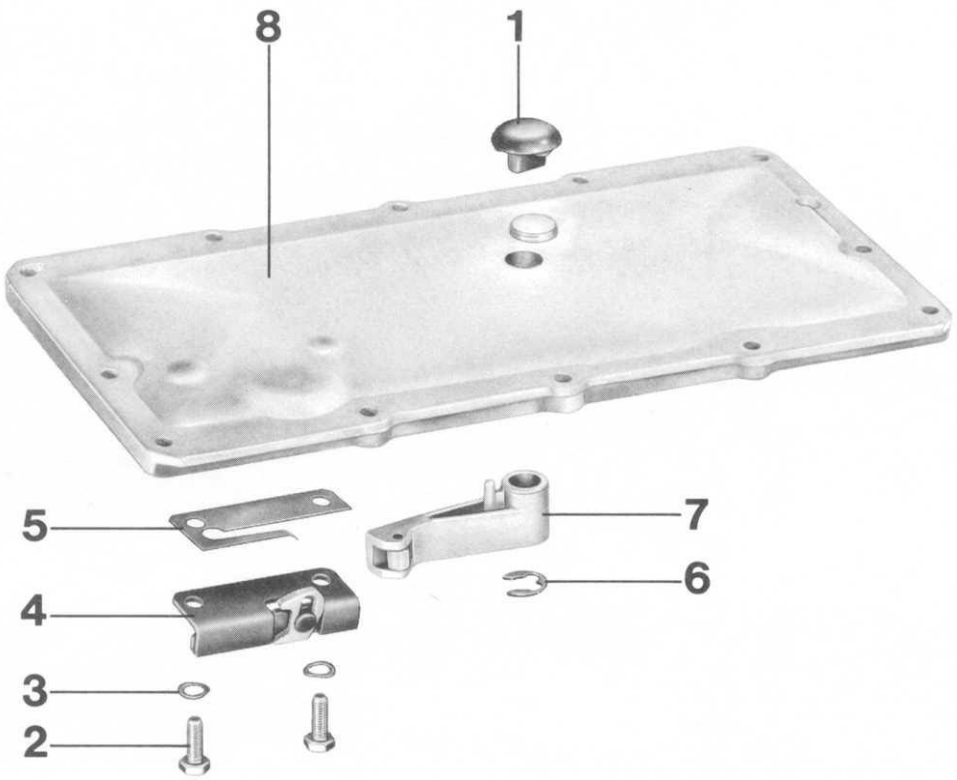
6. As a check, select each gear in turn with Special Tool 9155 (turn drive pinion during this procedure) and ensure that all the gears can be selected in the correct manner.

DISASSEMBLING AND ASSEMBLING UPPER TRANSMISSION COVER



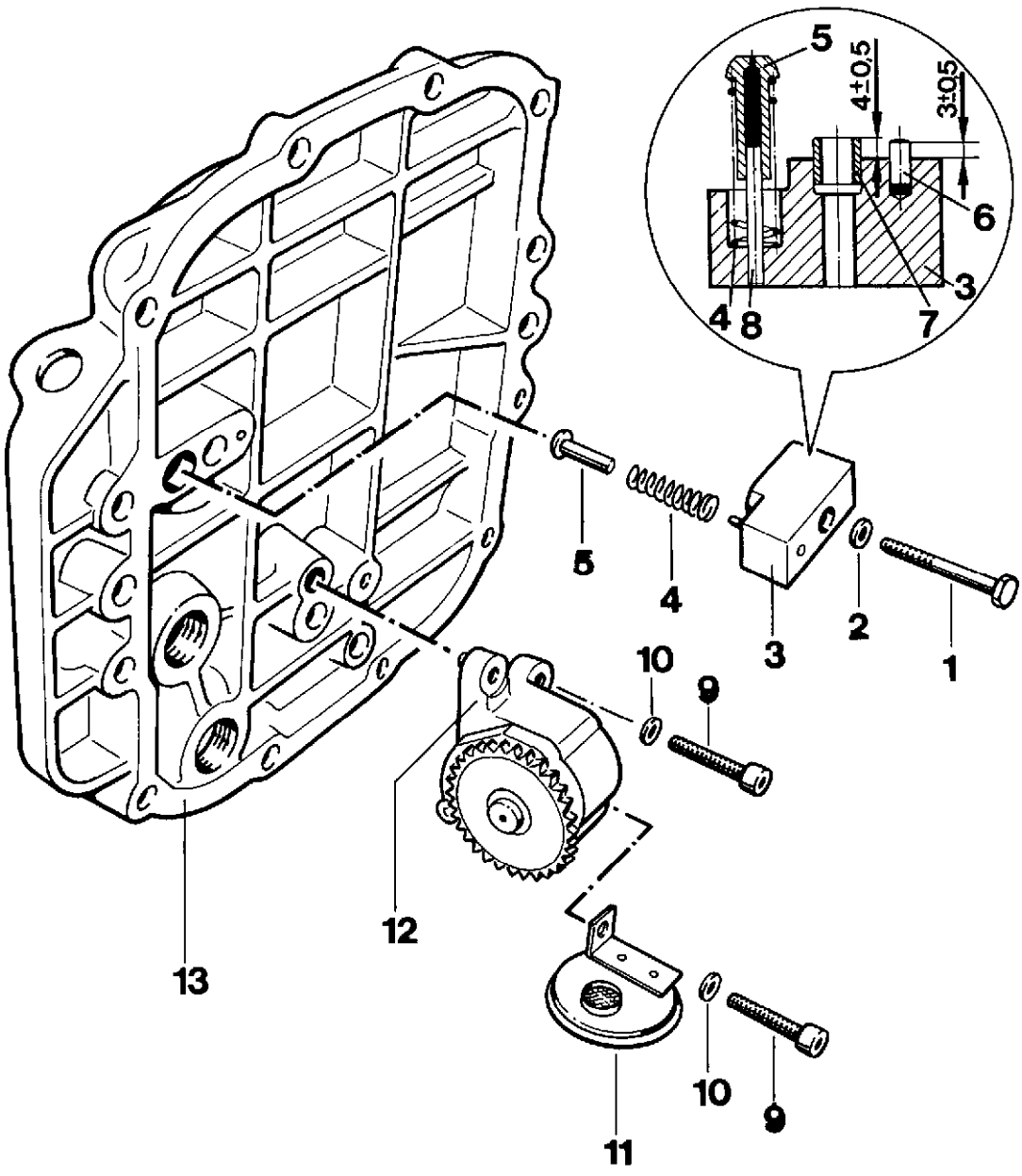
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Vent	1			
2	Bolt	2		Torque: 9Nm (7 ftlb)	
3	Washer	2			
4	Gear arrest	1		Check that locking pawl moves easily	
5	Leaf spring	1		Install in correct position	
6	Case cover	1			

DISASSEMBLING AND ASSEMBLING UPPER TRANSMISSION COVER ('87 MODELS ONWARD)



No.	Description	Qty.	Note When: Removing	Installing
1	Air bleed	1		
2	Hex bolt	2		Tightening torque 9 Nm (6.6 ftlb)
3	Spring washer	2		
4	Gear lock	1		Check that locking cam moves freely
5	Leaf spring	1		Install right way round
6	Circlip	1		
7	Roller lever	1		
8	Case cover	1		

Dismantling and assembling housing cover with oil pump



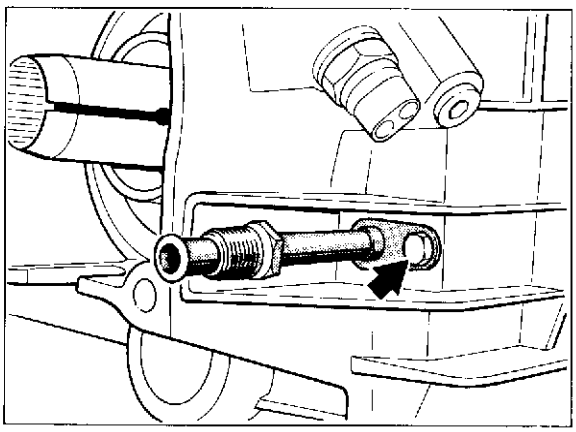
Printed in Germany – XXXI, 1993

No.	Designation	Qty.	Note: Removal	Note: Installation
1	Hexagon head bolt	1		Tighten to 10 Nm (7 ftlb.)
2	Washer	1		
3	Bracket	1		
4	Thrust spring	1		
5	Valve	1		
6	Roll pin	1		Fitting depth 3 ± 0.5 mm
7	Adapter sleeve	1		Fitting depth 4 ± 0.5 mm
8	Roll pin	1		Press in flush
9	Pan-head screw	3		Tighten to 10 Nm (7 ftlb.)
10	Washer	3		
11	Suction cone with strainer	1		
12	Oil pump	1		
13	Housing cover	1		

Printed in Germany – XXXI, 1993

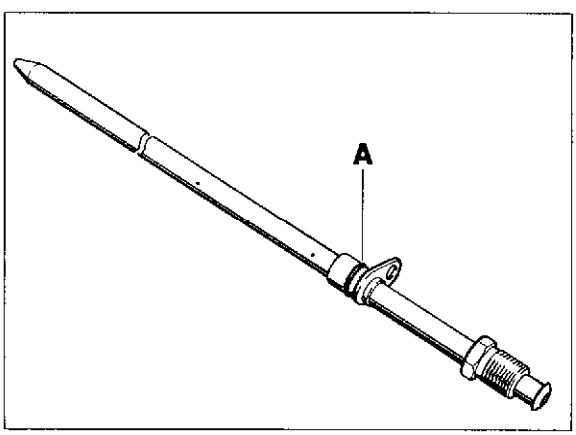
Replacing O-ring for spray tube (type G28/57)

1. Remove spray tube, undoing hexagon head bolt and pulling out tube.



1332-34

2. Coat new O-ring with transmission oil and push tube carefully into the housing.
   Tighten hexagon head bolt to 10 Nm (7 ftlb.).

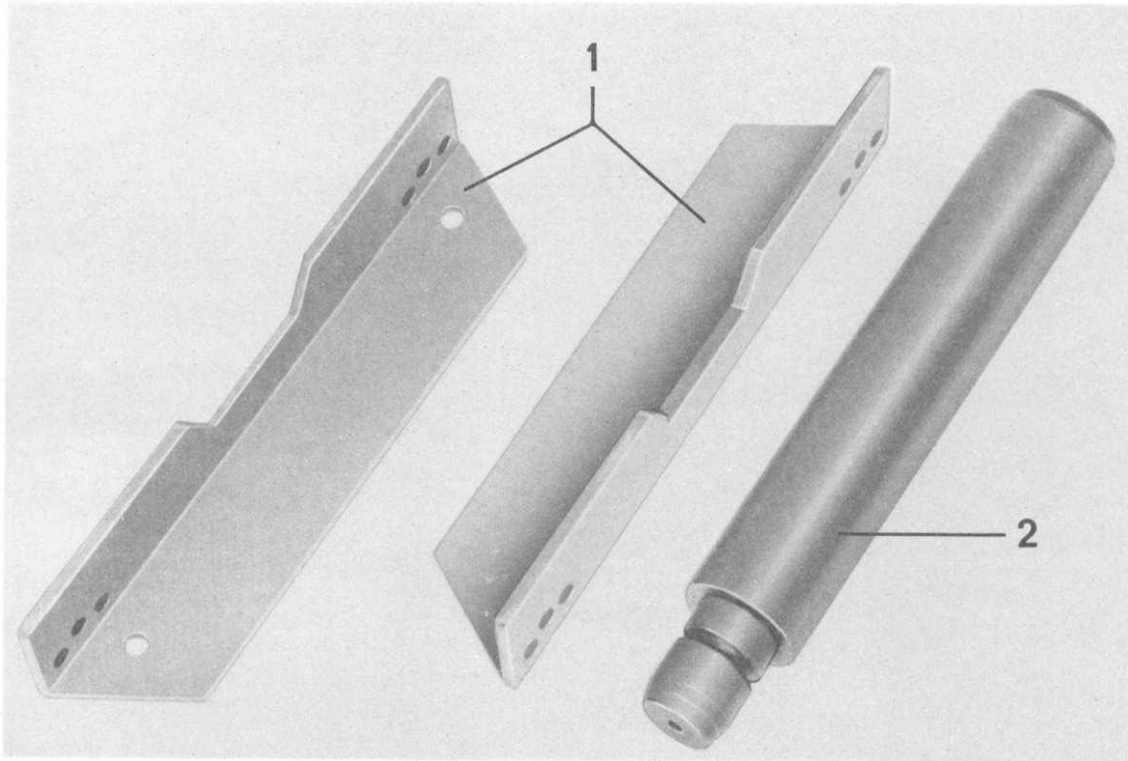


1333-34

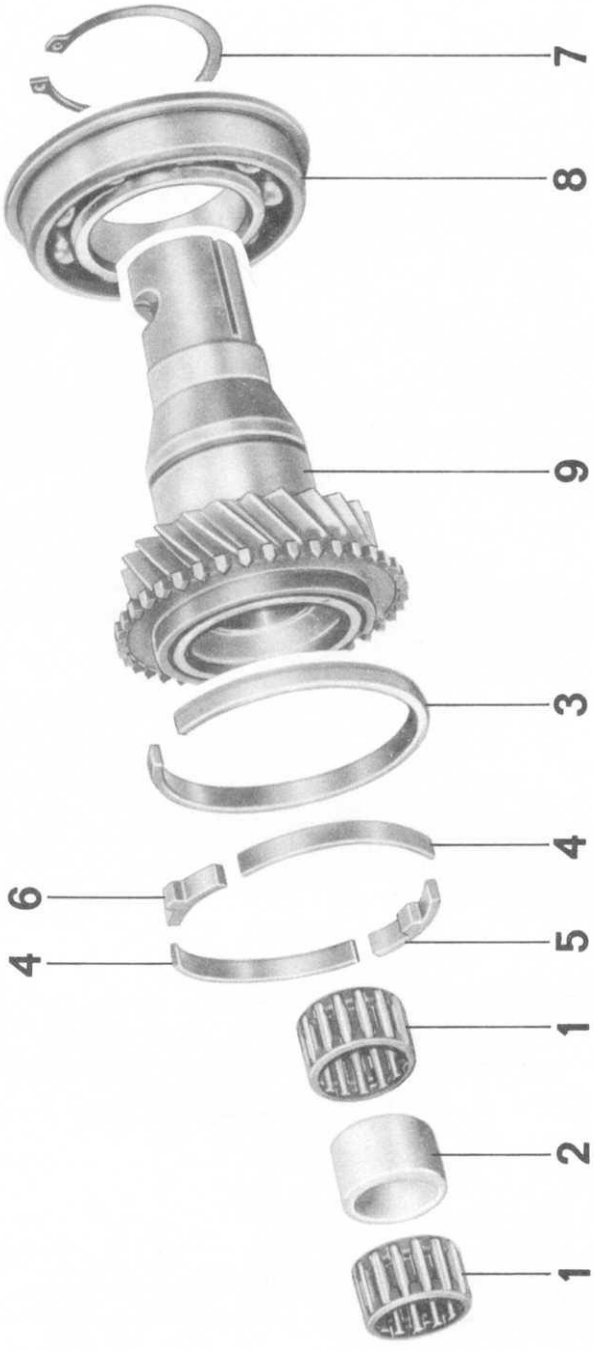
A = O-ring

Printed in Germany – XXXI, 1993

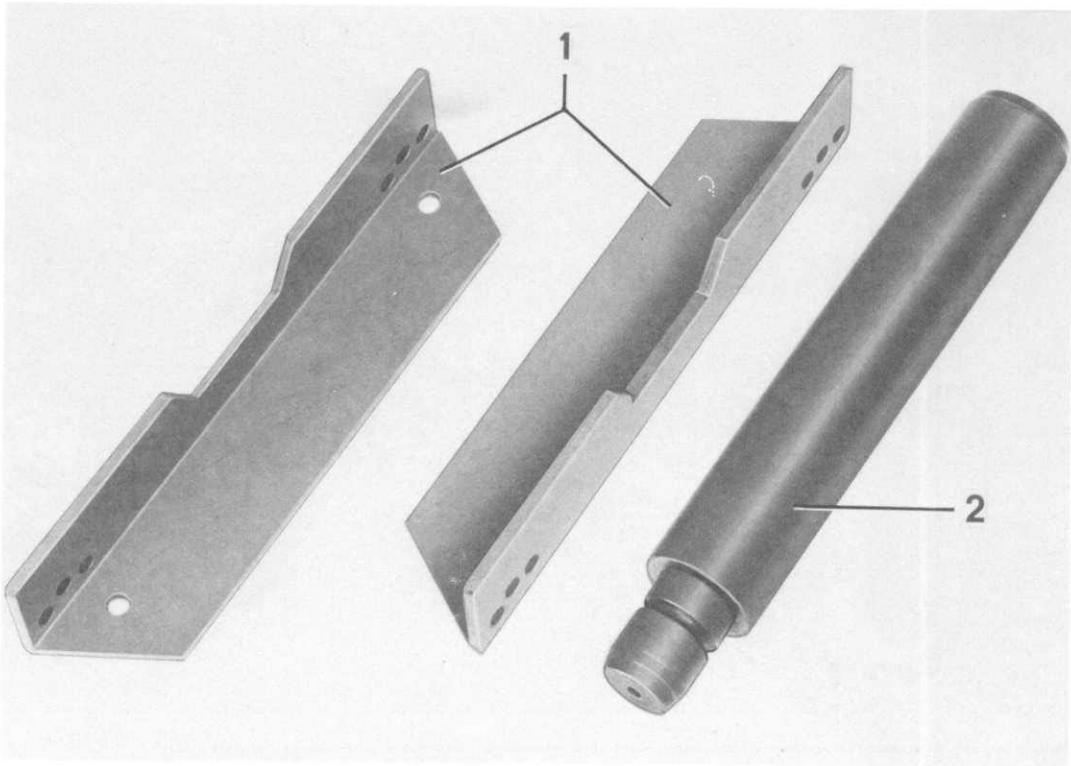
TOOLS



No.	Description	Special Tool	Remarks
1	Support rail	VW 457	
2	Mandrel	VW 407	

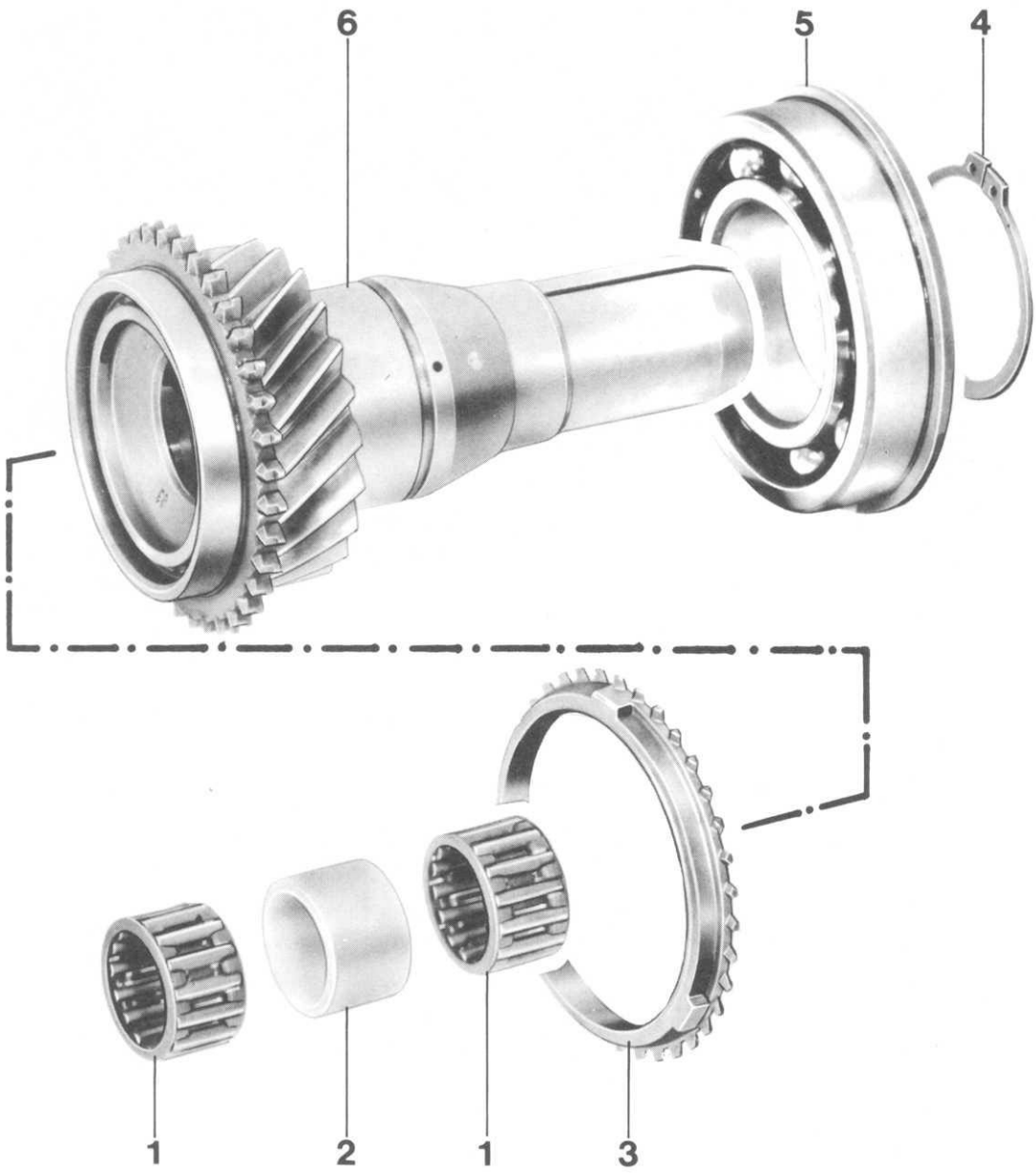

7
8
9
3
4
6
4
5
1
2
1

TOOLS



No.	Description	Special Tool	Remarks
1	Take-up rail	VW 457	
2	Pressure pad	VW 407	

DISASSEMBLING AND ASSEMBLING DRIVE SHAFT

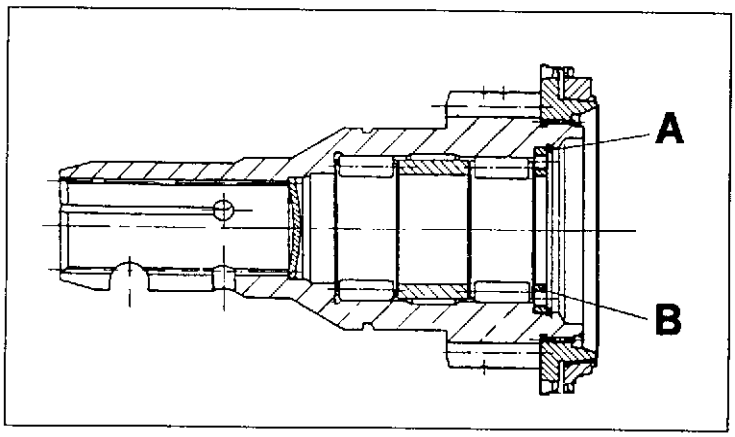


Printed in Germany

No.	Description	Qty.	Note when: Removing	Installing
1	Needle	2		Install with bearing grease
2	Thrust ring	1		
3	Synchronizing ring	1	Mark for reassembly	Mount with same gear. Check for wear
4	Circlip	1		
5	Grooved ball bearing	1	Press off with VW 457 and VW 407	Heat to approx. 100° C/212° F and drive on
6	Drive shaft	1		

Note

As of MY '92, a modified drive shaft with new needle cages and axial retainer is used.



A = Snap Ring
B = Thrust washer

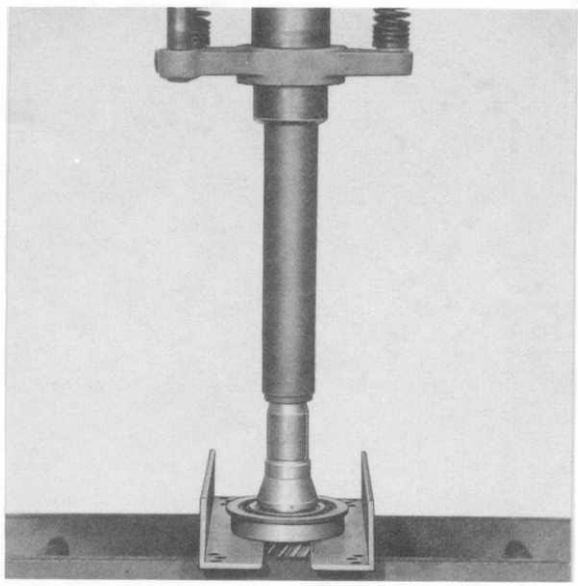
Printed in Germany – XXXI, 1993

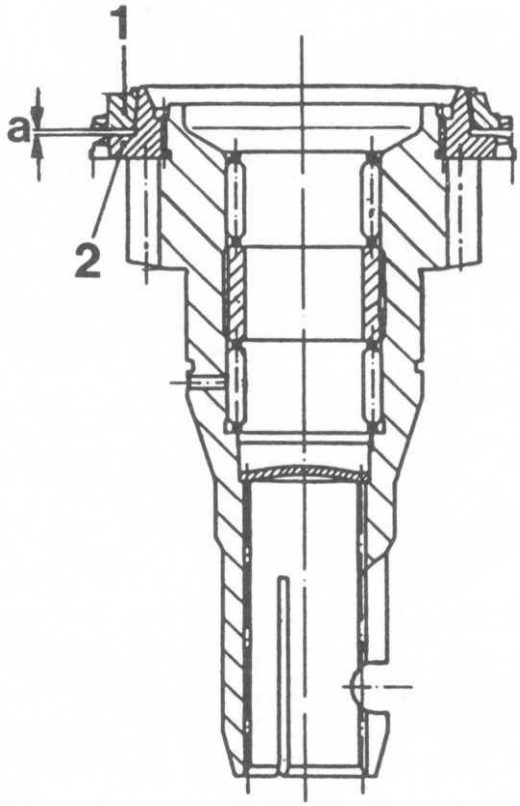
DISASSEMBLING AND ASSEMBLING DRIVE SHAFT

Disassembling

1. Remove circlip.

2. Press off grooved ball bearing with a pertinent pressure pad and Special VW 457.





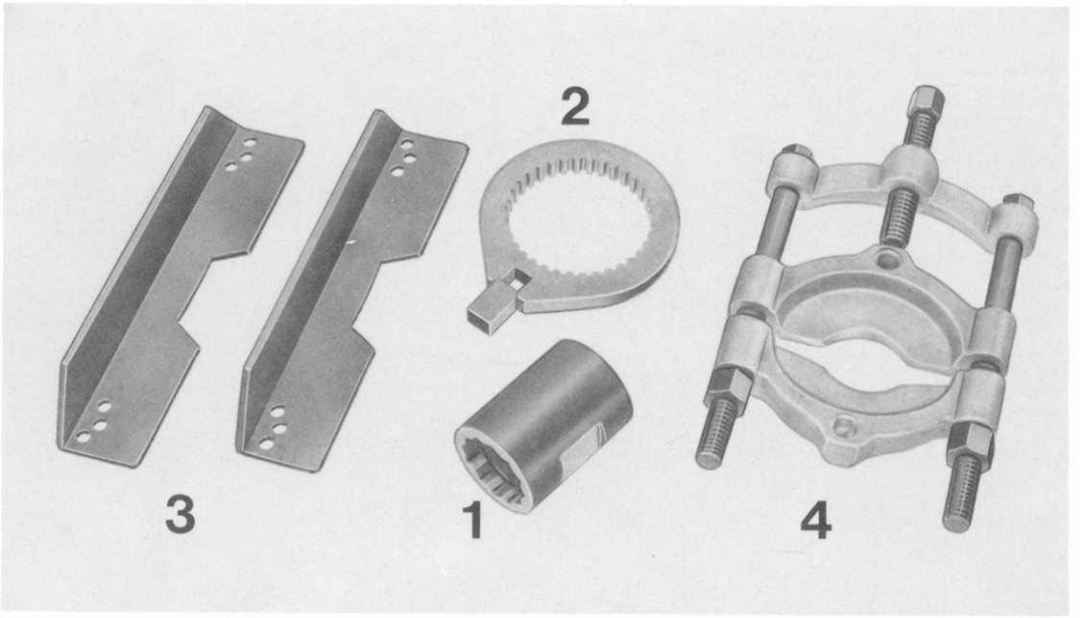
Assembling

1. Heat grooved ball bearing to approx. 100° C / 212° F and drive on.

2. Check synchronizing ring by pressing ring against taper of gear wheel and measure gap "a" with a feeler gage blade.

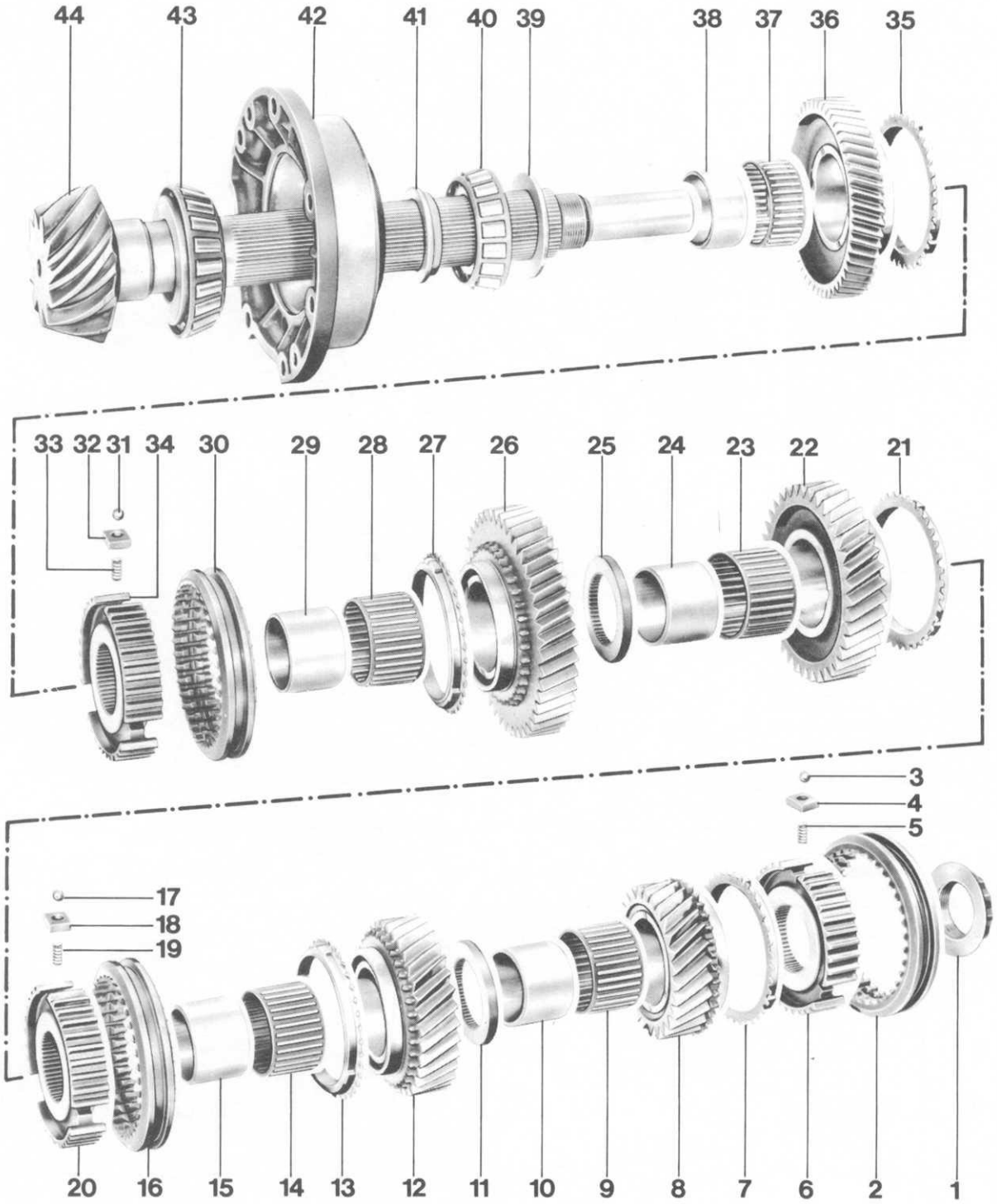
Installed distance (new) = 0.9 to 1.5 mm
Wear limit = 0.6 to 0.7 mm

TOOLS



No.	Description	Special Tool	Remarks
1	Holder	9219	
2	Wrench socket	9218	
3	Holding rail	VW 457	
4	Separator	-	Standard

DISASSEMBLING AND ASSEMBLING DRIVE PINION



No.	Description	Qty.	Note When: Removing	Installing
1	Locknut	1	Remove with Special Tool 9218 and 9219	Tightening torque 300 Nm (221 ftlb) and lock by punching collar
2	Actuating sleeve	1	Remove together with guide sleeve and synchromesh parts	
3	Ball	3		
4	Intercept stop	3		Insert right way round
5	Compression spring	3		
6	Guide sleeve	1		
7	Synchromesh ring	1	Mark for reinstallation	Check for wear, reinstall with original gear
8	Free gear, 4th gear	1		
9	Needle cage	1	Mark for reinstallation	Reinstall with original gear
10	Inner race	1	Mark for reinstallation	Heat to approx. 100°C, install with original gear
11	Thrust washer ('85/'86 models = 6.0 mm) ('87 models = 10.5 mm)	1		
12	Free gear, 3rd gear	1		
13	Synchromesh ring	1	Mark for reinstallation	Check for wear, install with original gear
14	Needle bearing	1	Mark for reinstallation	Install with original gear

No.	Description	Qty.	Note When: Removing	Installing
15	Inner race	1	Mark for reinstallation	Heat to approx. 100°C, install with original gear
16	Operating sleeve	1	Remove together with guide sleeve and synchromesh parts	
17	Ball	3		
18	Intercept stop	3		Insert right way round
19	Compression spring	3		
20	Guide sleeve	1		
21	Synchromesh ring	1	Mark for reinstallation	Check for wear, install with original gear
22	Free gear, 2nd gear	1		
23	Needle cage	1	Mark for reinstallation	Install with original gear
24	Inner race	1	Mark for reinstallation	Heat to approx. 100°C, install with original gear
25	Thrust washer ('85/'86 models = 6 mm) ('87 models = 2.5 mm)	1		
26	Free gear, 1st gear	1		
27	Synchromesh ring	1	Mark for reinstallation	Check for wear, install with original gear

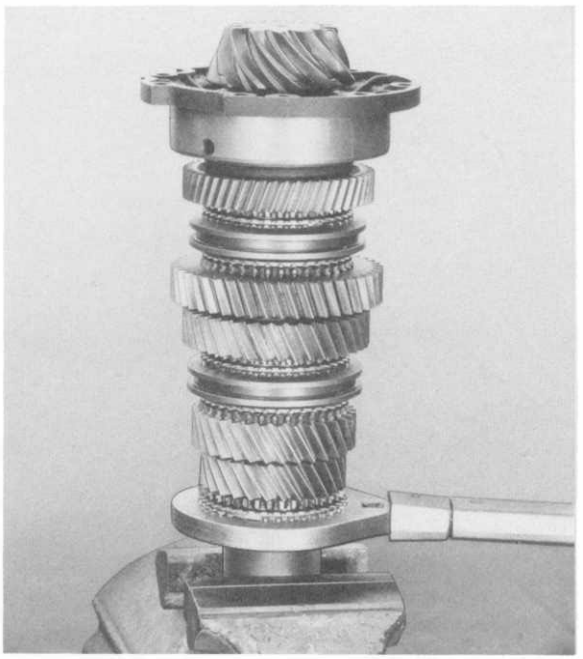
No.	Description	Qty.	Note When: Removing	Installing
28	Needle cage	1	Mark for reinstallation	Install with original gear
29	Inner race	1	Mark for reinstallation	Heat to approx. 100°C, install with original gear
30	Operating sleeve	1	Remove together with guide sleeve and synchromesh parts	'87 models onward, with recess (see page 35 - 213 for installation position)
31	Ball	3		
32	Intercept stop	3		Insert right way round
33	Compression spring	3		
34	Guide sleeve	1		
35	Synchromesh ring	1	Mark for reinstallation	Check for wear, install with original gear ('87 models onward, with modification to tips of teeth, brown for identification).
36	Free gear III, reverse gear	1		
37	Needle bearing	1	Mark for reinstallation	Install with original gear
38	Inner race	1	Mark for reinstallation	Re-measure if necessary, heat to approx. 100°C (see page 39 - 216)
39	Shim	1	Mark for reinstallation	Calculate thickness if necessary
40	Taper roller bearing inner race	1	Press off together with bearing cover	Heat to approx. 100°C
41	Spacer	1		

No.	Description	Qty.	Note When: Removing	Installing
42	Bearing cover	1	Press off	
43	Taper roller bearing inner race	1	Press off with suitable press-off tool	Heat to approx. 100°C
44	Drive pinion	1		Adjust if necessary, note pairing code

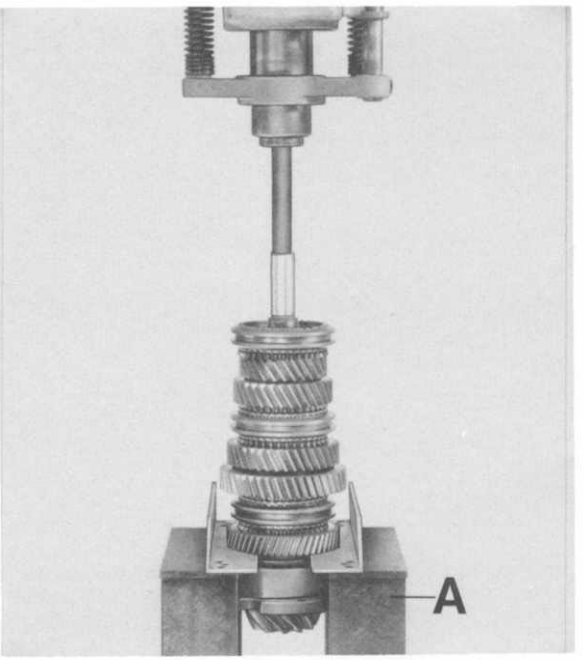
DIASSEMBLING AND ASSEMBLING DRIVE PINION

Disassembling

1. Remove lock nut for drive pinion with Special Tools 9219 and 9218.

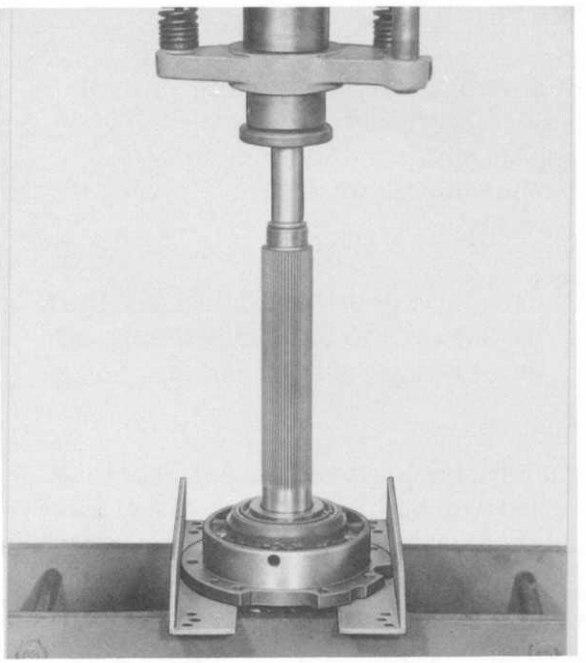


2. Press off gear wheels with Special Tool VW 457 and a pertinent support.

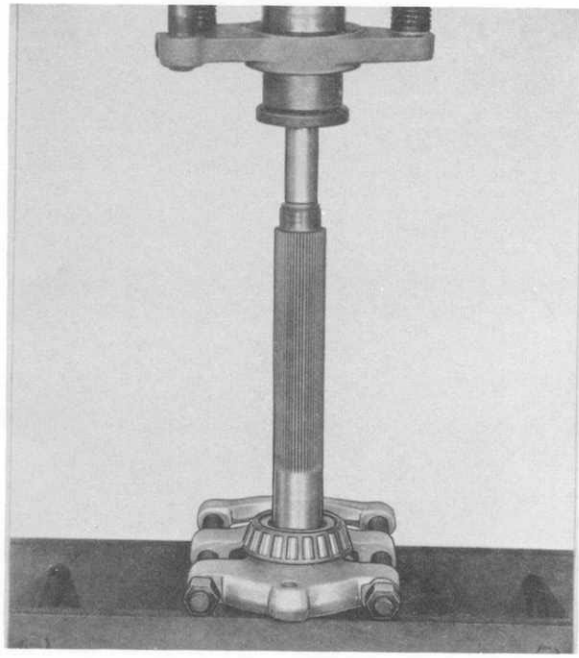


A = Standard U-iron (U 200) approx. 260 mm long.

3. Press off bearing cap with a pertinent pressure pad.



4. Press off large taper roller bearing inner race with a pertinent separator.



Assembling

Note

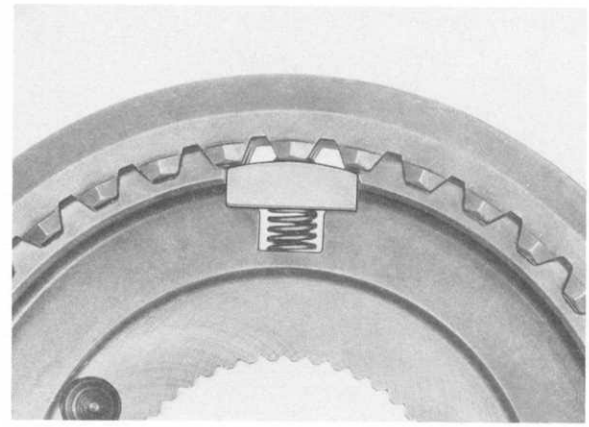
If drive pinion has to be adjusted, it must only be assembled after completion of adjustments (see "Adjusting Drive Pinion" on page 39 - 215).

1. Inner races of needle bearings as well as bearing surfaces on guiding sleeves and thrust washers must be cleaned of oil.

Lubricate needle cages, bores and bearing surfaces on both sides of gear wheels with oil thoroughly.

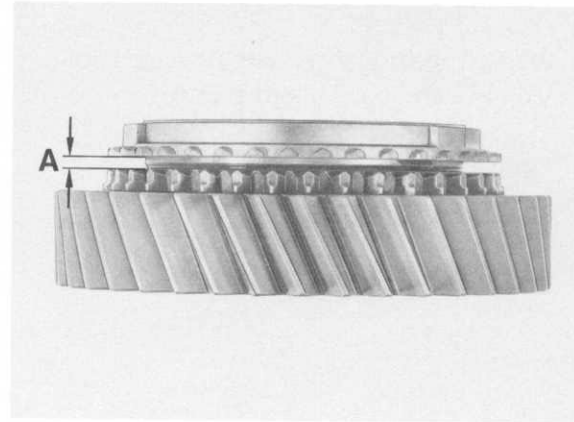
2. Mount bearing assembly on drive pinion and apply initial pressure of 20 kN (2 tons).

3. Mount drives for synchronization in correct position (domed side facing sliding sleeve).



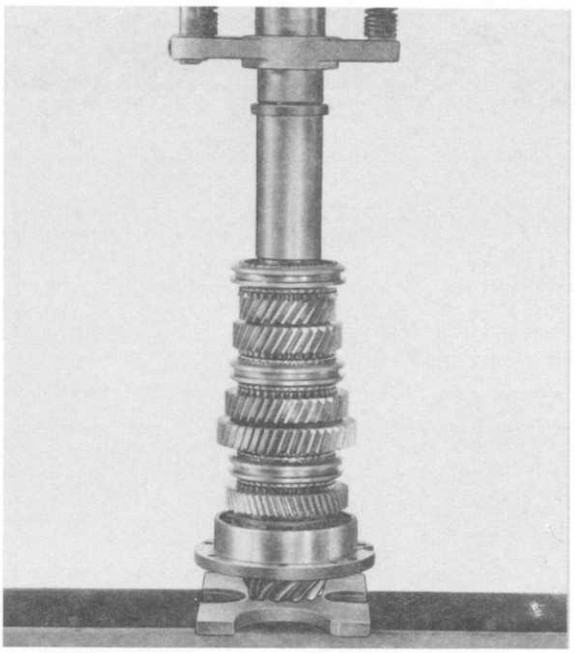
4. Check synchronizing rings by pressing rings against tapers of gear wheels and measuring gaps "A" with a feeler gage blade.

Installed distance (new) = 0.9 to 1.5 mm
Wear limit = 0.6 to 0.7 mm



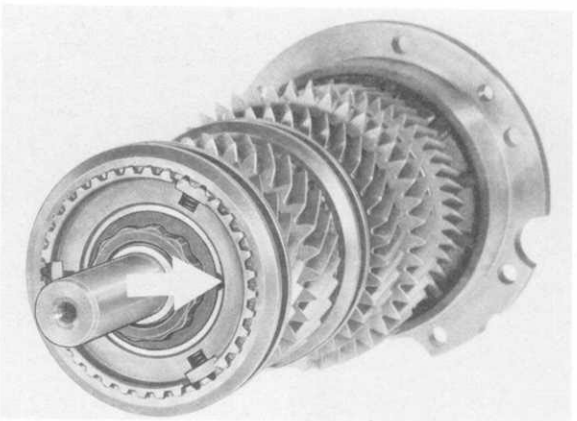
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5.Apply approx. 60 kN (6t) to press assembled drive pinion into position over hub of guide sleeve.



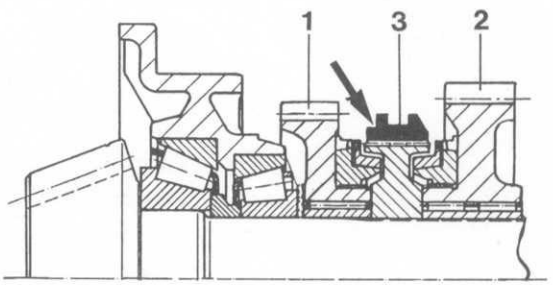
6.Tighten locknut to 300 Nm (221 ftlb) and lock by punching collar.





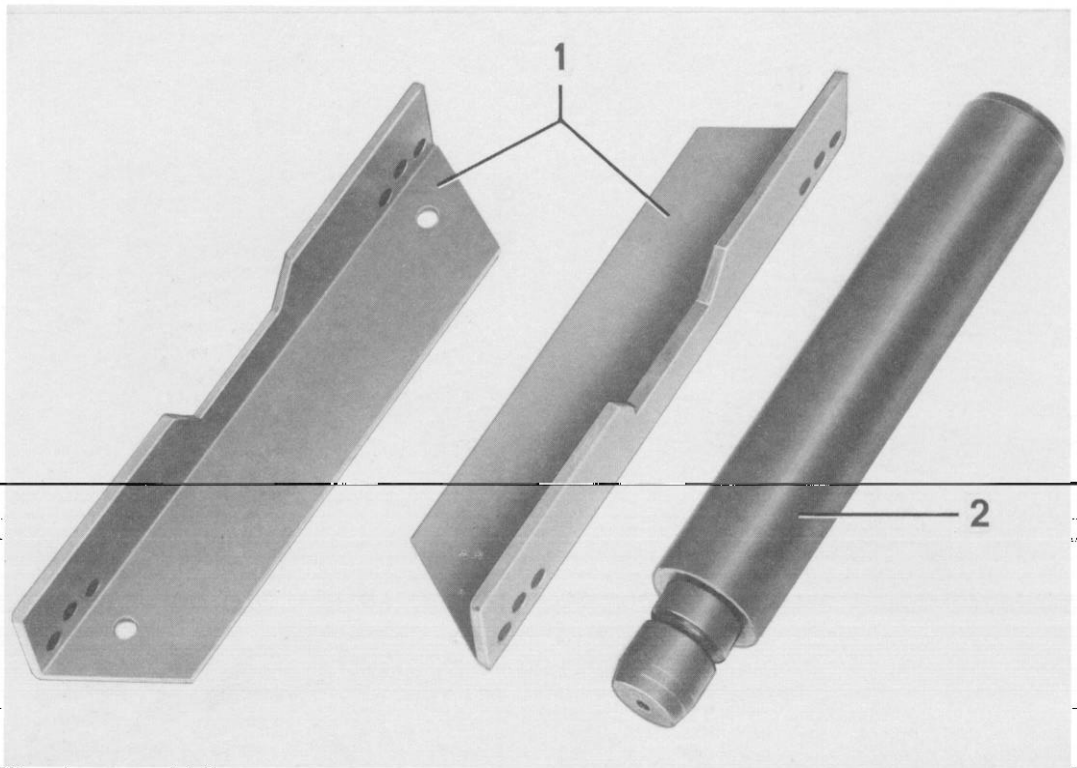
Modification, '87 models onward

The tips of the teeth of the 1st and reverse-gear operating sleeve have been modified. Note installation position, the recess (arrowed) must face the reverse free gear.



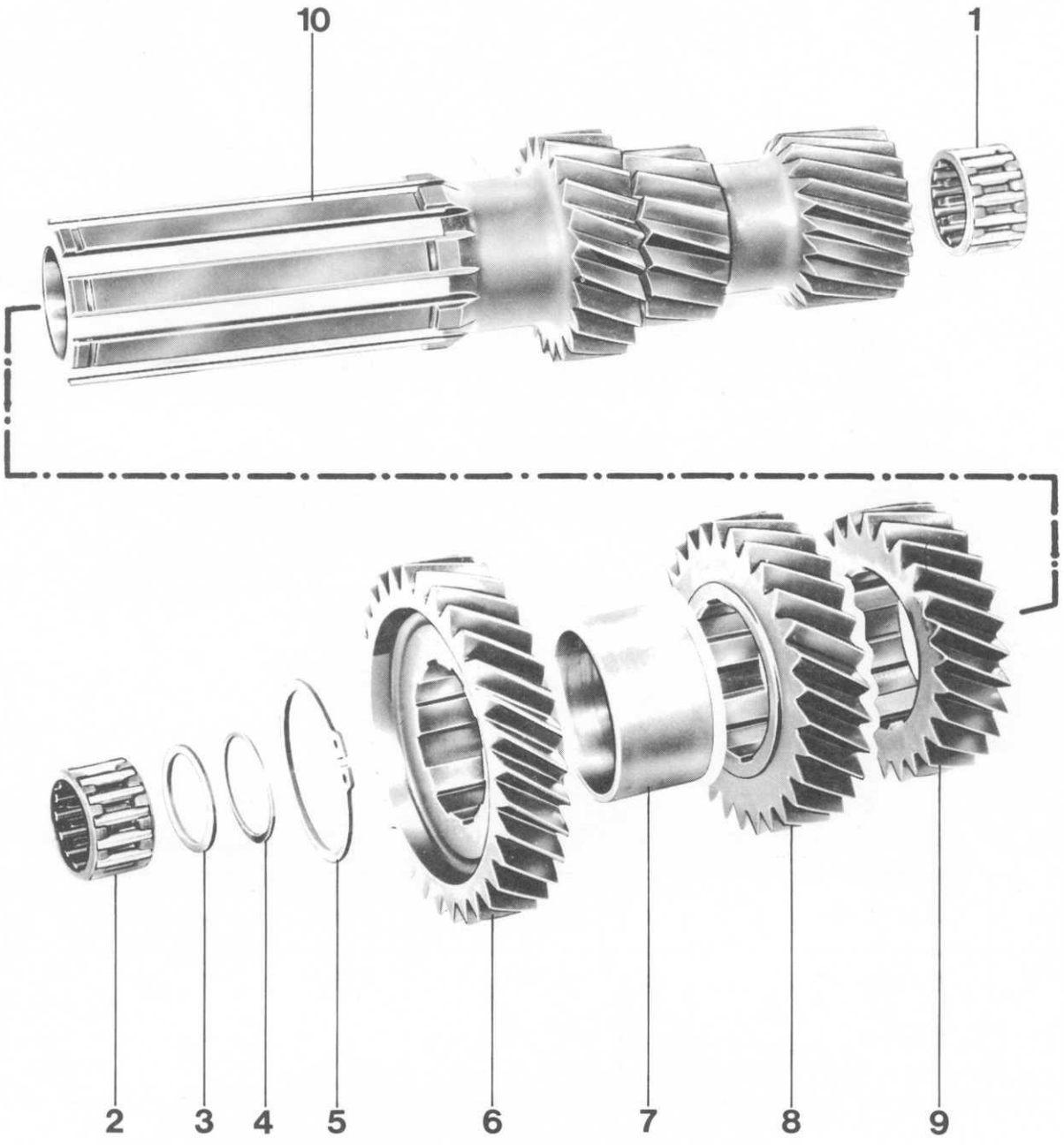
1 = Free gear, reverse gear
2 = Free gear, 1st gear
3 = Operating sleeve 1st/reverse gear

TOOLS

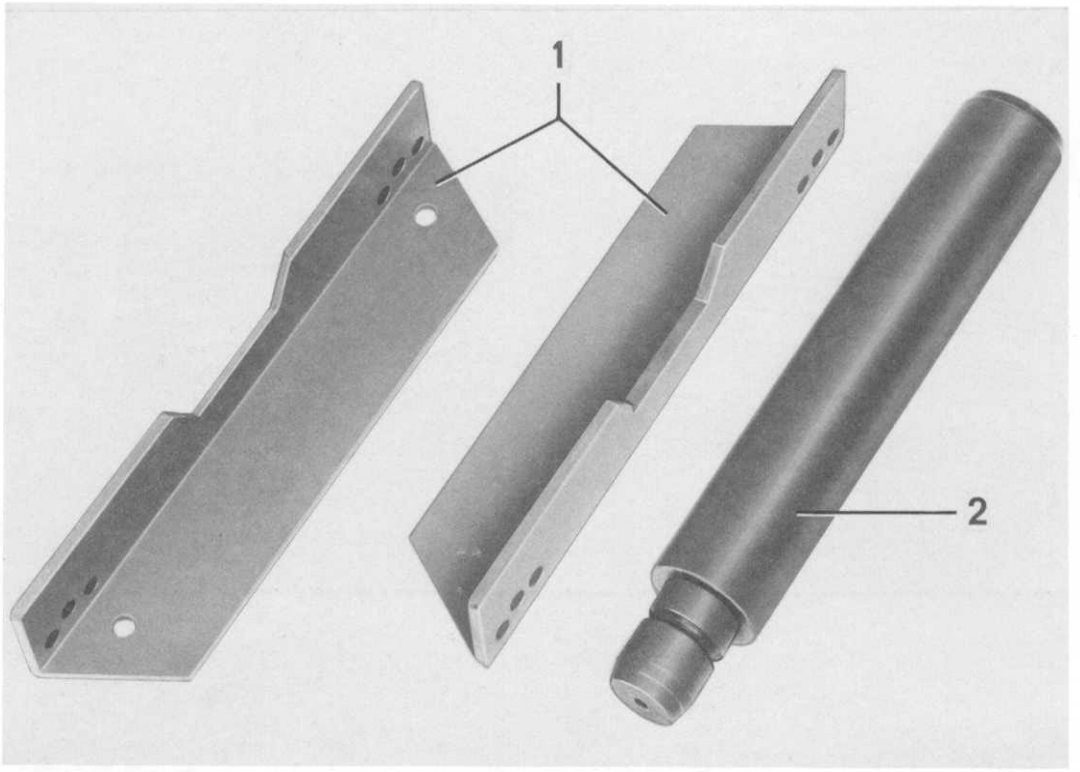


No.	Description	Special Tool	Remarks
1	Take-up rail	VW 457	
2	Mandrel	VW-407	

DISASSEMBLING AND ASSEMBLING COUNTERSHAFT

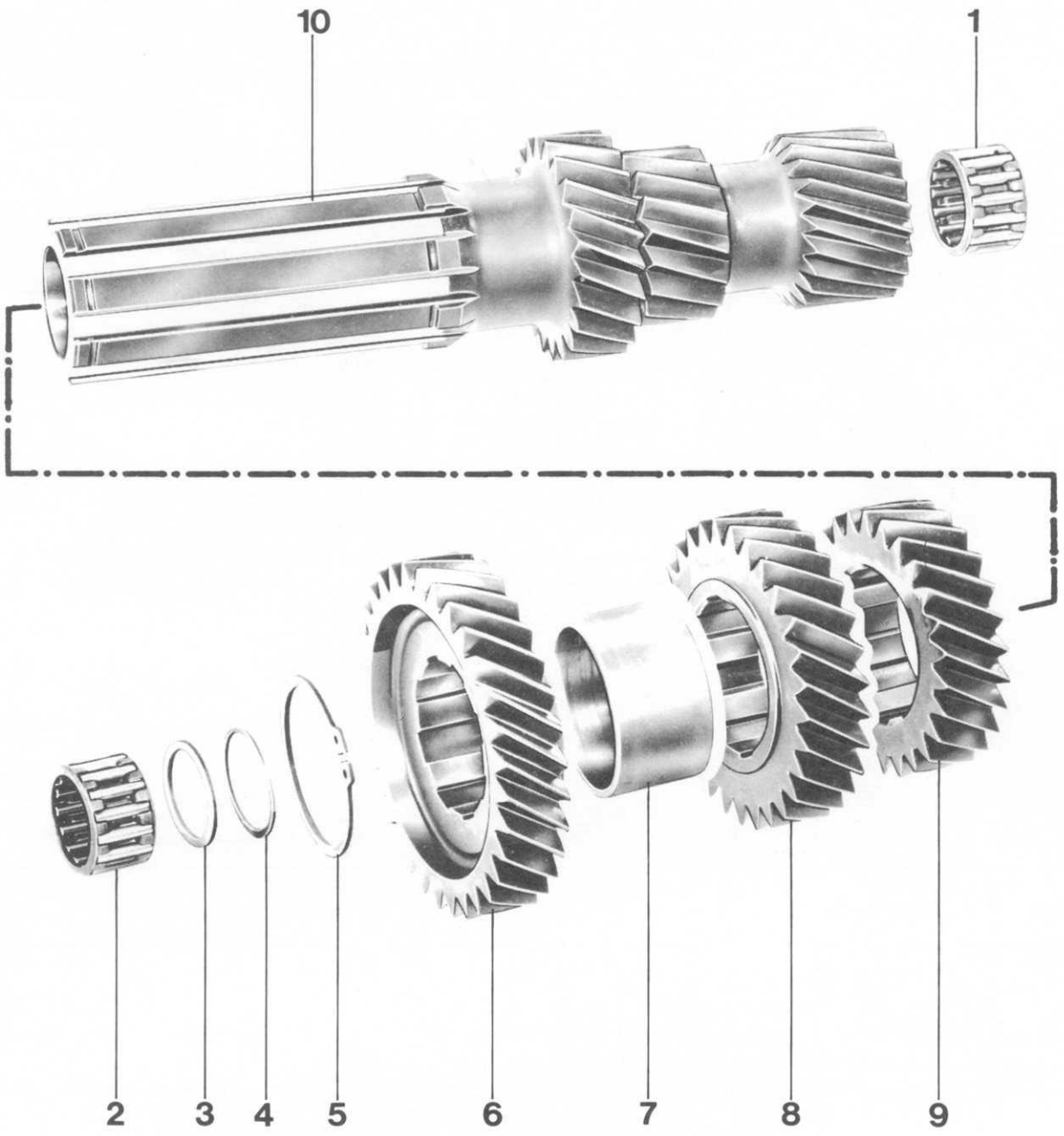


TOOLS



No.	Description	Special Tool	Remarks
1	Take-up rail	VW 457	
2	Mandrel	VW 407	

DISASSEMBLING AND ASSEMBLING COUNTERSHAFT



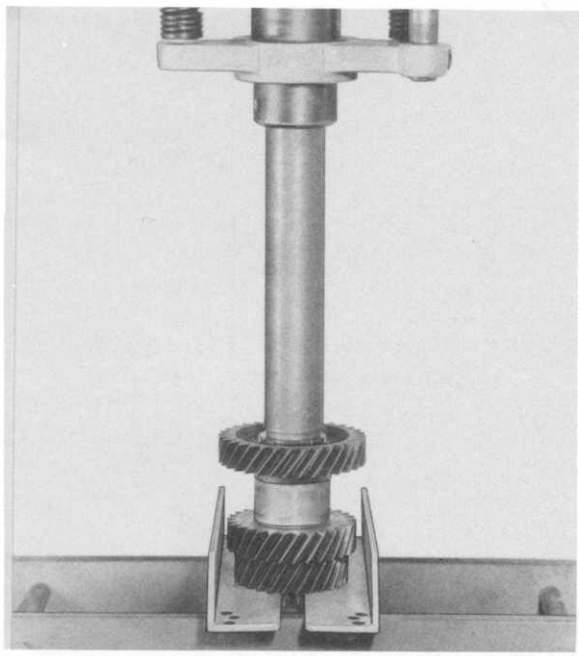
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Needle cage	1			
2	Needle cage	1			
3	Washer	1			
4	Circlip	1			
5	Circlip	1			
6	Gear	1	Press off with VW 407 and VW 457	Replace only in pairs; collar faces spacer	
7	Spacer	1			
8	4th gear	1	Press off with VW 407 and VW 457	Replace only in pairs; pair number and manufacturing date face 3rd gear	
9	3rd gear	1	Press off with VW 407 and VW 457	Replace only in pairs; collar faces stop	
10	Countershaft	1			

DISASSEMBLING AND ASSEMBLING COUNTERSHAFT

Disassembling

1. Remove circlip.

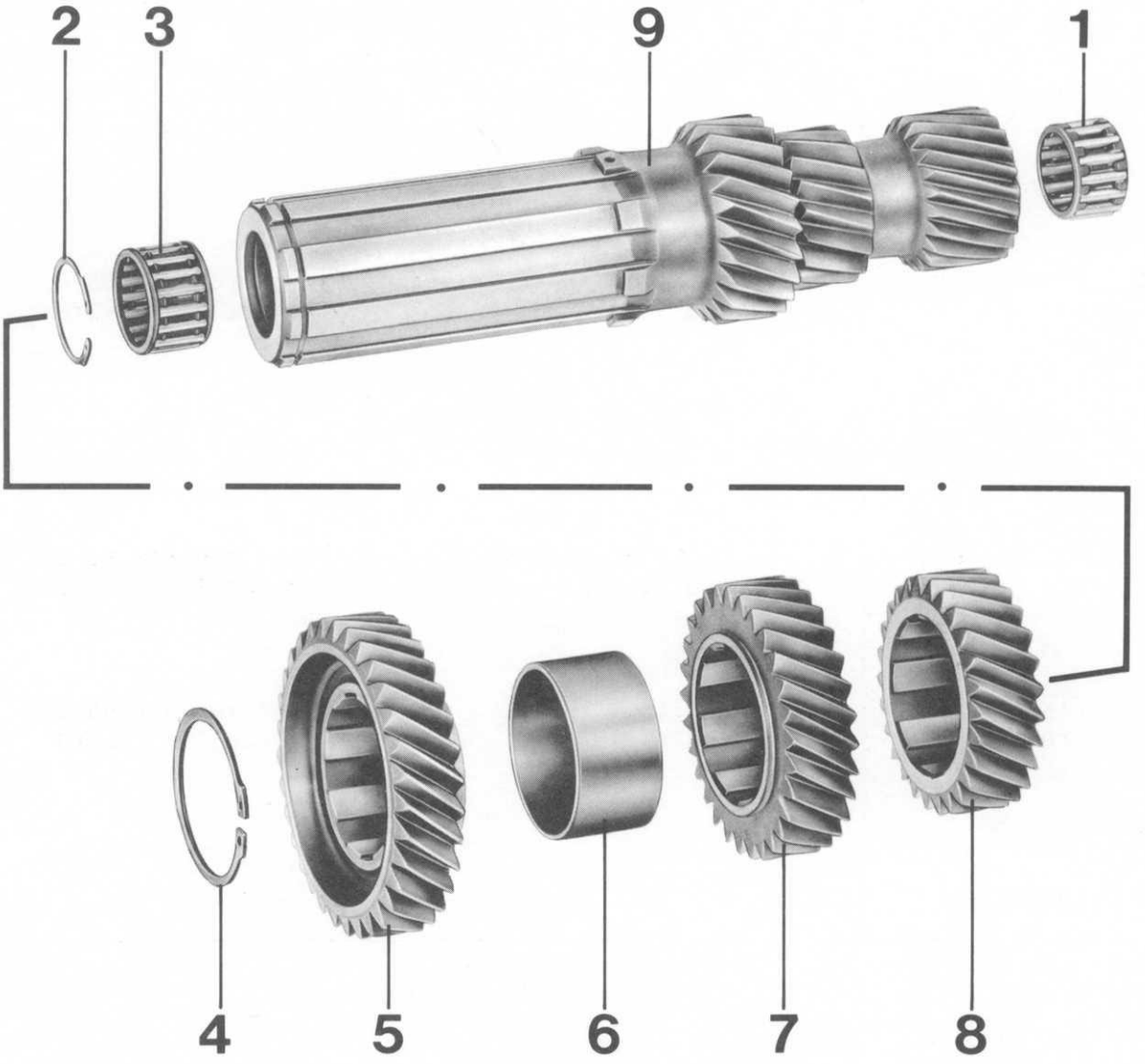
2. Press off gear wheels with a suitable mandrel and Special Tool VW 457.



Assembling

Heat gear wheels to approx. 100° C / 212° F and install to correct position

DISASSEMBLING AND ASSEMBLING LAYSHAFT (87 MODELS ONWARD)



No.	Description	Qty.	Note When: Removing	Installing
1	Needle cage	1		
2	Circlip	1		
3	Needle bearing	1		
4	Circlip	1		
5	Fixed gear	1	Press off with VW 407 and VW 457	Always replace as a pair, collar toward spacer
6	Spacer	1		
7	Fixed gear, 4th gear	1	Press of with VW 407 and VW 457	Always replace as a pair, collar toward spacer
8	Fixed gear, 3rd gear	1	Press of VW 407 and VW 457	Always replace as a pair, collar toward stop
9	Layshaft	1		

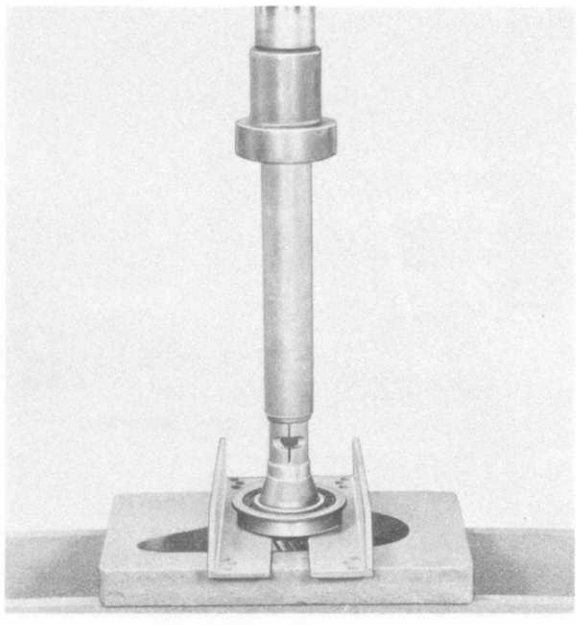
Printed in Germany

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Needle bearing	2			
2	Spacer	1			
3	Synchronizer ring	1			
4	Shift band	2			
5	Stop	1			
6	Thrust block	1			
7	Circlip	1			
8	Ball bearing	1	Press off with VW 457 and VW 407	Heat to approx. 100° C/212° F and drive on	
9	Input shaft				

DISASSEMBLING AND ASSEMBLING INPUT SHAFT

Disassembling

1. Remove circlip.
2. Press off ball bearing with a pertinent mandrel (e.g. VW 407) and Special Tool VW 457.



Assembling

Heat ball bearing to approx. 100° C/212° F and drive on.

Modification from Transm. No. 118 1093

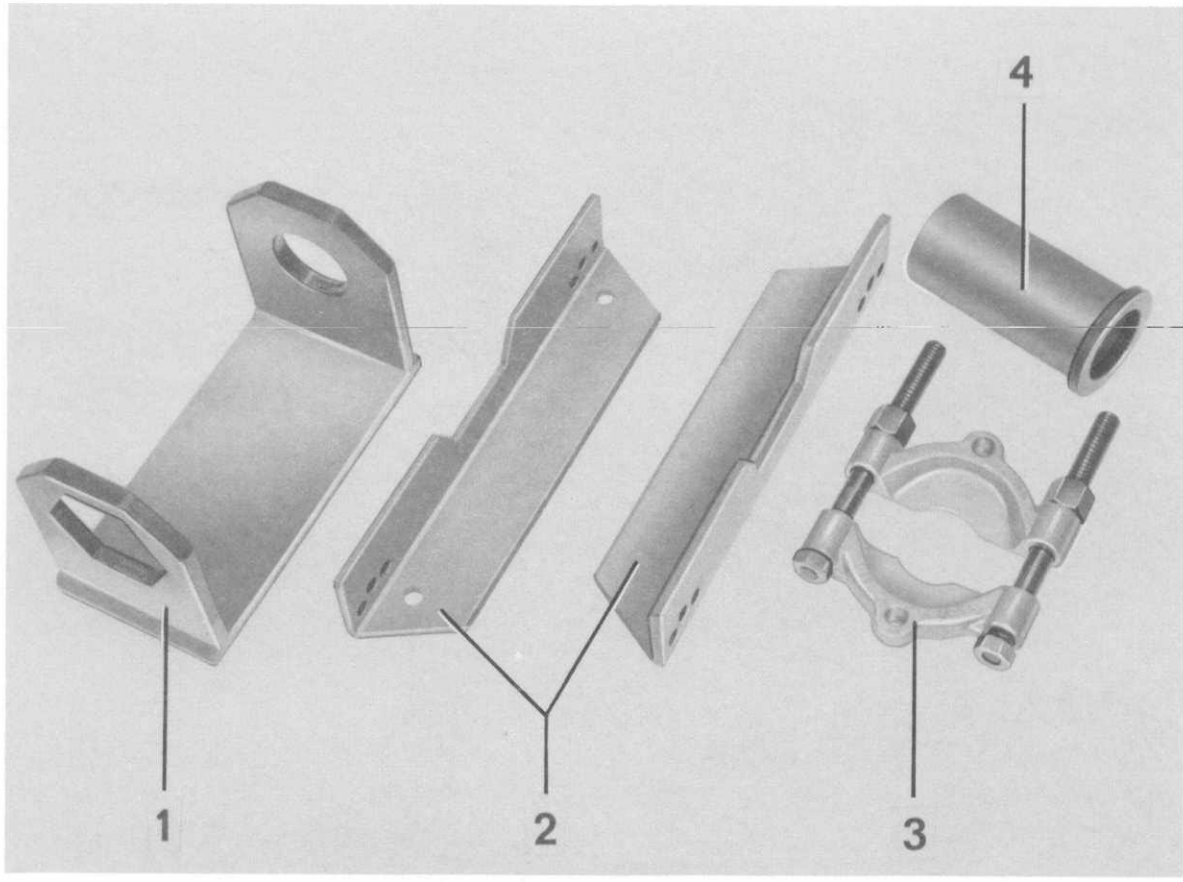
A new input shaft with modified clutch body and a new synchronizer ring for 5th gear are installed from Transmission No. 118 1093.

This modification has changed distance "Z" and the calculation of distance "X" (see pages 35 - 11 and 35 - 15).

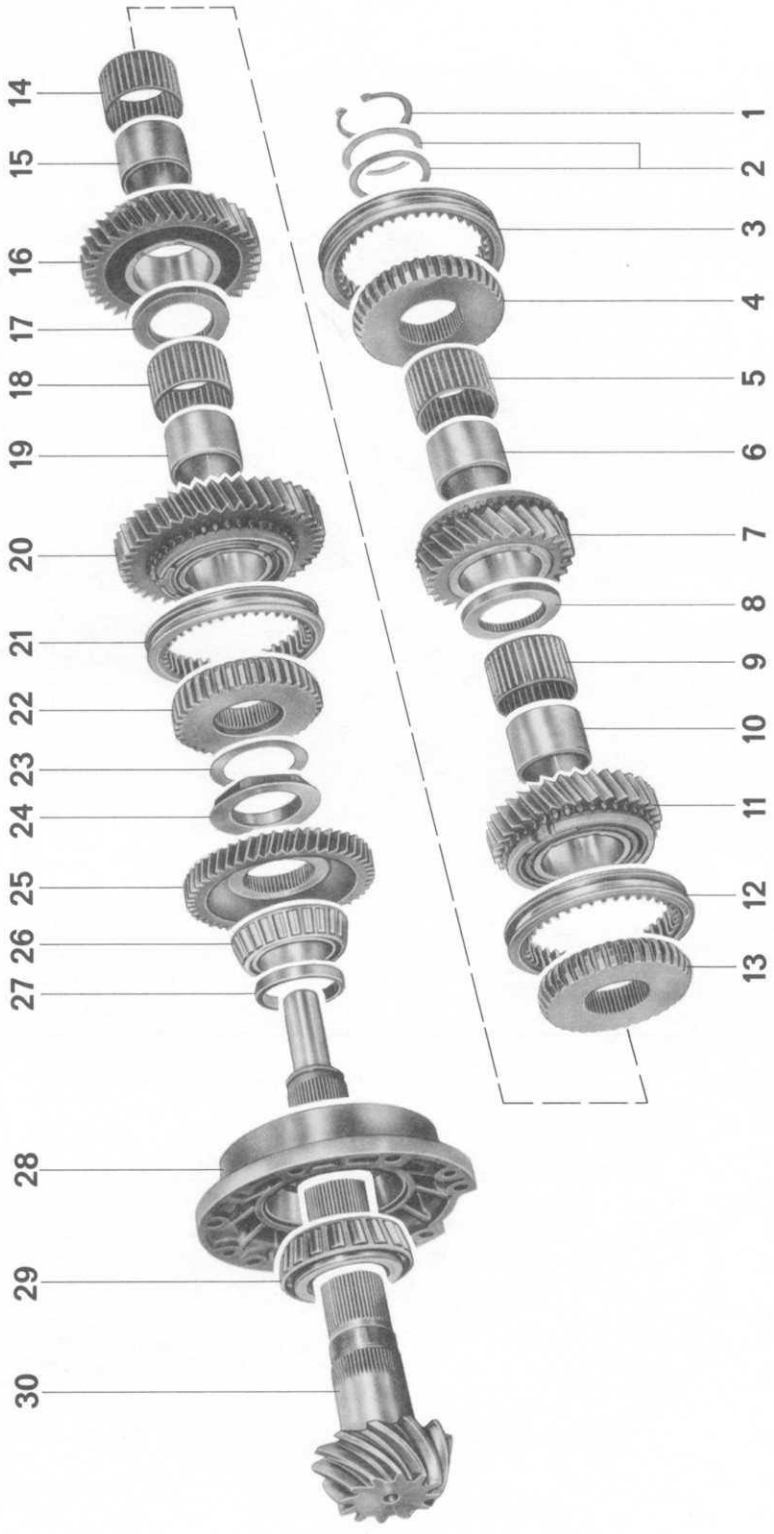
Note

Old and new parts must not be installed together when repairing.

TOOLS



No.	Description	Special Tool	Remarks
1	Retainer	9142	
2	Support rail	VW 457	
3	Separator	US 1103	
4	Wrench	9143	


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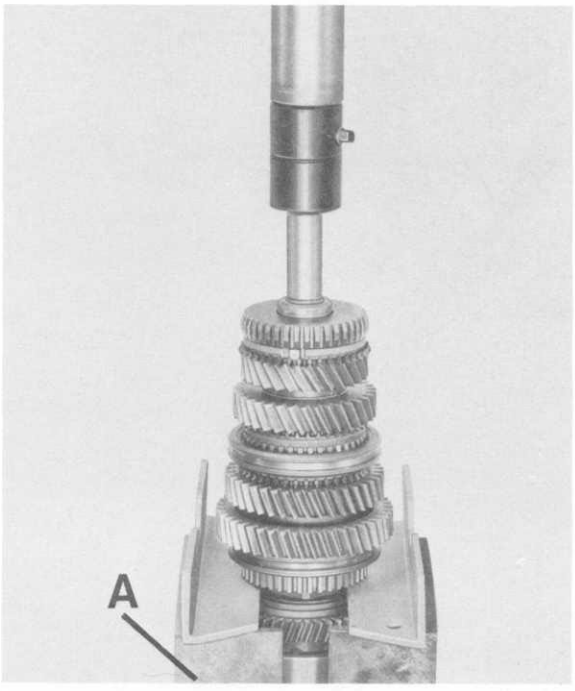
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Circlip	1		Replace, if necessary	
2	Shim (distance y)	X	Note number and thickness for reassembly	If necessary, remeasure thickness	
3	Shift sleeve	1			
4	Hub	1			
5	Needle bearing	1	Mark for reassembly	Install with same gear	
6	Inner race	1	Mark for reassembly	Heat to approx. 100° C/212° F, install with same needle bearing and gear	
7	Gear, 4th speed	1		Check synchronization, replace in pairs only	
8	Thrust washer	1			
9	Needle bearing	1	Mark for reassembly	Install with same gear	
10	Inner race	1	Mark for reassembly	Heat to approx. 100° C/212° F, install with same needle bearing and gear	
11	Gear, 3rd speed	1		Check synchronization, replace in pairs only	
12	Shift sleeve	1			
13	Hub	1			
14	Needle bearing	1	Mark for reassembly	Install with same gear	
15	Inner race	1	Mark for reassembly	Heat to approx. 100° C/212° F, install with same needle bearing and gear	
16	Gear, 2nd speed	1		Check synchronization, replace in pairs only	
17	Thrust washer	1			

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
18	Needle cage	1	Mark for reassembly	Install with same gear	
19	Inner race	1	Mark for reassembly	Heat to approx. 100 °C/212 °F, install with same needle bearing and gear	
20	Gear, 1st speed	1		Check synchronization, replace in pairs only	
21	Shift sleeve	1			
22	Guide sleeve	1		Flat surface on side flank faces 1st gear	
23	Shim (distance X)	X	Note quantity and thickness for reassembly	If necessary, remeasure thickness	
24	Lock nut	1		Tighten to specified torque, lock by staking	
25	Reverse gear	1		Cavity faces lock nut	
26	Tapered roller bearing inner race	1	Press off together with bearing cover	Heat to approx. 100 °C/212 °F and drive on	
27	Shim	1			
28	Bearing cover	1	Press off	Replace only complete with tapered roller bearing and shim	
29	Tapered roller bearing inner race	1	Press off with a suitable separator	Heat to approx. 100 °C/212 °F and drive on	
30	Pinion shaft	1		Adjust if necessary. Note pair number	

DISASSEMBLING AND ASSEMBLING PINION SHAFT

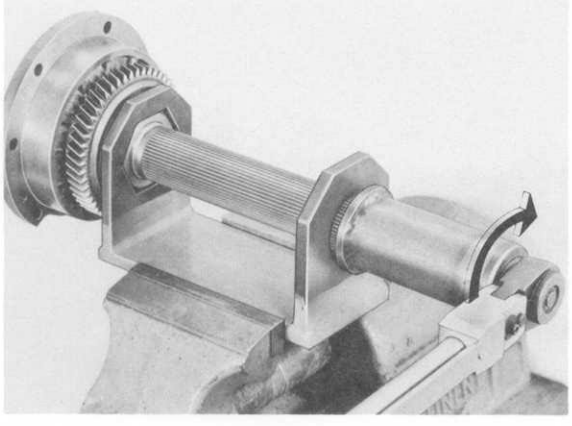
Disassembling

1. Press gears and inner races off of pinion shaft with special tool VW 457 and a suitable support.

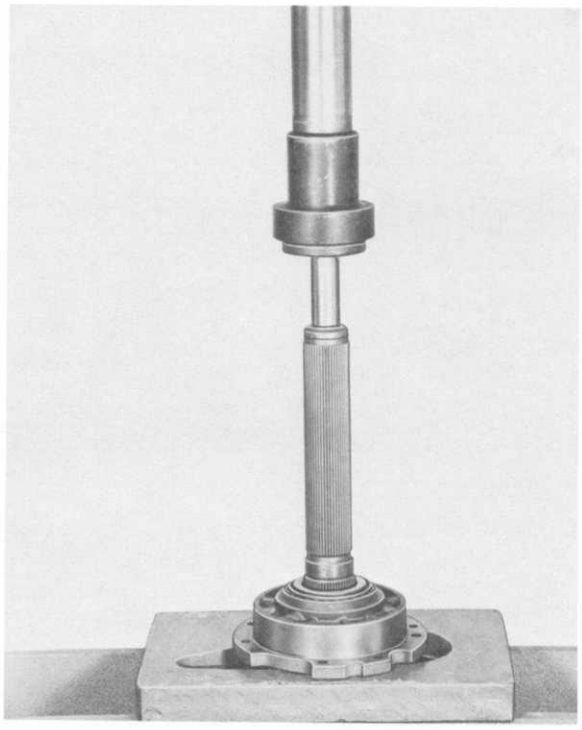


A – Standard U-steel (U 200) approx. 260 mm long

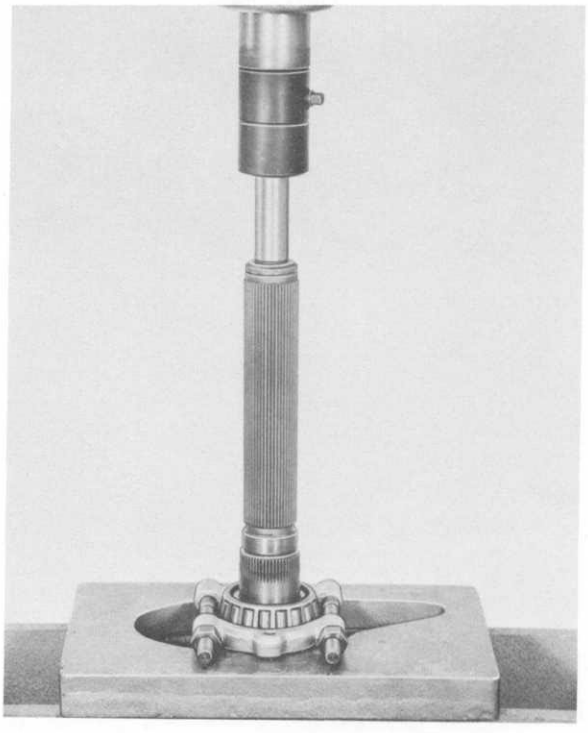
2. Unscrew lock nut with special tools 9142 and 9143.



3. Press off bearing cover with a suitable press tool.

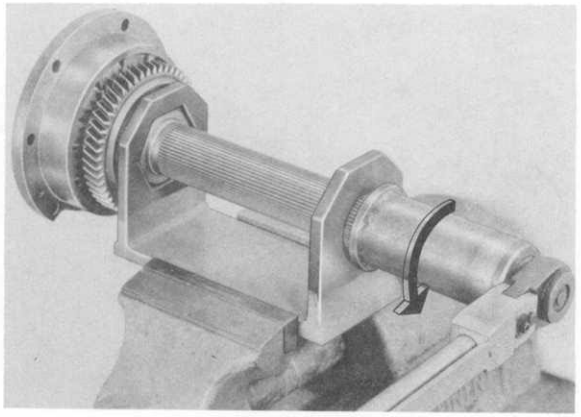


4. Press off large tapered roller bearing inner race with a suitable seperator.



Assembling

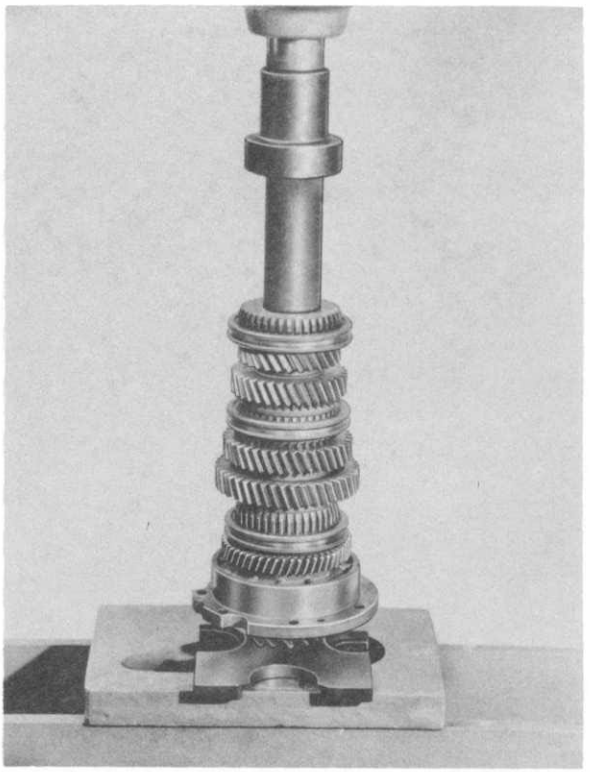
1. Tighten lock nut to specified torque with Special Tools 9142 and 9143.



2. Lock lock nut by staking collar.



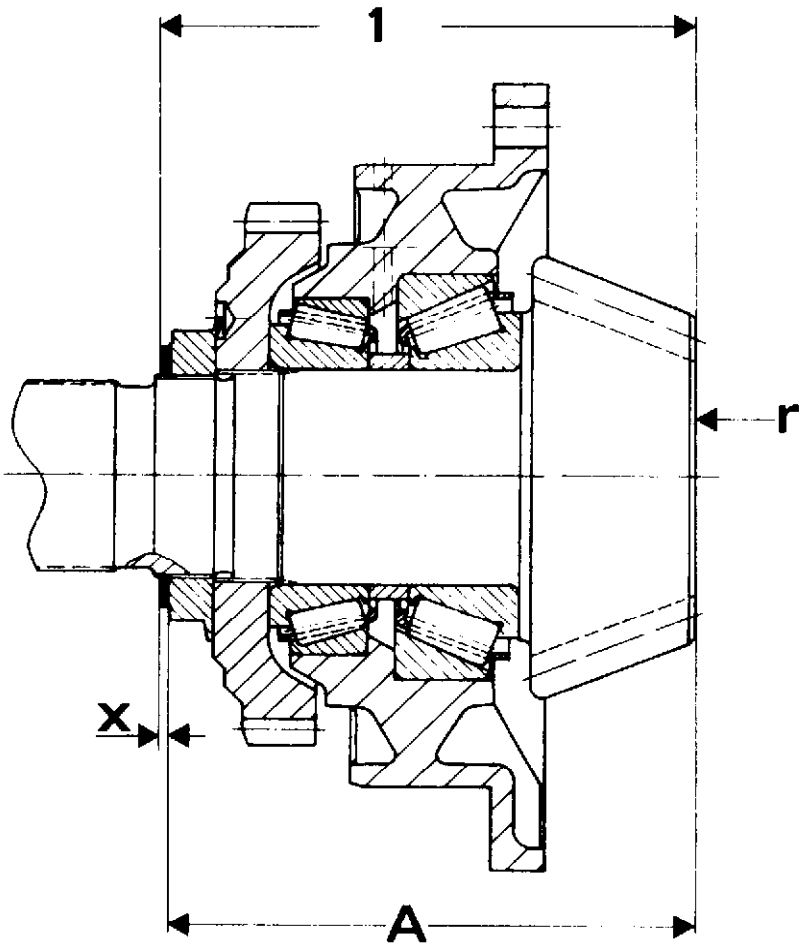
3. Press assembled gear set together with an appropriate piece of pipe (e.g. VW 519). Approx. 5 tons of pressure.



DETERMINING SHIM THICKNESS "X" OF PINION SHAFT LOCK NUT

Note

To guarantee perfect running of spur gears from pinion shaft and countershaft, shims must be used on the pinion shaft.



A – Distance from pinion head to bearing surface of lock nut

B – Distance A + r (pinion shaft deviation)

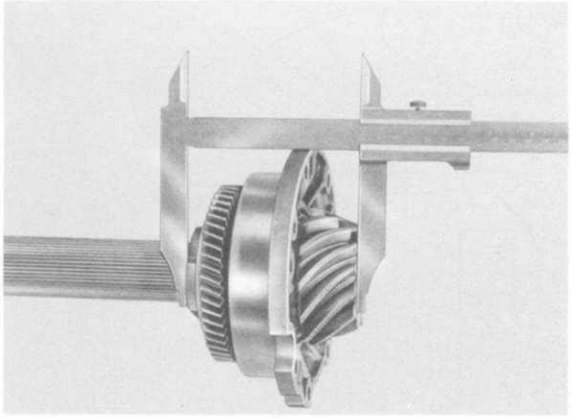
r – Pinion shaft deviation (e. g. N 12)

1 – Design specification

Transmission Type G 28.03	108.85 mm up to transm. no. 118 1092
	108.70 mm from transm. no. 118 1093
Transmission Type G 28.05	110.70 mm from transm. no. 110 5001

Measuring Procedures

1. Measure distance "A" with a sliding calipers.



2. Work out distance "B"
   B = A + r

3. Work out distance "X"
   (Type G 28.03 up to Transm. No. 118 1092)
   X = 108.85 – B

4. Work out distance "X"
   (Type G 28.03 from Transm. No. 118 1093)
   X = 108.70 – B

5. Work out distance "X"
   (Type G 28.05 from Transm. No. 110 5001)
   X = 110.70 – B

Example (Type G 28.03 up to Transm. No. 118 1092)

Distance "A" = 106.90
Distance "B" = A + r

	A	= 106.90 mm
+	r	= 0.12 mm
		107.02 mm

Distance "X" = 108.85 – B

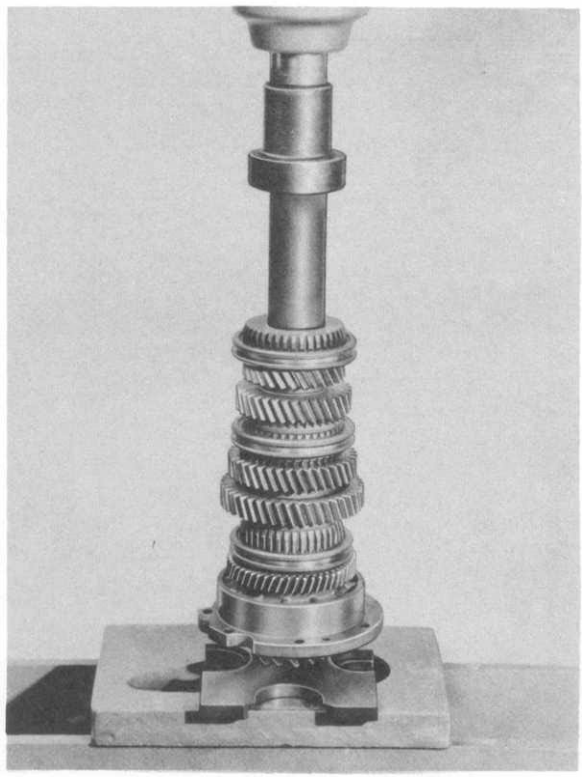
	108.85 mm
–	107.02 mm
	1.83 mm

DETERMINING SHIM THICKNESS "Y" AT GEAR SET END

Note

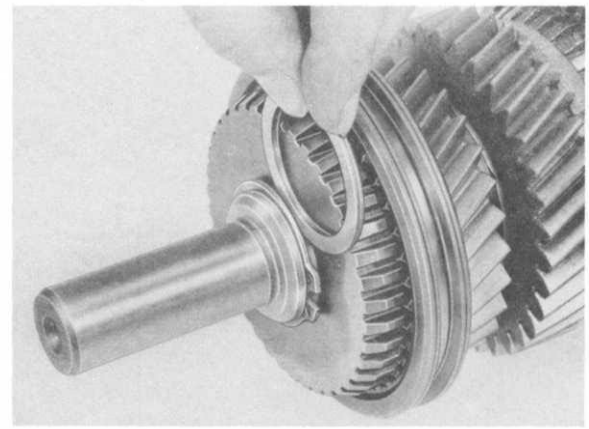
Since a circlip on the pinion shaft prevents axial movement, gear set must be adjusted to take up all play between gear set and circlip.

1. Press assembled gear set together with an appropriate piece of pipe (e.g. VW 519). Approx. 5 tons of pressure.



2. Install new circlip in groove.

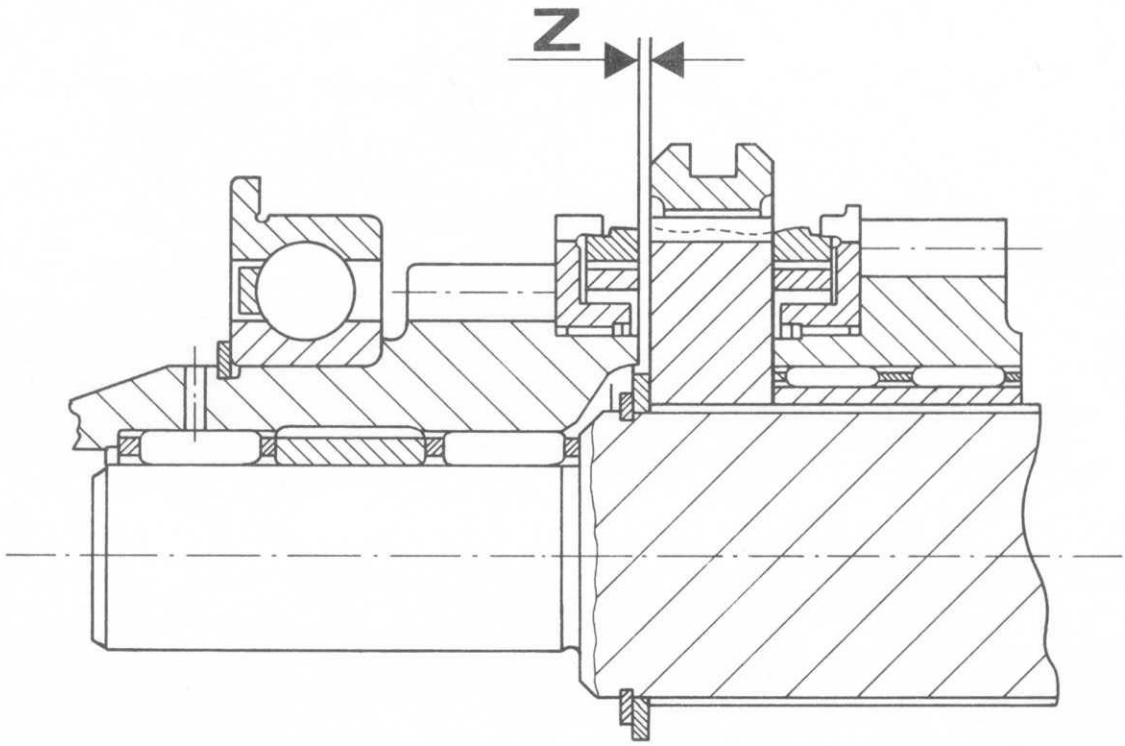
3. Install a shim with maximum thickness "Y" to take up all play.



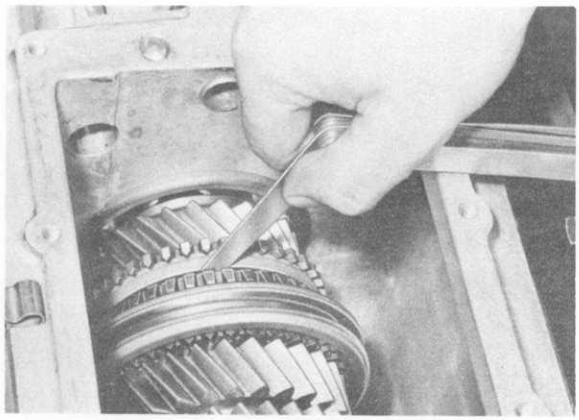
MEASURING DISTANCE "Z" BETWEEN INPUT SHAFT AND PINION SHAFT

Since the new Porsche synchronizing system does not employ circlips, it is important to make sure that distance "Z" is maintained between end face of input shaft and 4th/5th speed hub on pinion shaft.

Distance "Z" 0.2 to 0.3 mm up to transm. no. 118 1092
0.4 to 0.6 mm from transm. no. 118 1093



1. Measure distance "Z" between input shaft and hub with a feeler gage.



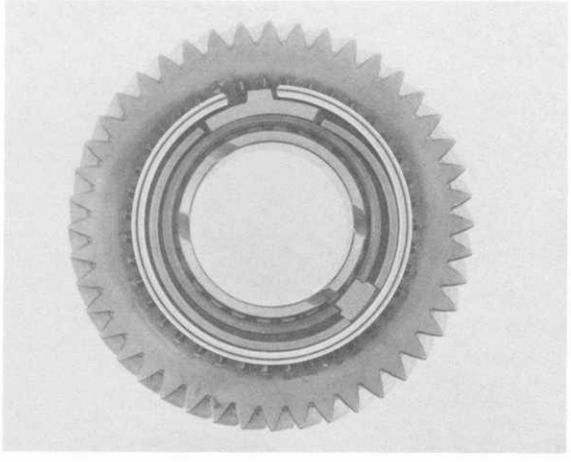
Note

Do not measure distance between synchronizer ring and shift sleeve or clutch body and shift sleeve.

2. If distance "Z" is not 0.2 to 0.3 mm or 0.4 to 0.6 mm, disassemble pinion shaft again and correct shim thickness "X". Of course, it will also be necessary to redetermine shim thickness "Y" on end of pinion shaft.

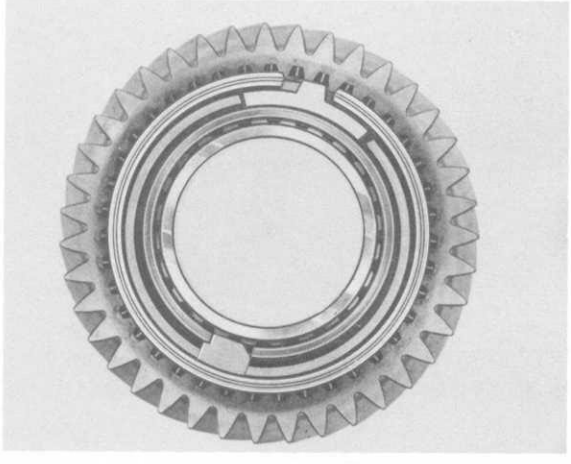
DISASSEMBLING AND ASSEMBLING SYNCHRONIZERS

The transmission of the 928 is equipped with modified Porsche synchronization for all forward speeds. One of the changes is the omission of circlips, which previously were used to keep the synchronizing ring thrust blocks and shift bands from moving axially. In the new system this is accomplished by a shift sleeve with beveled flanks.



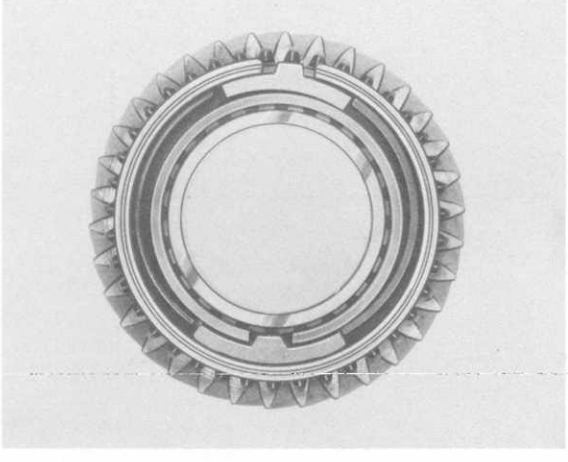
1st Gear

Synchronizer ring:	1 groove on face
Thrust block:	2 bevelled flanks
Shift band:	Asymmetrical shift band
Stop:	Two straight flanks
Installation Note:	Short side of shift band must be to right of thrust block



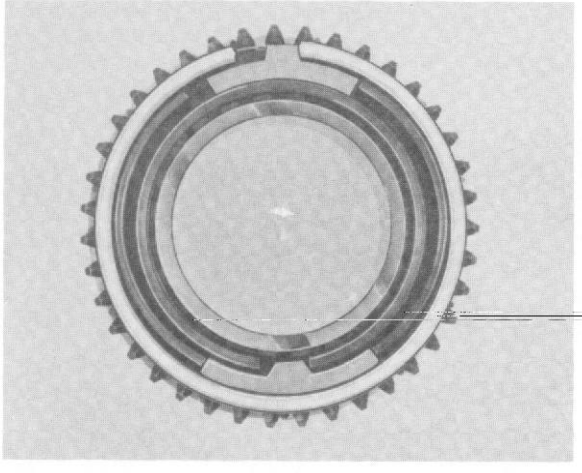
2nd Gear

Synchronizer ring:	2 grooves on face or red dot
Thrust block:	2 bevelled flanks
Shift band:	Symmetrical shift band
Stop:	1 straight, 1 bevelled flank
Installation Note:	Bevelled side of stop must face to right as seen from top view



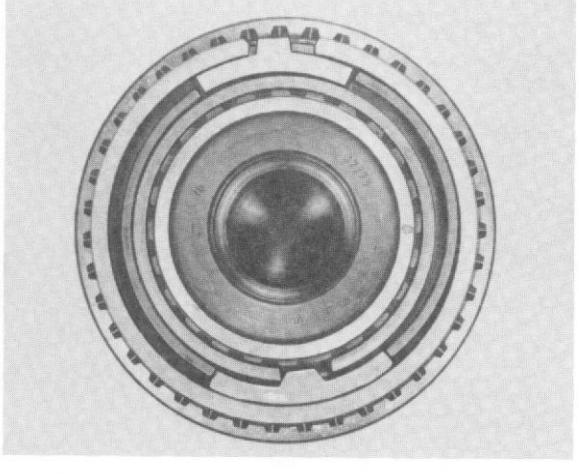
3rd Gear

Synchronizer ring:	2 grooves on face or red dot
Thrust block:	2 bevelled flanks
Shift band:	2 separate shift bands
Stop:	Bevelled flanks



4th Gear:

Synchronizer ring:	No grooves
Thrust block:	2 bevelled flanks
Shift band:	2 separate shift bands
Stop:	Bevelled flanks
Note:	See below

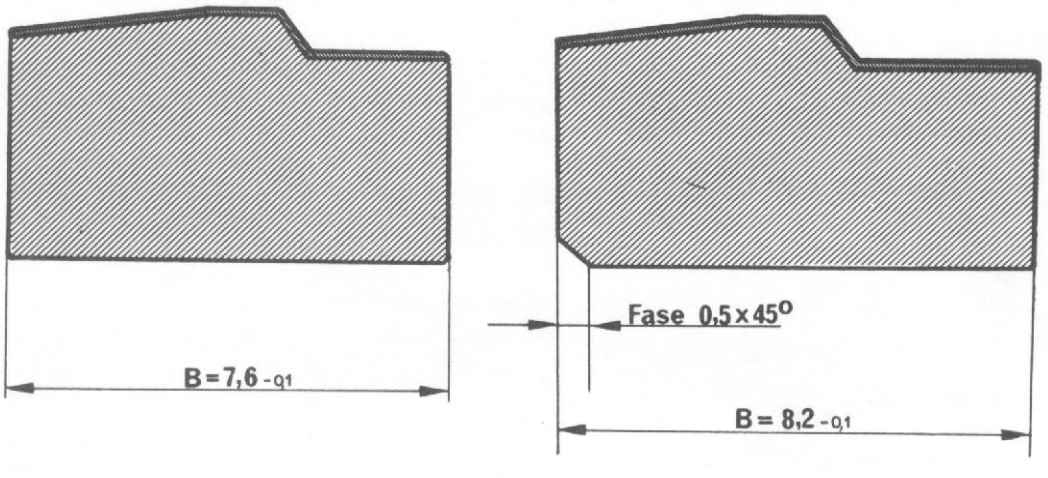


5th Gear:

Synchronizer ring:	No grooves
Thrust block:	2 bevelled flanks
Shift band:	2 separate shift bands
Stop:	Bevelled flanks
Note:	See below

Fifth gear synchronizer ring is identical with fourth gear synchronizer ring up to Transmission No. 118 1092.

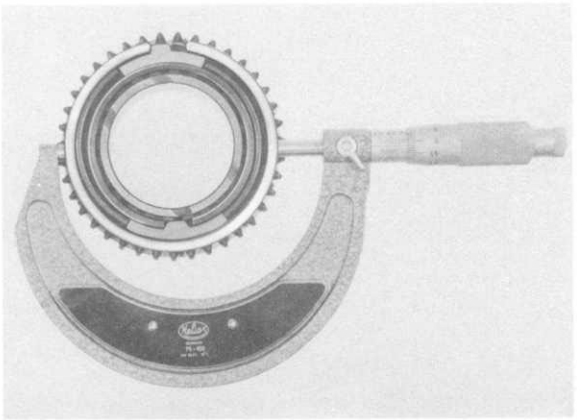
Fifth gear synchronizer ring cannot be used on 4th gear wheel beginning with Transmission No. 118 1093.



CHECKING SYNCHRONIZATION

Check installed diameter of synchronization rings to guarantee perfect synchronization.

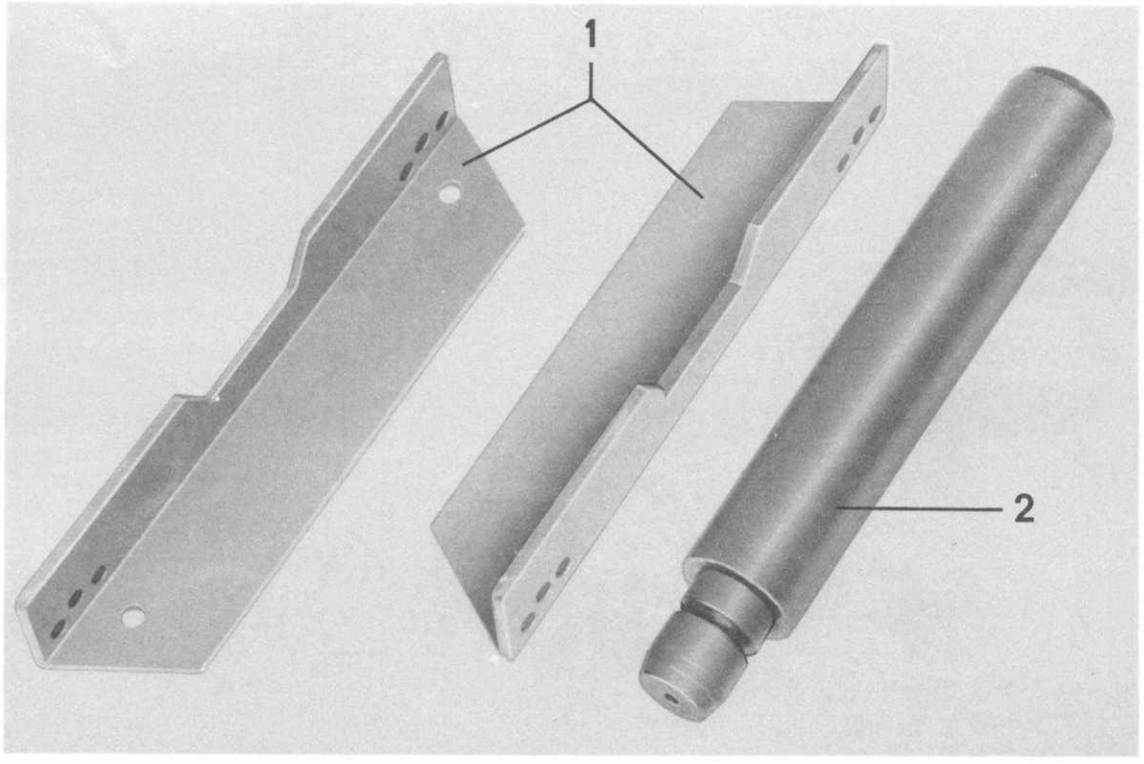
Check installed diameter of installed synchronization ring with a micrometer. Micrometer must be applied at highest point of synchronization ring.



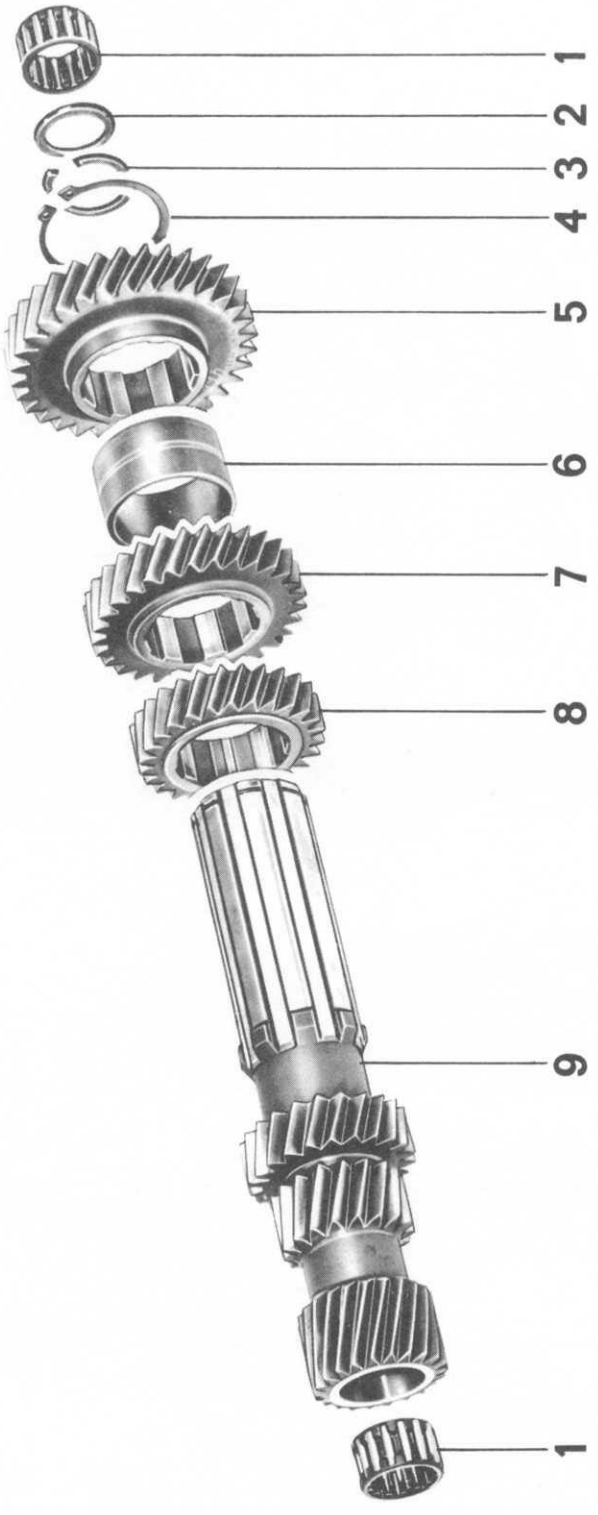
Installed Diameter:

1st through 5th speed = $86,0 \pm 0,24$ mm

TOOLS



No.	Description	Special Tool	Remarks
1	Support rail	VW 457	
2	Mandrel	VW 407	


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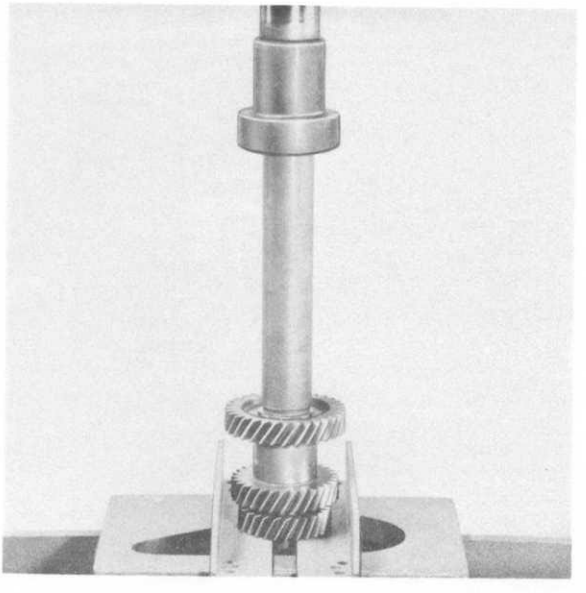
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Needle bearing	2			
2	Washer	1			Only for transm. type 28.05
3	Circlip	1			
4	Circlip	1			
5	5th gear	1	Press off with VW 407 and VW 457	Replace only in pairs (with input shaft), large shoulder faces spacer	
6	Spacer	1			
7	4th gear	1	Press off with VW 407 and VW 457	Replace only in pairs, large shoulder faces 3rd gear	
8	3rd gear	1	Press off with VW 407 and VW 457	Replace only in pairs, small shoulder faces stop	
9	Countershaft hub	1			

DISASSEMBLING AND ASSEMBLING COUNTERSHAFT HUB/GEARS

Disassembling

1. Remove circlip.

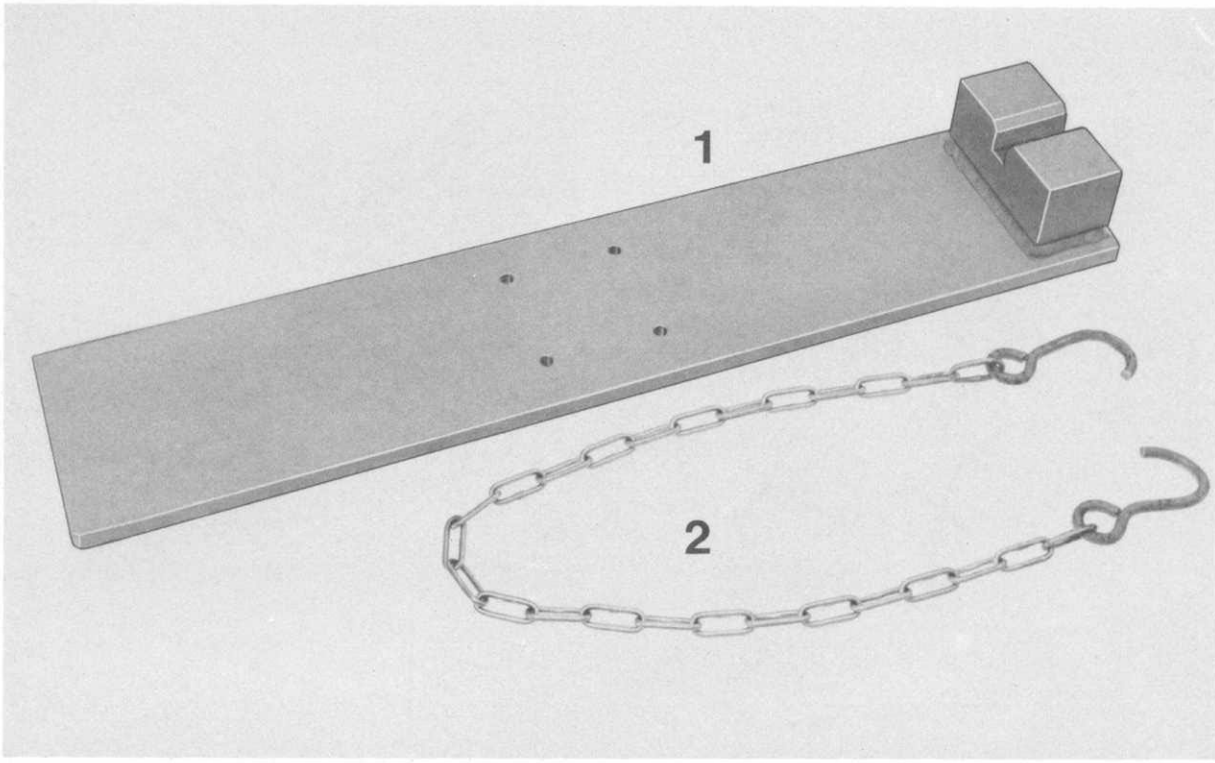
2. Press off gears (3rd, 4th and 5th) with a suitable mandrel (e.g. VW 407) and Special Tool VW 457



Assembling

Heat gear to approx. 100° C/212° F and install to correct position.

TOOLS



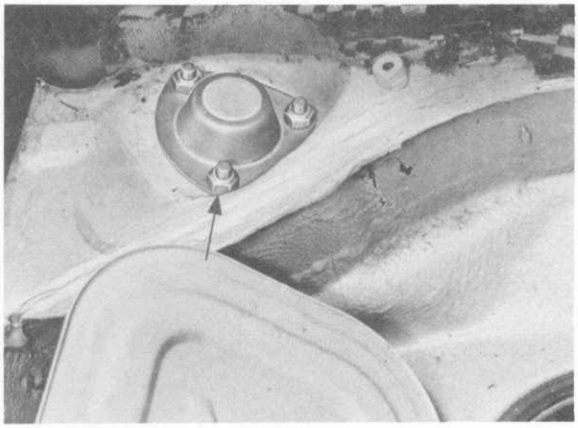
No.	Description	Special Tool	Remarks
1	Removal plate	9163	
2	Chain	9164	

REMOVING AND INSTALLING AUTOMATIC TRANSMISSION

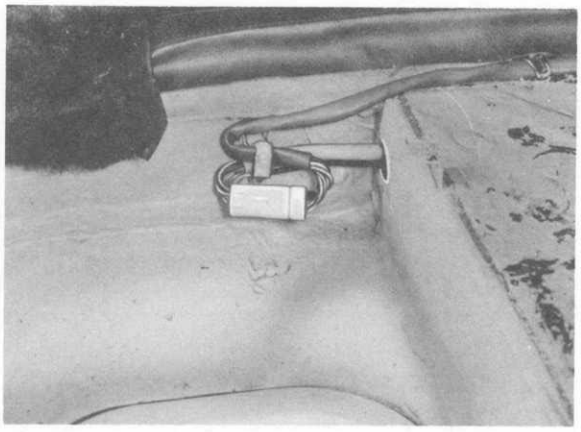
Removing

1. Remove battery.

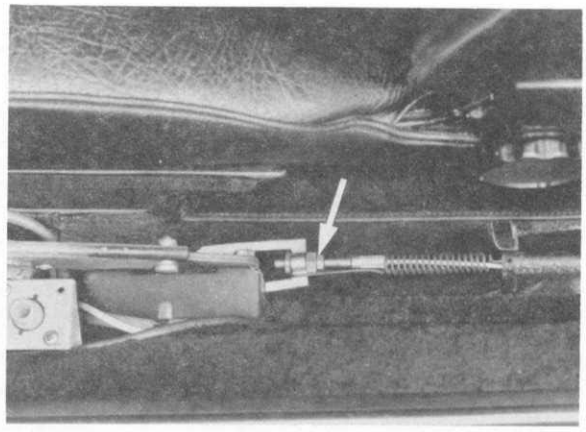
2. Unscrew self-locking hexagon nuts from spring struts in trunk.



3. Disconnect multiple plug in spare wheel well and pull out toward rear.

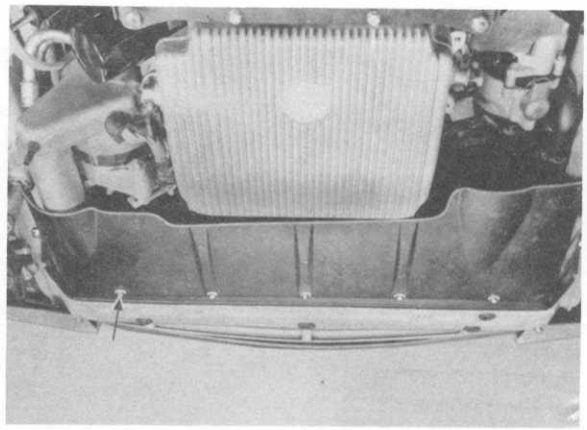


4. Detach parking brake cable and lock.

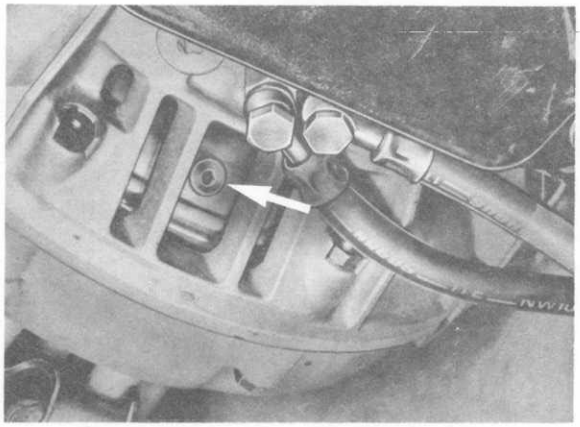


5. Remove rear wheels.

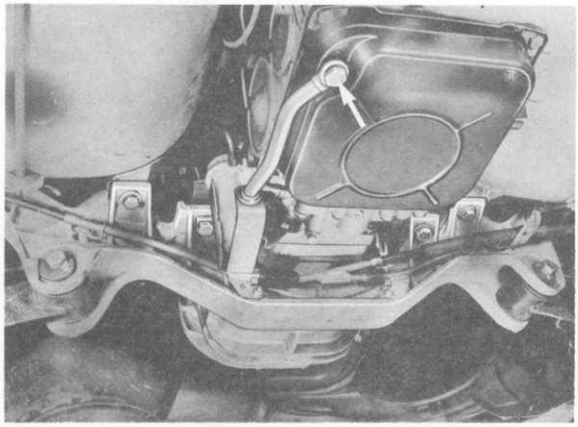
6. Unscrew air duct.



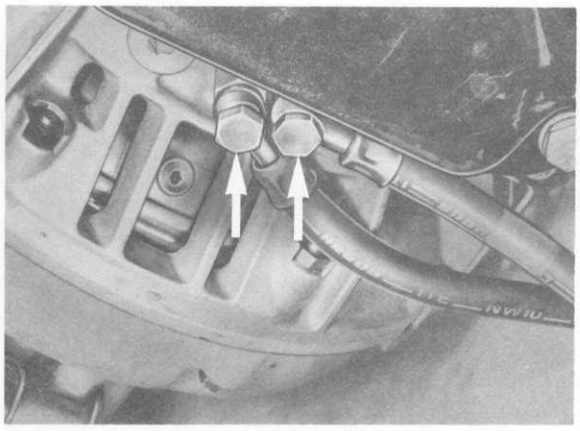
7. Turn crankshaft until converter drain plug can be seen. Now unscrew drain plug and drain ATF.



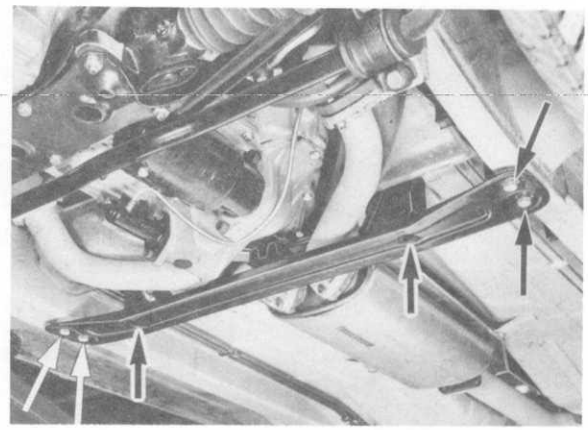
8. Unscrew oil filler tube from oil pan and drain ATF.



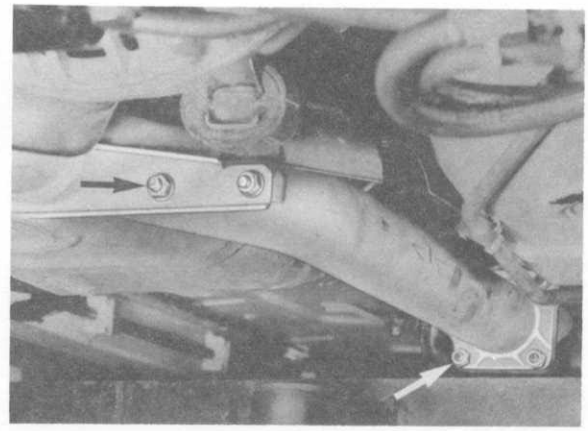
9. Unscrew feed and return lines for ATF cooler.

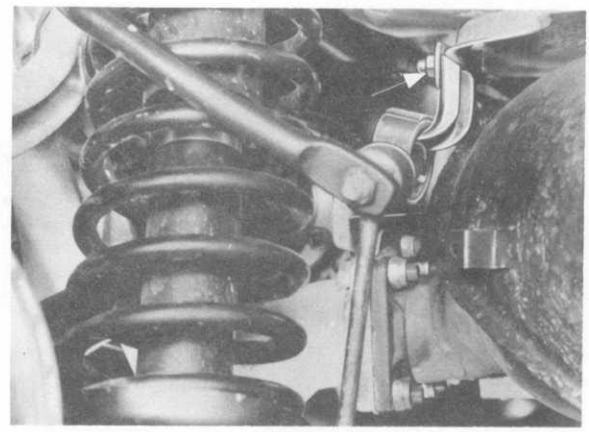


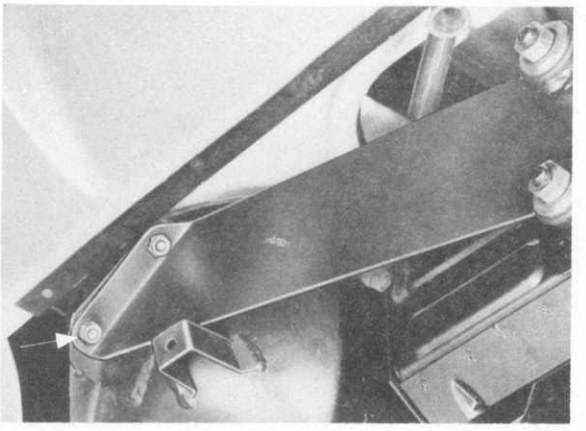
10. Remove cross member.



11. Remove exhaust system from primary muffler.



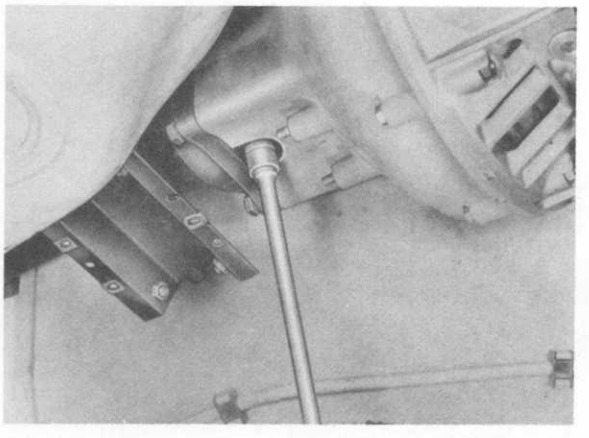




12. Remove exhaust system guards.

13. Remove battery console.

14. Remove rubber cap from sight hole in central pipe and turn crankshaft to position double clamp that capscrew can be removed.

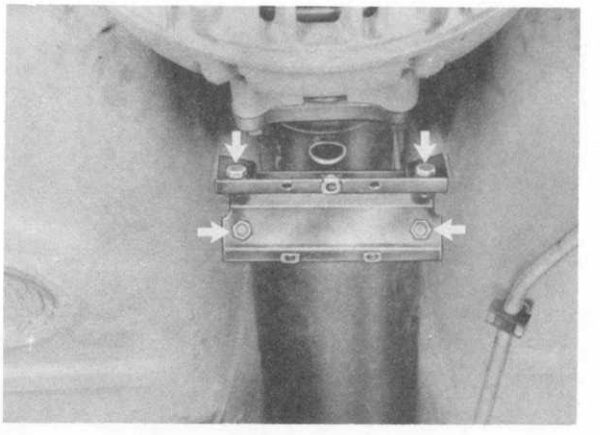


15. Detach brake calipers and suspend that brake hoses are without tension.

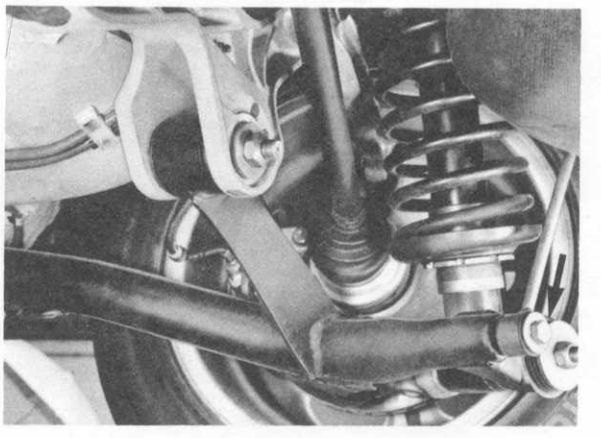
16. Detach axle shafts from transmission and suspend in horizontal position.

17. Detach holder for parking brake cable and pull out cable toward rear.

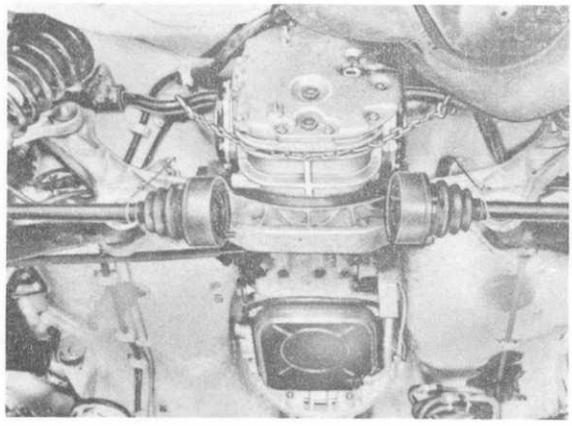
18. Remove rear reinforcement plate.



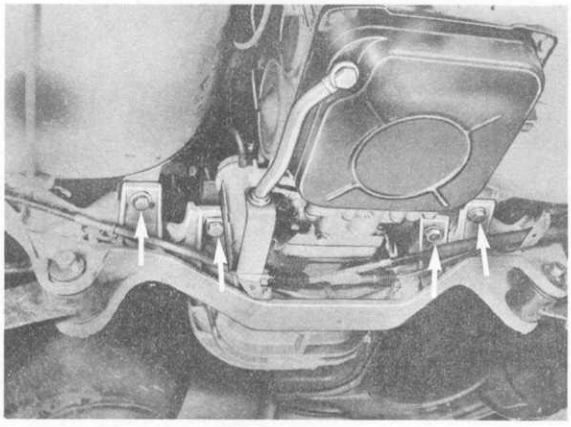
19. Detach stabilizer from lower control arm.



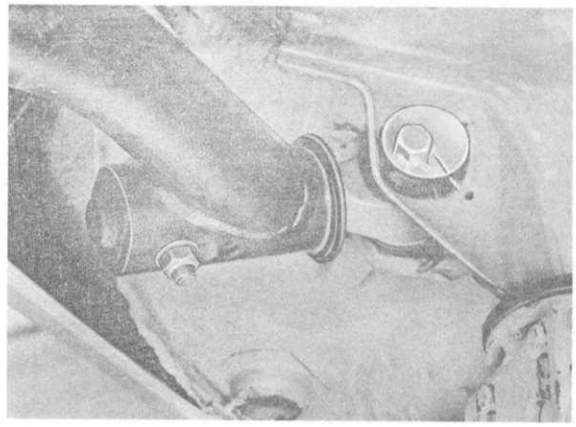
20. Support transmission on stabilizer bar with Special Tool 9164.



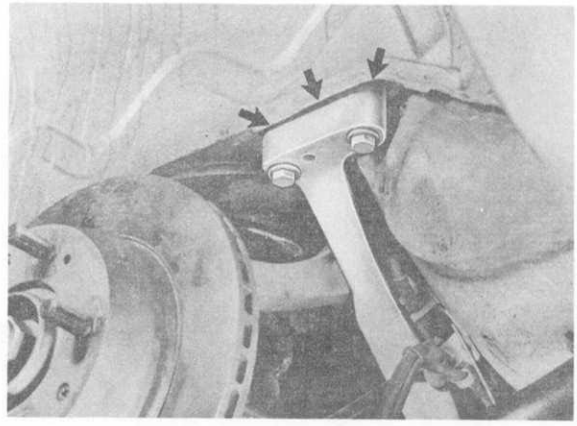
21. Remove two bolts from transmission mounts and two bolts holding rear axle cross member to frame.



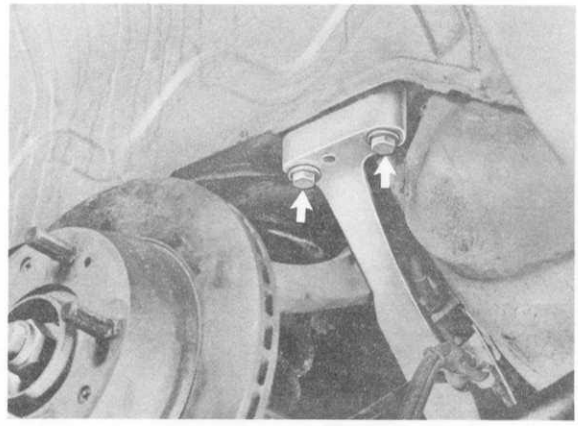
22. Mark position of toe eccentric bolts for reinstallation and remove eccentric bolts.



23. Mark position of rear axle cross member for reinstallation.



24. Place jack underneath rear axle cross member and remove mounting bolts from cross member.



25. Lower rear axle carefully and be careful that spring struts, cross member and bearing brackets do not tilt.

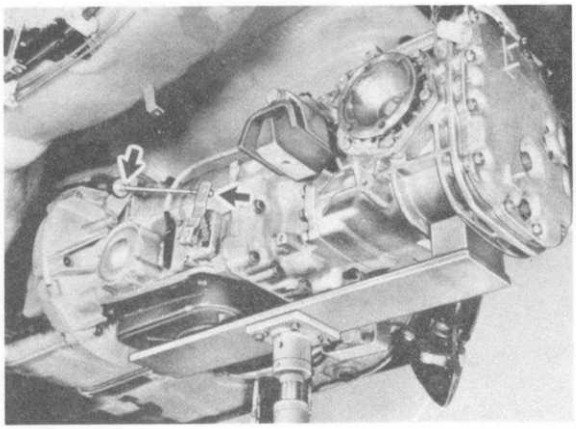
Note

A second person is required for removal of rear axle.

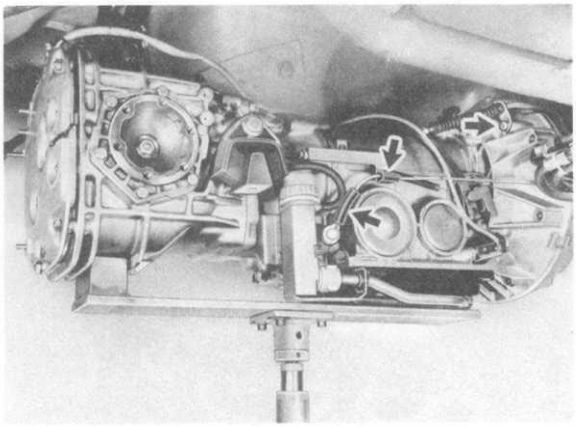
26. Mount Special Tool 9163 on universal transmission lift and place underneath transmission.

27. Lift transmission and detach Special Tool 9164.

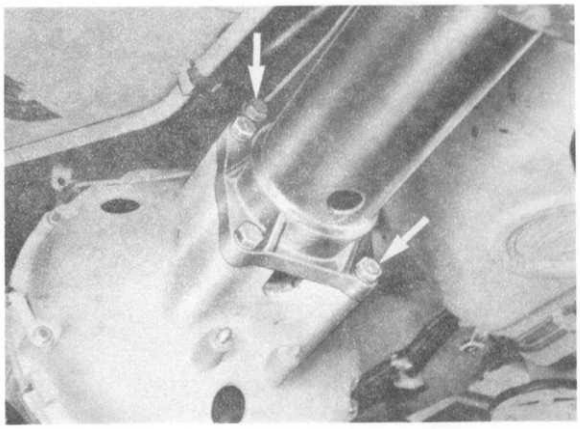
28. Lower transmission a little, detach selector lever cable and disconnect cable sleeve.



29. Pull off vacuum line from vacuum modulator and press out of holders. Detach transmission cable and remove holder for guide tube.

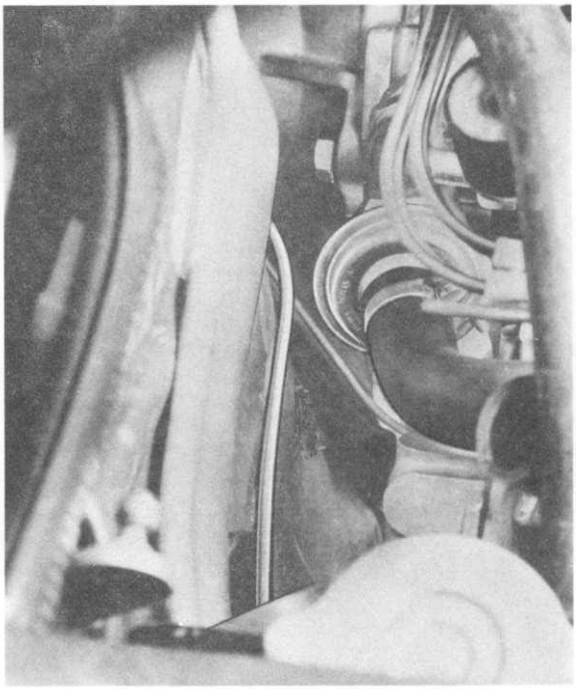


30. Remove six bolts of central tube. This requires lowering transmission as fas as possible.



Note

When lowering transmission, be careful that check valve for air injection does not damage brake line.

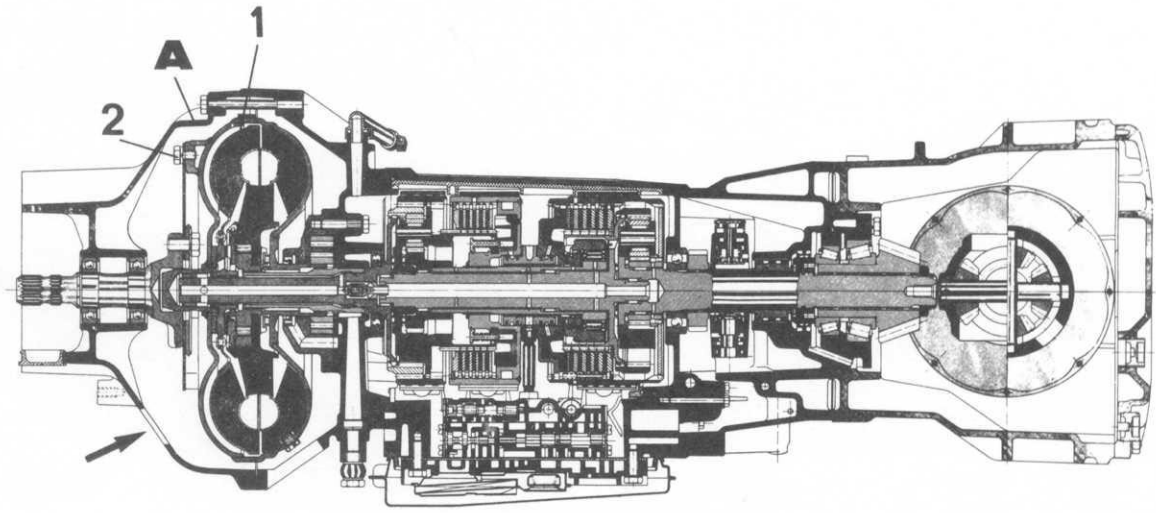


31. Pull transmission out of coupling splines and lower carefully.

FRONT CONVERTER HOUSING, EXCHANGING

Note

Before installing new automatic transmission/final drive assembly into vehicle, front converter housings must be exchanged between new and old units. This is to maintain factory adjustment between drive shaft coupling and transmission input shaft.



Perform following steps:

1. Loosen 6 bolts (2) attaching drive plate to torque converter (1) through opening (arrow).

2. Remove 8 bolts holding front converter housing (A).

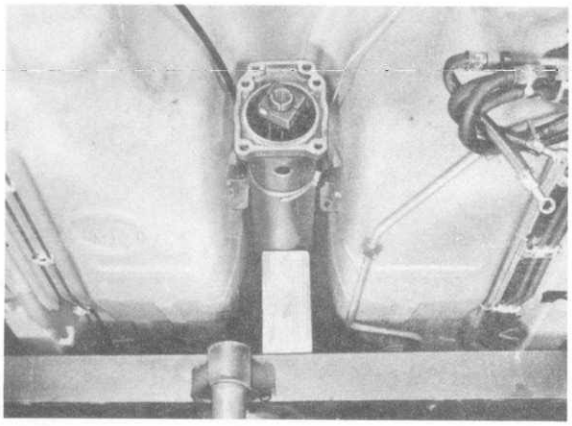
3. Exchange front converter housings only.

4. Tighten converter housing bolts to 1.9 - 2.3 mkg (14 - 17 ft lb).

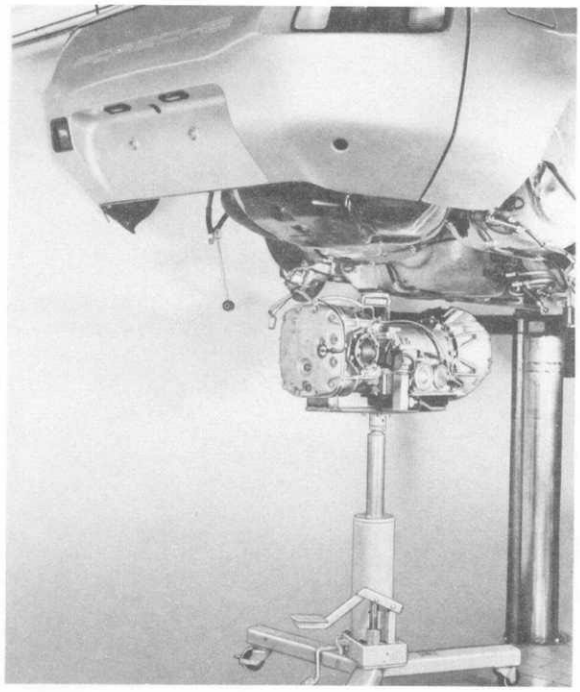
5. Tighten drive plate bolts to 3.2 - 3.9 mkg (23 - 28 ft lb).

Installing

1. Move central tube to installed position with a suitable piece of wood. Install rear reinforcement plate for car lifts without a center pillar.



2. Lift transmission with universal transmission lift and Special Tool 9163, and push it into splines of coupling.



3. Install accessible bolts on central tube and tighten hand tight.

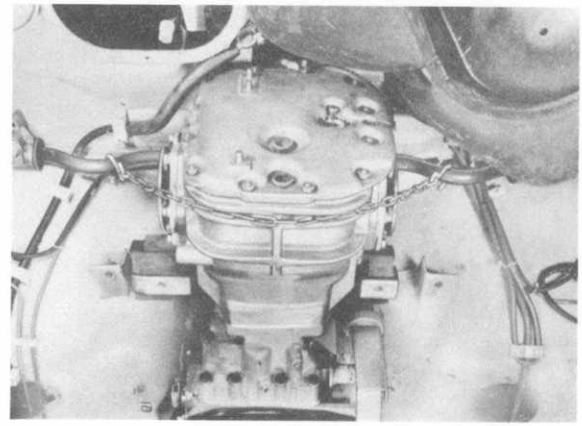
4. Lift transmission and remove piece of wood from central tube.

5. Lower transmission until all bolts can be installed on central tube flange.

6. Tighten six mounting bolts to specified torque.

7. Lift transmission again so that selector lever and transmission cables can be installed without tension.

8. Lift transmission and hold in installed position with Special Tool 9164.

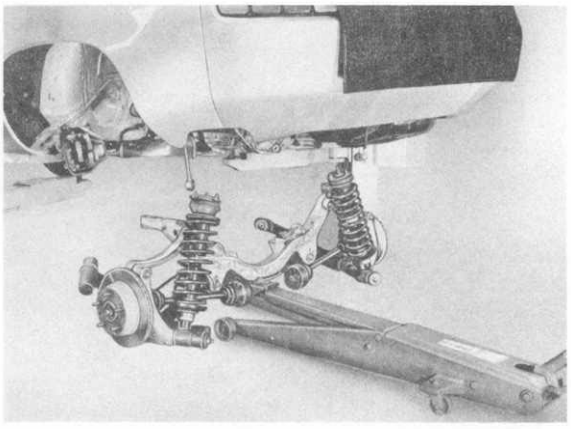


9. Push up wire harness through opening in spare wheel well and install rubber grommet.

10. Lower universal transmission lift.

11. Position rear axle and tighten all bolts except for the two transmission mount bolts.

Note:
A second person is required to install rear axle.



12. Lift transmission and detach Special Tool 9164.

13. Mount transmission on cross member and tighten all bolts to specified torque.

Note:
Watch marks for correct reinstallation.

REMOVING AND INSTALLING SELECTOR LEVER CABLE

Removing

Note

To remove the selector lever cable it will be necessary to remove muffler and rear shield. Further the rear axle has to be removed up to the control arm mountings and lowered (see page 37 - 2, "Removing and Installing Transmission").



1. Unscrew ground strap of battery.

2. Remove selector lever grip and take off rubber cover.

3. Remove cover frame (see page 37 - 10 a).

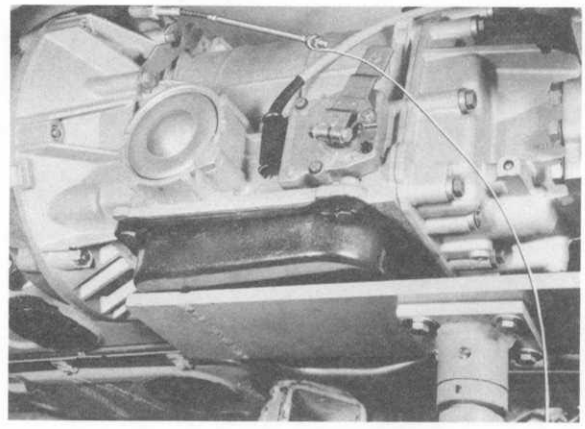
4. Pull bulb holder carrier out of retaining clips.

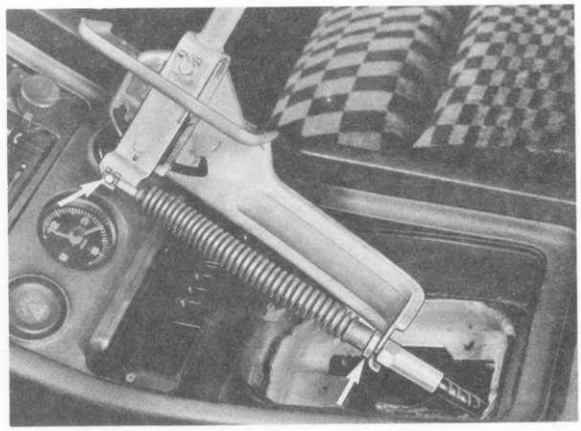
5. Mark location of selector lever base for reinstallation and remove mounting screws.

6. Disconnect selector lever cable at transmission and detach cable sleeve at holder.

7. Take off ball head, hexagon nut and mounting parts.

8. Mount wire on cable and pull out selector lever base by applying a jerk forwards. Lower central tube and transmission slightly for this purpose.





9. Remove cable circlip from selector lever and detach cable sleeve at selector lever base.

Installing

1. Attach cable sleeve on selector lever base, tightening the hexagon nut carefully.

2. Push cable on to selector lever pin and install circlip.

3. Mount wire, pulled forward during removal, on cable and pull cable toward rear.

Note

Selector lever cable must be routed underneath a metal tab, which is mounted on converter housing with a hexagon screw.

4. Install selector lever base (watching mark) and tighten the mounting screws.

5. Install cover frame and place selector lever at "N".

Note

If light opening of gate and letter "N" are not exactly opposite each other in cover frame, remove cover frame again and reposition selector lever base in slots.

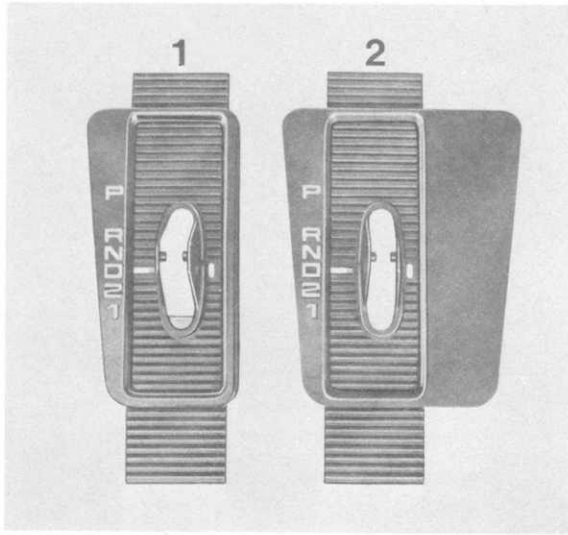
6. Adjust selector lever cable and check adjustment (see pages 37 - 11 to 37 - 12).

REMOVING AND INSTALLING SELECTOR LEVER COVER FRAME

Note

At the beginning of standard production cover frames without locks were used. These frames can be pried out of the center console with a suitable screwdriver.

Removal of the new version with locks, on the other hand, requires unlocking both locking bars.

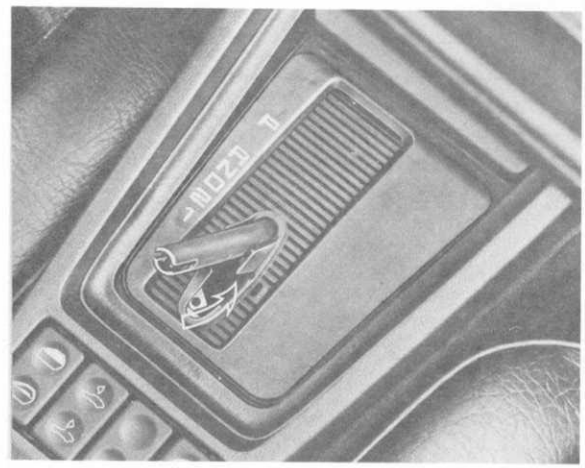


1 - Cover frame without lock (old version)
2 - Cover frame with lock (new version)

Removing

1. Remove selector lever handle and take off rubber cover.

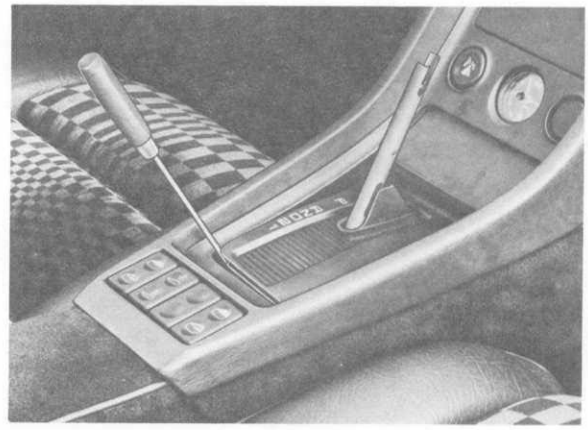
2. Move selector lever to position "1" and push rear locking bar forward against stop with a suitable tool (e. g. scribe).



3. Move selector lever to position "R", disconnect gate and push forward as far as possible.

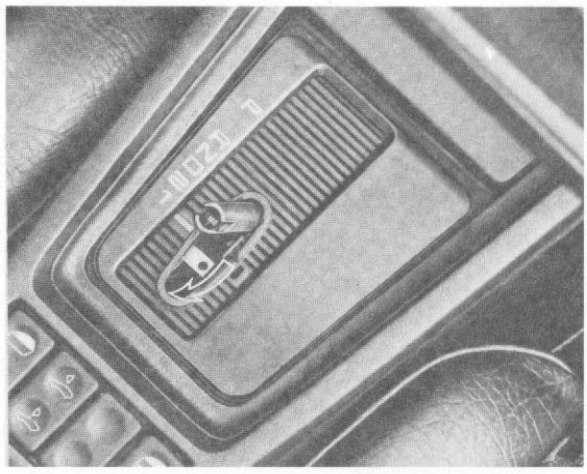
4. Push front locking bar forward against stop with a suitable tool (e. g. scribe).

5. Move selector lever to position "P" and press out cover frame carefully with a suitable screwdriver applied at the left rear corner.



6. Move selector lever to position "N" and remove frame inclined toward rear.

Installing



1. Move selector lever to position "2".

2. Push gate in frame forward all the way.

3. Install cover frame in correct position and move selector lever to position "P".

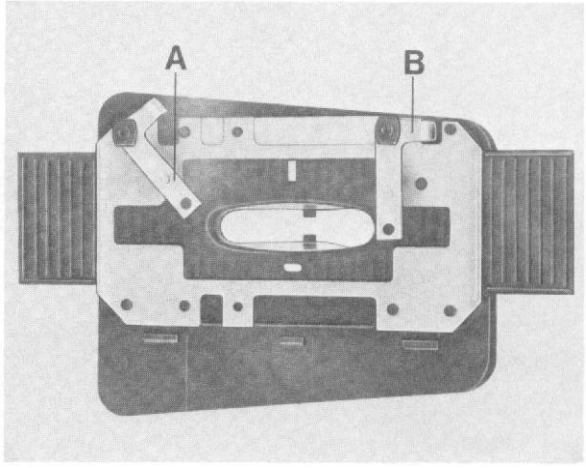
4. Push cover frame forward and move right side to correct installed position (this is done by lifting left rear corner slightly and pushing down on right side).

5. Push down on left rear corner until frame fits in center console correctly.

6. Move selector lever between "R" and "P", connect gate on selector lever and push forward.

7. Push front locking bar toward rear until it engages.

8. Move selector lever to position "2" and push rear locking bar toward rear until it engages.

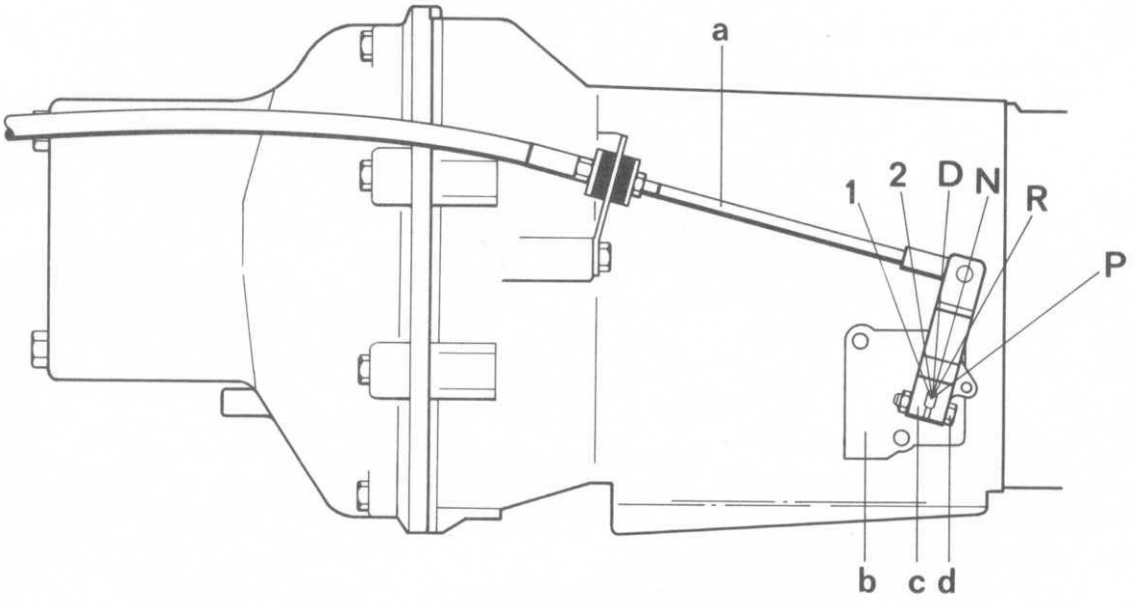


A - Locked
B - Unlocked

9. Attach gate in selector lever, install rubber cover in correct position and install selector lever handle.

10. Move selector lever in and out of all positions and make sure that cover frame fits correctly.

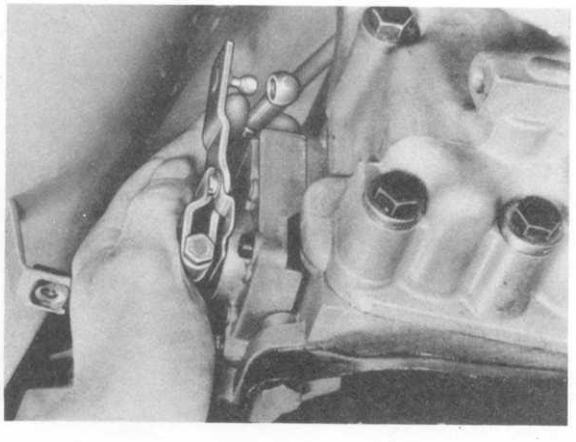
ADJUSTING SELECTOR CABLE



1. Place selector lever in N.

2. Detach cable from operating lever (on trans.).

3. Place selector operating lever (on trans.) in N position.



4. Adjust cable so that ball socket attaches to operating lever without tension.

CHECKING SELECTOR CABLE AND BACKUP LIGHT SWITCH OPERATION

Note
Correct adjustment of selector lever and selector cable is absolutely necessary for proper operation of transmission.

1. Place selector lever in N. Apply parking and foot brakes. Start engine and idle at about 1000 - 1200 rpm.

2. Move lever to R. Engine speed must drop as gear engages. Backup lights must light.

3. Move lever to P. Engine speed should increase as reverse gear disengages.

4. Move lever to R. Engine speed must drop as gear engages.

5. Move lever to N. Engine speed should increase as reverse gear disengages.

6. Move lever to D. Engine speed should drop as gear engages.

7. Move lever to P. Turn off engine.

8. Adjust selector cable if necessary.

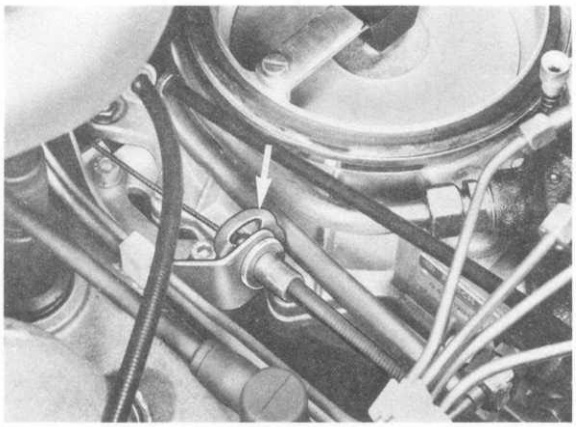
REMOVING AND INSTALLING ACCELERATOR CABLE

Removing

1. Detach cable at transmission lever. Unscrew ball socket and locknut. Pull off rubber grommet.

2. Detach cable at throttle valve lever.

3. Remove circlip for cable sleeve and pull cable out forward, being careful not to bend cable.



Installing

Adjust cable (see page 37 - 14).

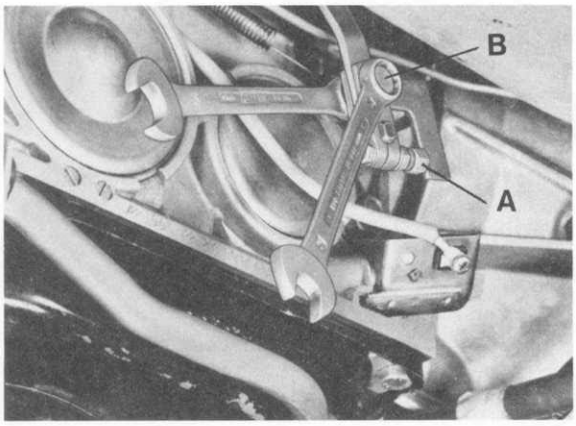
ADJUSTING THROTTLE PRESSURE CABLE

1. Detach cable at trans. lever.

2. Adjust lever with adjusting bolt A after loosening clamping bolt B so that cable can be attached without tension or free play.

Caution

If clamping bolt B is loosened for adjustments, under no circumstances should bolt be tightened against stop inside transmission (damages operating lever). Use second wrench.



A - adjusting bolt
B - clamping bolt

Note

Ball socket of cable must be screwed on threads approx. 6 mm (1/4 in.).

When cable is adjusted correctly, trans. lever travel will be approx. 33 mm (1 5/16 in.) as accelerator pedal is depressed from idle to full throttle (not kickdown).

CHECKING NEUTRAL/PARK STARTING SWITCH

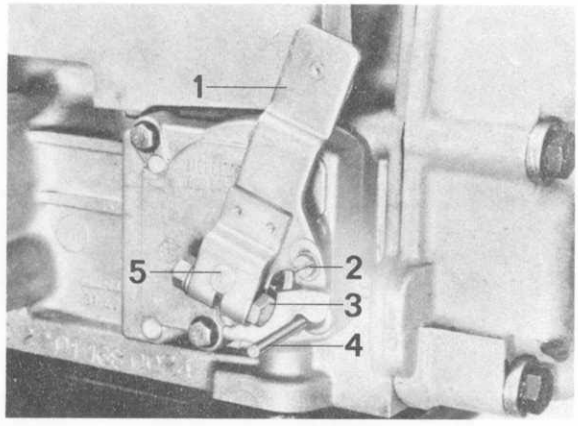
Starter should only operate in P or N positions with properly adjusted switch.

ADJUSTING NEUTRAL/PARK STARTING SWITCH

1. Move selector lever to position N.

2. Loosen adjusting screw.

3. Insert 4 mm dia. pin from US 8030 tool set through drive dog into locating hole in case.



1 = operating lever
2 = adjusting screw
3 = clamping bolt
4 = locating pin (from US 8030 tool set)
5 = shaft

4. Tighten adjusting screw. Remove locating pin.

5. Check whether engine can be started with selector lever in N or P positions.

REMOVING NEUTRAL/PARK STARTING SWITCH

1. Place selector lever in N position.

2. Disconnect electrical plug.

3. Remove clamping bolt 3 and pull operating lever 1 (with attached driving dog) off shaft 5.

4. Remove switch mounting bolts and withdraw switch.

INSTALLING NEUTRAL/PARK STARTING SWITCH

1. Install switch and mounting bolts for same.

2. Place operating lever 1 (with attached driving dog) onto shaft 5.

3. Insert lugs of driving dog into switch.

4. Insert clamping bolt 3 into operating lever 1 and tighten nut.

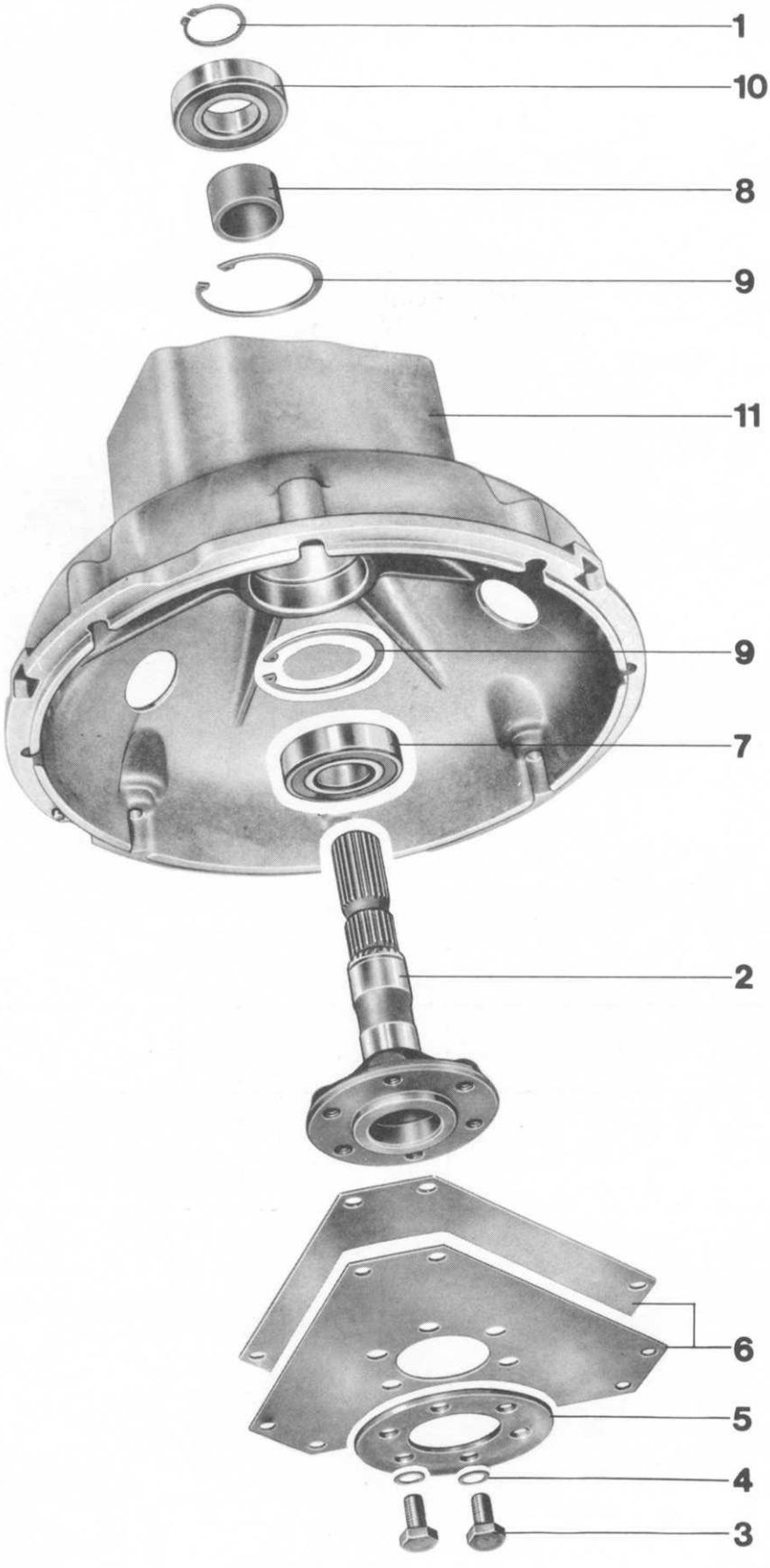
5. Connect electrical plug.

6. Adjust switch.

TOOLS



No.	Description	Special Tool	Remarks
1	Take-up rail	VW 457	


1
10
8
9
11
9
7
2
6
5
4
3

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Circlip	1			
2	Input flange	1			If replaced, readjust connection between fly-wheel and drive plate (page 39 - 51)
3	Bolt	6		Torque: 54 – 64 Nm (39 – 46 ftlb)	
4	Lockwasher	6		Replace. Position correctly	
5	Lockplate	1			
6	Drive plate	2			See below
7	Grooved ball bearing	1	Press from output flange with VW 457	Replace. Install in heated housing together with output flange	
8	Spacer	1			
9	Circlip	1			
10	Grooved ball bearing	1	Drive out with suitable mandrel	Replace. Heat housing to approx. 120 °C and press in with a suitable piece of pipe. Support input flange	
11	Front converter housing	1			If replaced, readjust connection between fly-wheel and drive plate (page 39 - 51)

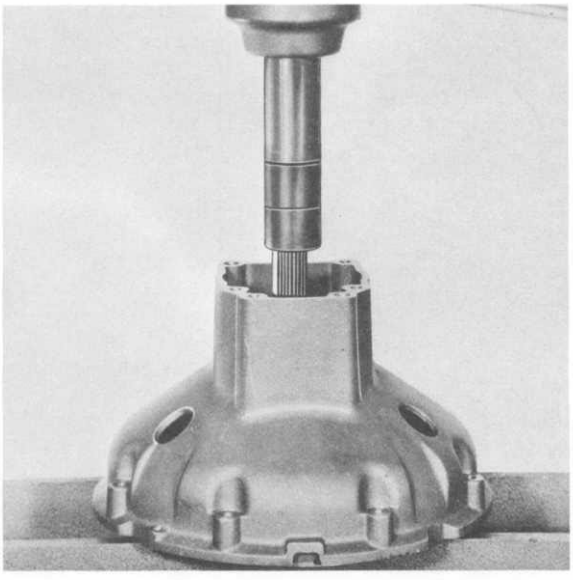
Note

Two drive plates (each 1.5 mm thick) have replaced the single drive plate (2.0 mm thick).
In conjunction with this change the input flange (Pos. 2) also had to be modified.
Since spare parts of former version are no longer available, when repairing cars with only one drive plate they must be changed to the new version.

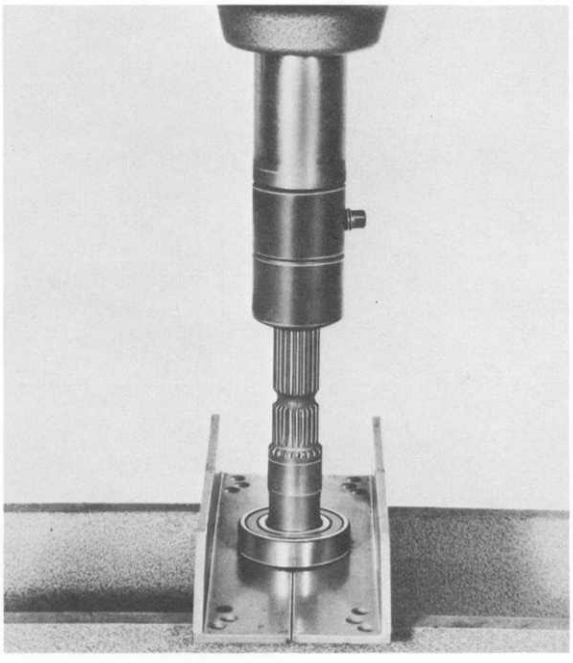
DISASSEMBLING AND ASSEMBLING FRONT CONVERTER HOUSING

Disassembling

1. Remove circlip and press out drive flange.



2. Press grooved ball bearing off of drive flange with Special Tool VW 457.



Assembling

1. Install both circlips in converter housing.

2. Press grooved ball bearing on drive flange against shoulder with a suitable piece of pipe applied on bearing inner race.

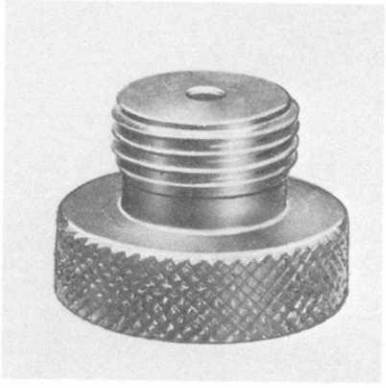
3. Heat converter housing to about 120° C/248° F and press in drive flange with grooved ball bearing against circlip.

4. Install spacer and press in front grooved ball bearing against circlip with a suitable piece of pipe applied on inner race.

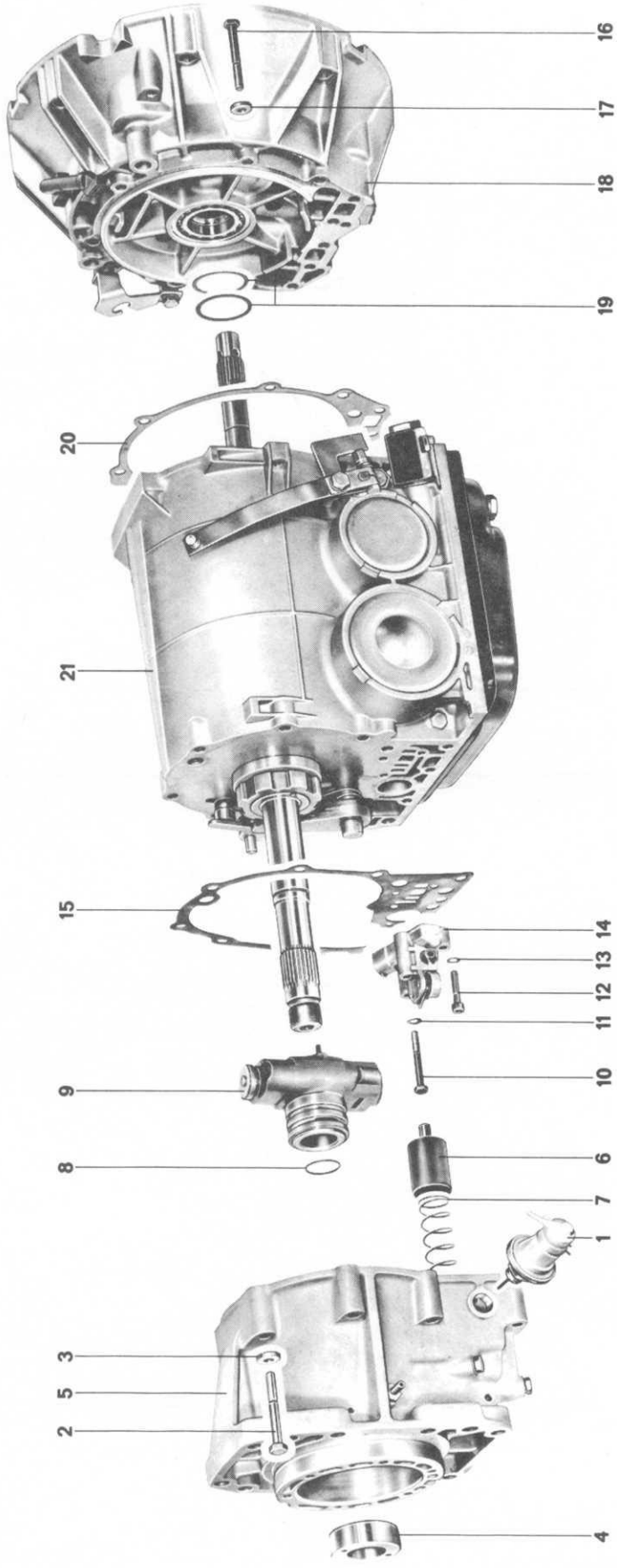
Note

To prevent the drive flange from moving out while pressing in the bearing, it must be supported from underneath with a suitable thrust pad.

TOOLS



No.	Description	Special Tool	Remarks
1	Knurled head bolt	9303	


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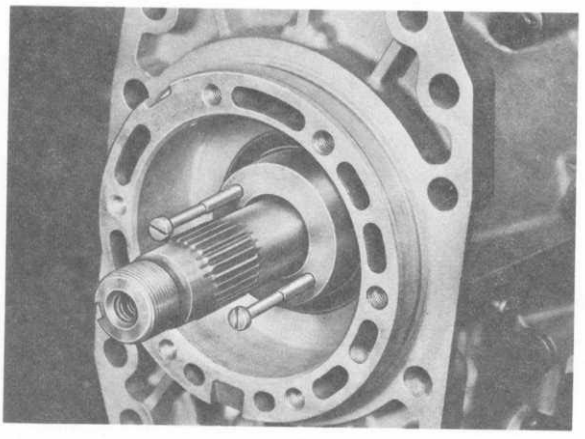
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Vacuum box	1		Check length of pressure pin with 9303 install with Omnifit Rapid Red M. Coat threads with Hyloma	
2	Bolt	10		Tighten to specified torque	
3	Washer	10			
4	Race	1	Pull out with 2 approx. 60 mm long bolts		
5	Final drive housing	1			
6	Piston	1			
7	Spring	1			
8	O-ring	1		Replace. Coat with ATF	
9	Centrifugal governor	1			
10	Bolt	2		Tighten to specified torque	
11	Washer	2			
12	Screw	1		Tighten to specified torque	
13	Washer	1			
14	Modulation pressure valve housing	1	Do not loosen or maladjust adjusting screw for bimetal spring	Check valve for easy movement after tightening mounting screws	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
15	Gasket	1		Replace	
16	Bolt	11		Tighten to specified torque	
17	Washer	11			
18	Rear converter housing	1	Must face up in assembly stand. Loosen by applying light knocks with a plastic hammer and remove		
19	Shim	X	Note thickness for reinstallation	Determine thickness again, if necessary	
20	Gasket	1			
21	Automatic transmission	1			

REMOVING AND INSTALLING FINAL DRIVE HOUSING AND REAR CONVERTER HOUSING

Removing

1. Pull out race with two approx. 60 mm long bolts and take off final drive housing.



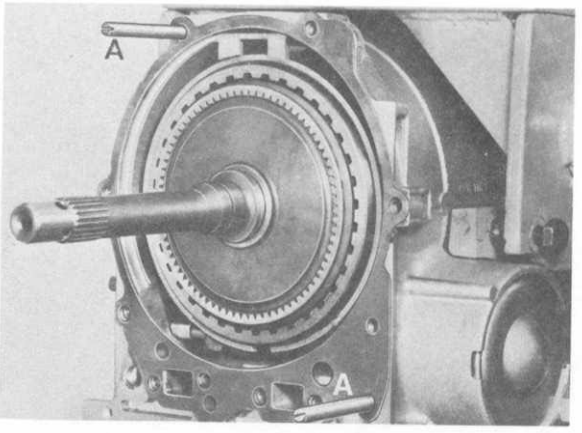
2. Turn transmission in assembly stand until converter housing faces up.

3. Remove converter housing mounting bolts and take off housing by applying light knocks with a plastic hammer.

Installing

1. Install the number of shims noted while removing or the shims calculated for the axial play on the input shaft.

2. Screw two staybolts in transmission case and install gasket.



A - Staybolts

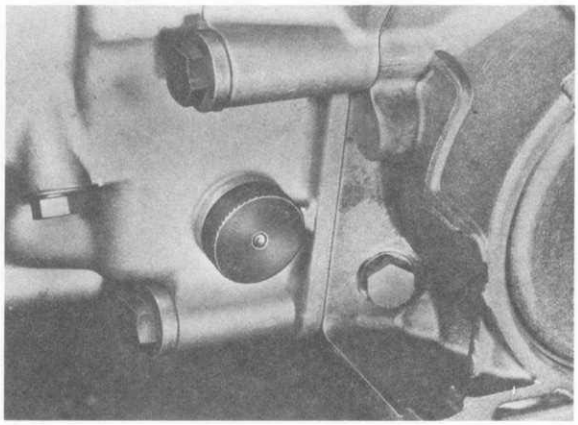
3. Align piston ring on input shaft that its gap is flush with the groove.

4. Install converter housing and tighten mounting bolts to the specified torque.

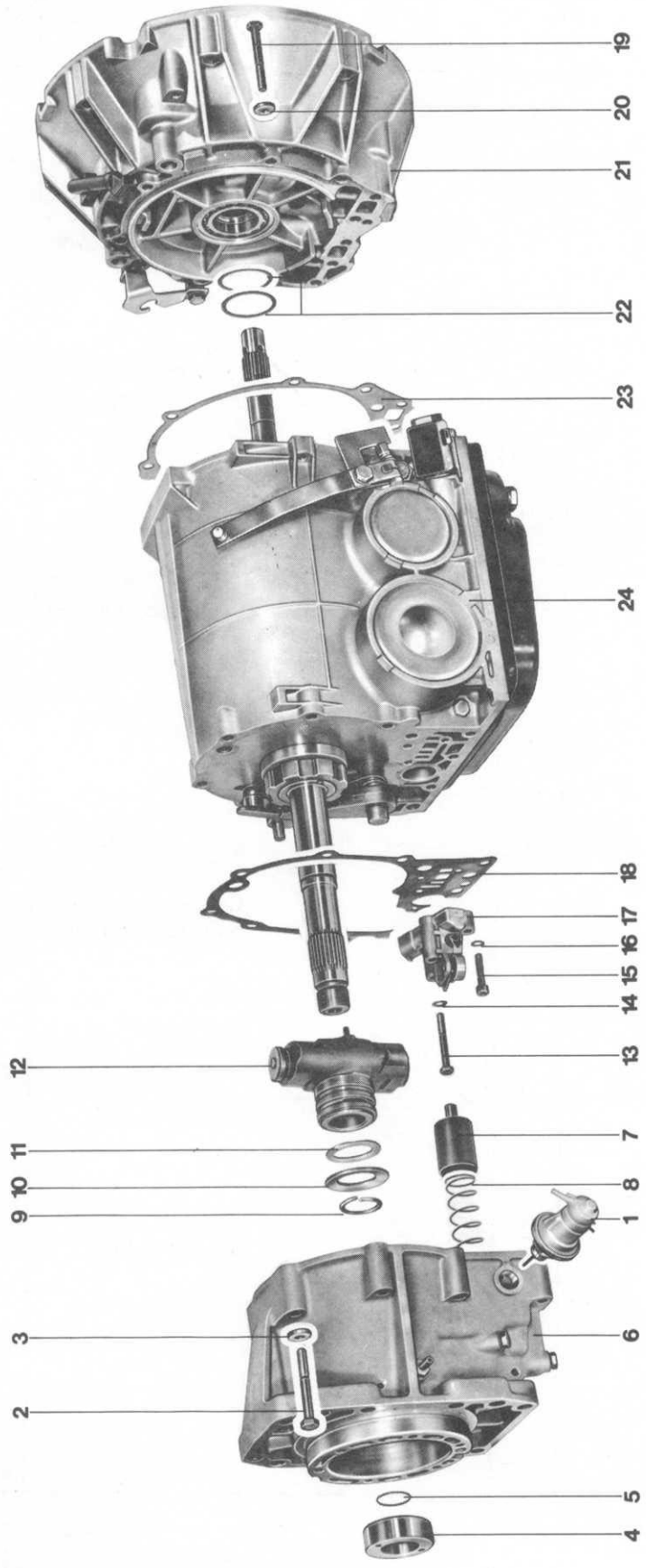
Note

Use a sealant (e. g. Hylomar SQ 32 M) on the lower seven bolts. This sealant remains permanently elastic within a high temperature range. It is available from Marston Ölchemie GmbH in 5352 Zülpich.

5. Determine pressure pin for vacuum box by screwing Special Tool 9303 in housing and tightening slightly. Insert pressure pin and press it in against stop. Pressure pin should be flush with face of special tool. If not, install a different pressure pin. For this reason pressure pins are available in three different lengths, which are identified by colors.



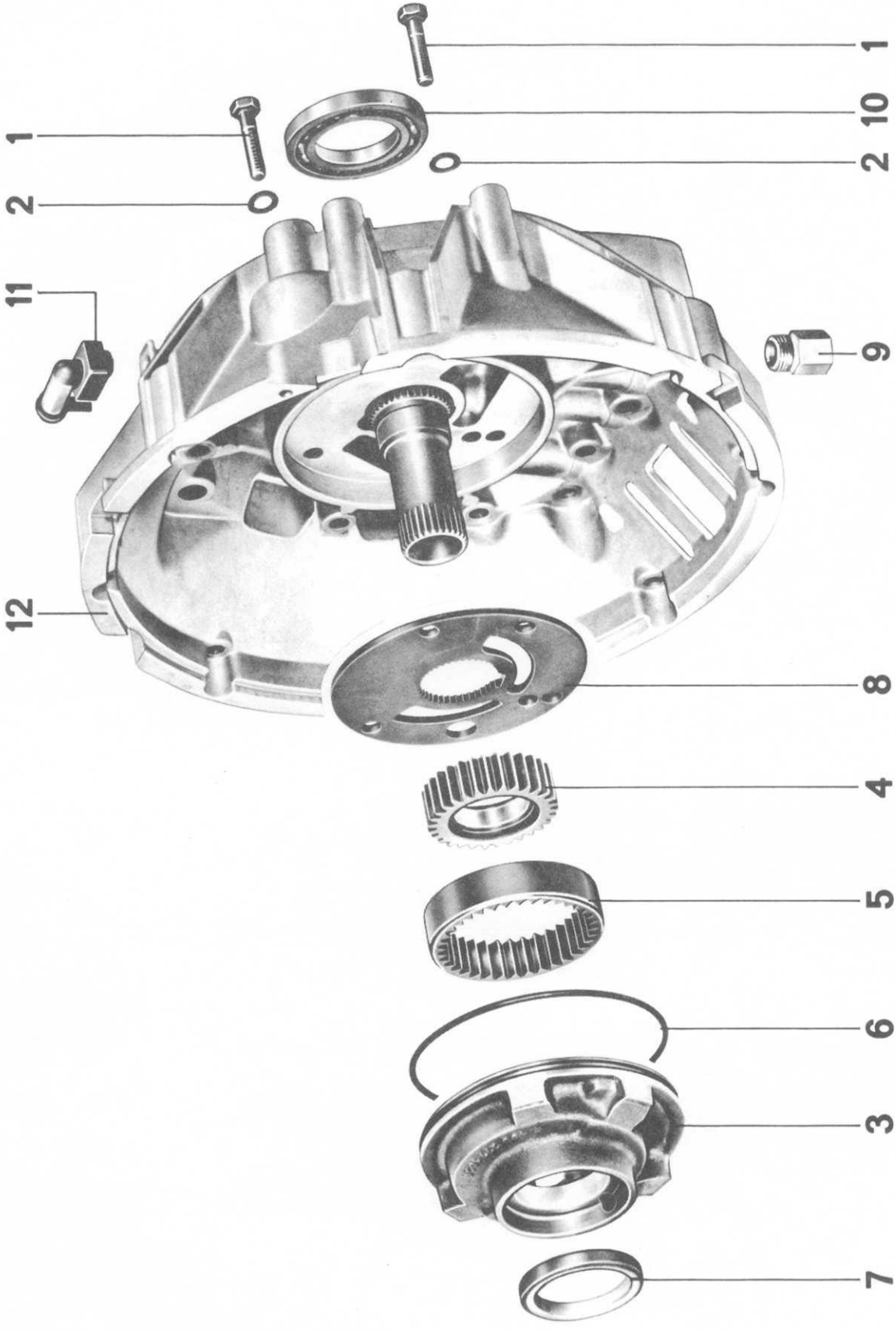
6. Install the determined pressure pin in the vacuum box with Omnifit Rapid Red M.


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No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Vacuum modulator	1		Check length of pressure pin with special tool 9303 and paste with Omnifit Rapid Red M. Coat threads with non-hardening sealant	
2	Bolt	10		Torque: 27 to 32 Nm (20 to 23 ftlb)	
3	Washer	10			
4	Thrust ring	1	Pull out with two approx. 60 mm long bolts		
5	O-ring	1		Replace, coat with ATF	
6	Rear transm. case	1			
7	Piston	1			
8	Spring	1			
9	Support ring	1			
10	Diaphragm spring	1		Concave side faces centrifugal governor	
11	Spacer	1			
12	Centrifugal governor	1			
13	Bolt	2		Torque: 7.0 Nm (5 ftlb)	
14	Washer	2			
15	Bolt	1		Torque: 7.0 Nm (5 ftlb)	
16	Washer	1			

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
17	Modulation pressure valve housing	1	Bimetal spring adjusting screw must not be unscrewed or maladjusted	Check valve for easy movement after tightening mounting bolts	
18	Gasket	1			
19	Bolt	11		Torque: 27 to 32 Nm (20 to 23 ftlb)	
20	Washer	11			
21	Rear converter housing	1	Must face up in assembly stand. Loosen with light taps from a plastic hammer and remove		
22	Shims	X	Note thickness for installation later	Redetermine thickness if necessary	
23	Gasket	1		Replace	
24	Automatic transmission	1			

Refer to pages 37 - 25/26 for instructions on removing and installing.

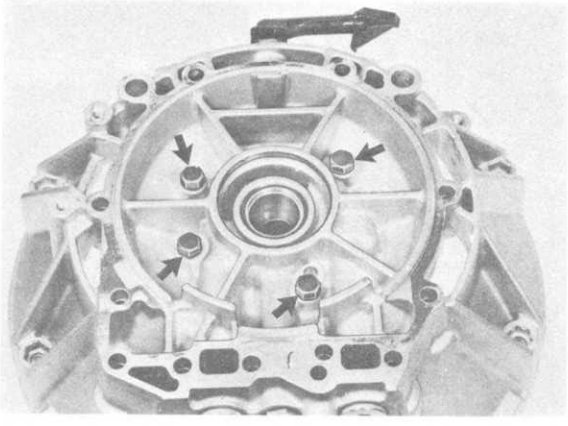

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	4		Tighten to specified torque	
2	Washer	4			
3	Pump housing with liner	1	Drive out with two bolts		
4	Drive gear	1		Install with ATF	
5	Gear	1		Install with ATF; chamfered outer edge faces pump housing	
6	O-ring	1		Replace, coat with ATF	
7	Seal	1	Drive out with suitable screw-driver	Replace, drive in flush with suitable thrust pad	
8	Intermediate plate	1			
9	Threaded plug	1			
10	Ball bearing	1	Heat converter housing to 120° C/ 248° F and remove	Drive in against stop with suitable thrust pad	
11	Breather	1			
12	Rear converter housing	1			

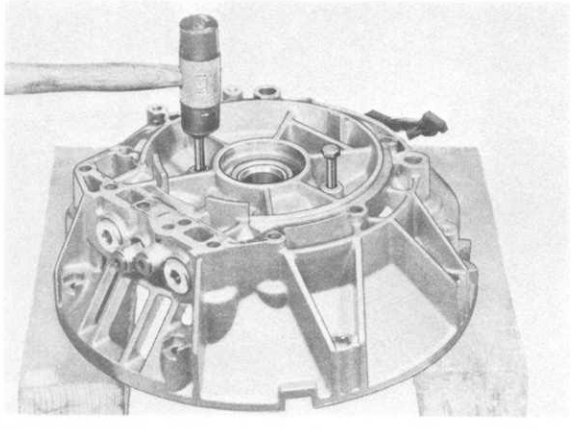
DISASSEMBLING AND ASSEMBLING REAR CONVERTER HOUSING

Disassembling

1. Remove ATF pump mounting bolts.

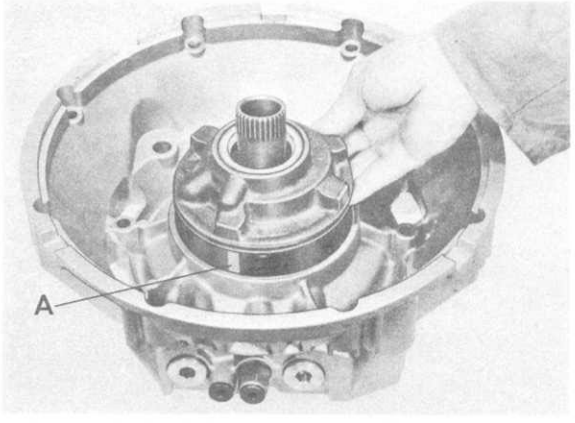


2. Screw in two approx. 50 mm long bolts opposite each other and drive out pump by lightly tapping on bolts.



Assembling

Insert ATF pump in converter housing carefully and tighten mounting bolts to specified torque.

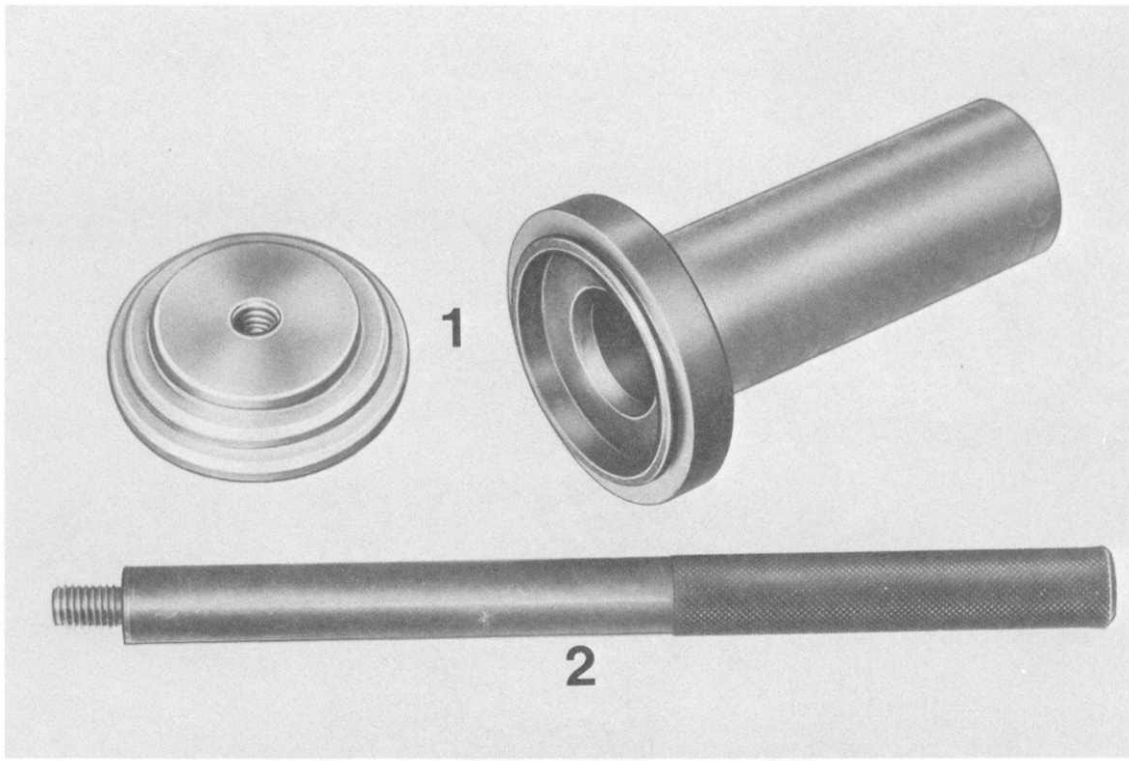


A - Studs

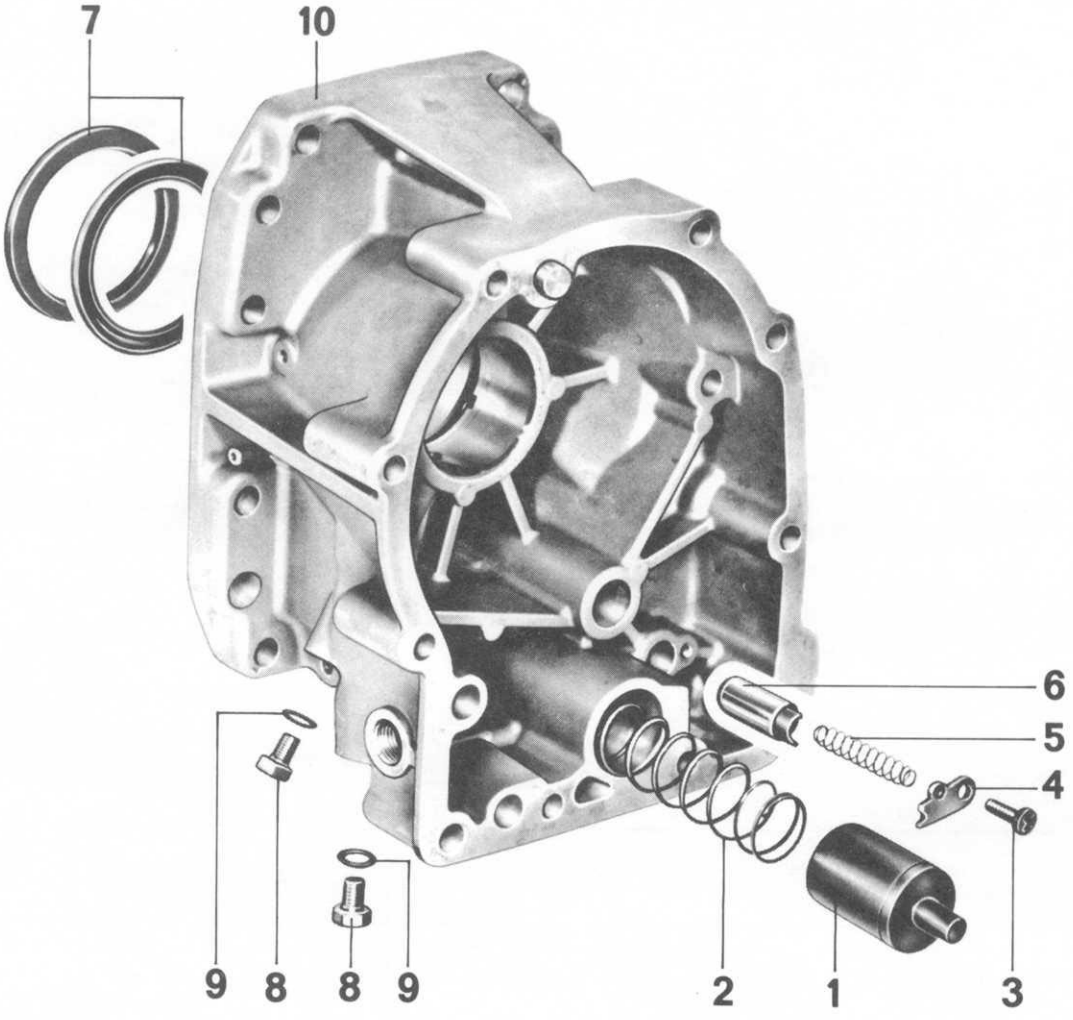
Note

Screw two studs in pump housing to facilitate installation.

TOOLS



No.	Description	Special Tool	Remarks
1	Thrust tool	9180	Consisting of thrust pad and thrust sleeve
2	Mandrel	P 254	



Printed in Germany

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Pressure piston	1		Position correctly	
2	Spring	1			
3	Bolt	1		Tighten to specified torque	
4	Holder	1			
5	Spring	1			
6	Piston	1			
7	Seal	2	Drive out from inside to outside with suitable screwdriver	Drive in to correct position with 9180 and P 254	
8	Plug	2		Tighten to specified torque	
9	Seal	2		Replace	
10	Housing	1			

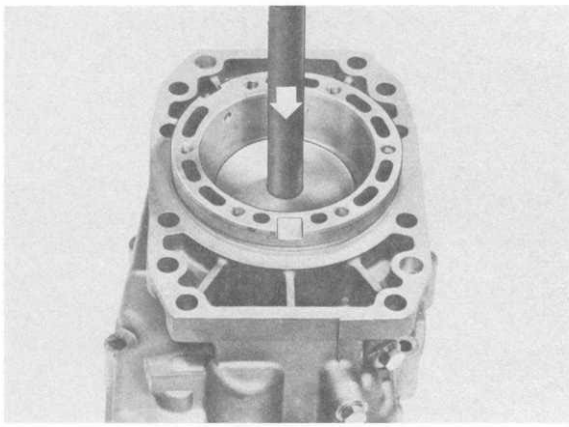
DISASSEMBLING AND ASSEMBLING FINAL DRIVE HOUSING

Disassembling

Drive out seals from inside to outside with a suitable screwdriver.

Assembling

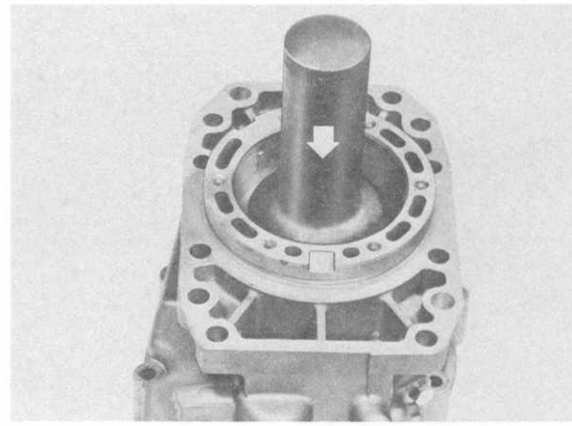
1. Drive in inner seal to correct position with Special Tools 9180 and P 254.



Note

Install seal that its sealing lip faces the automatic transmission.

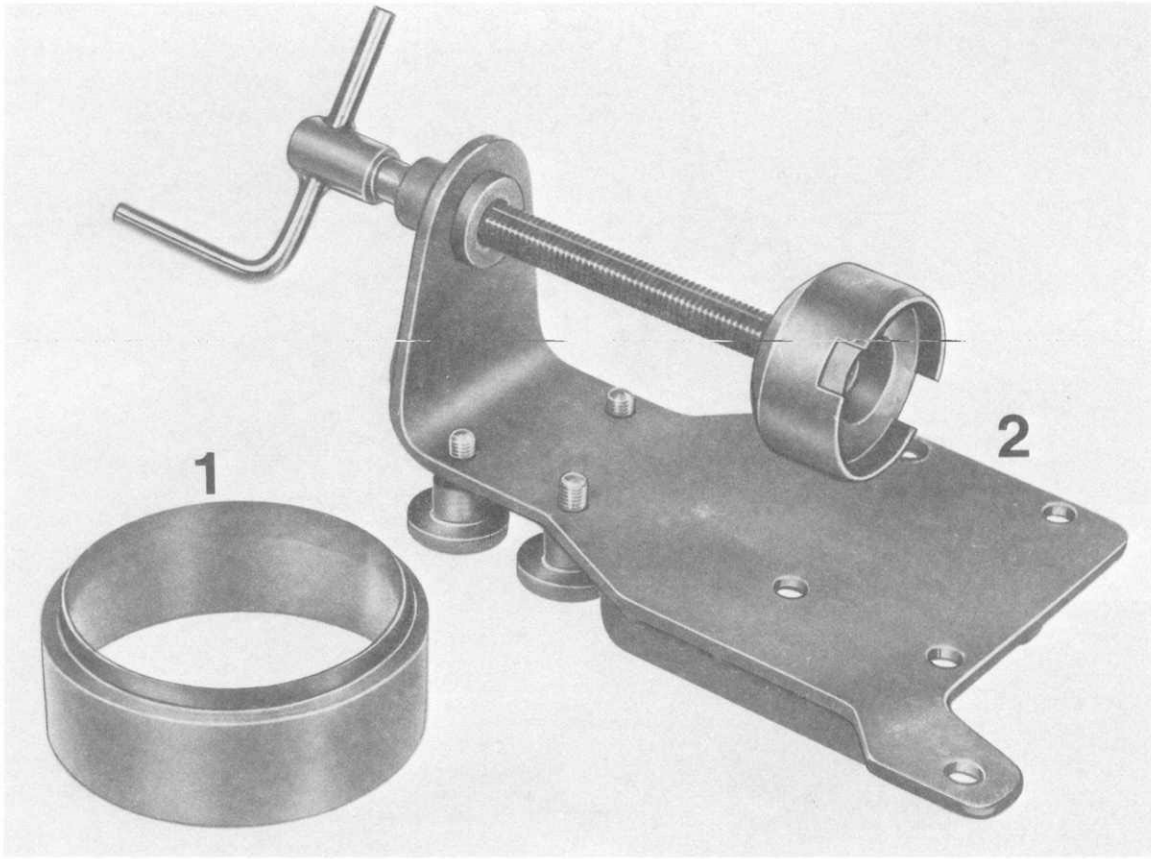
2. Drive in outer seal to correct position with Special Tool 9180.



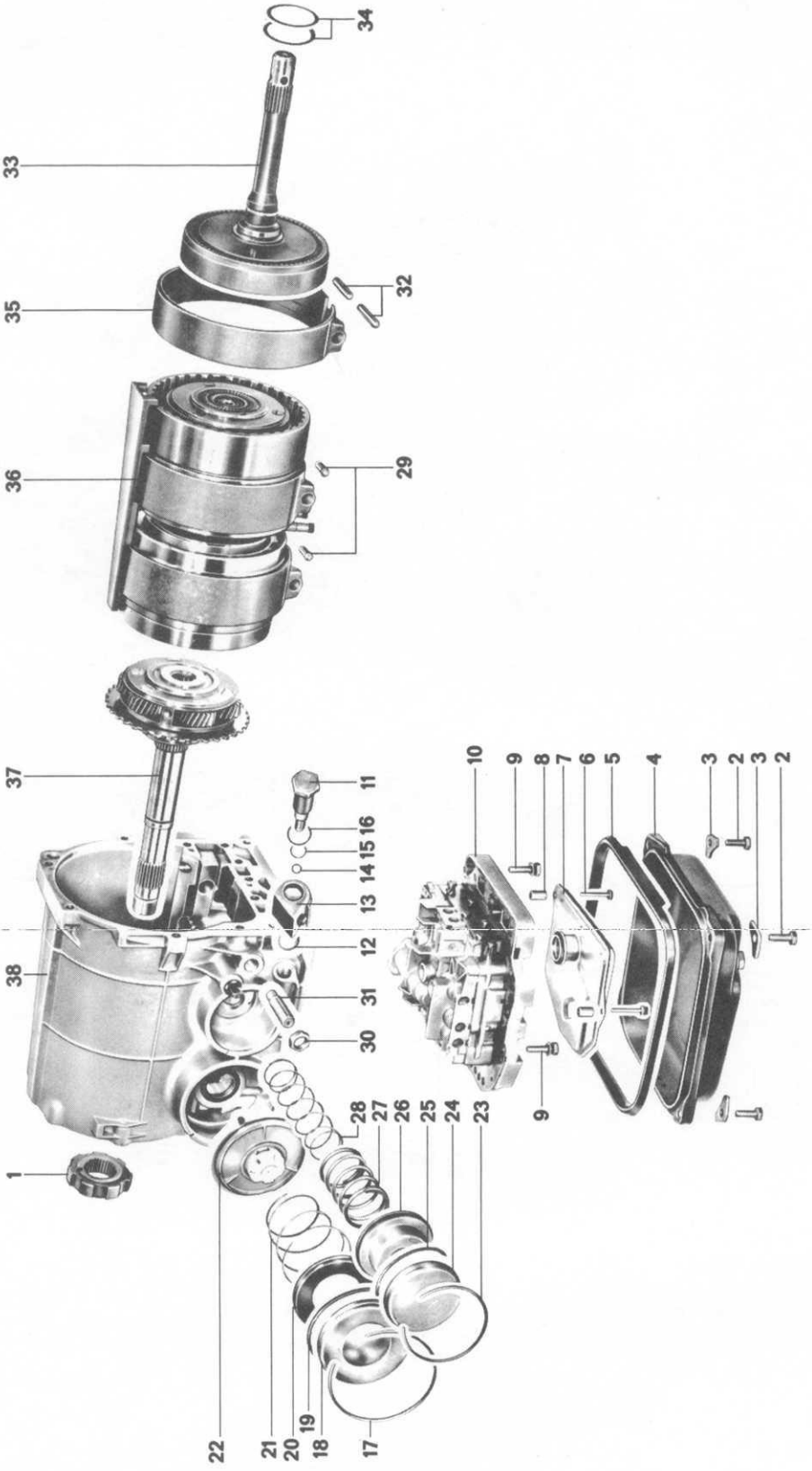
Note

Install seal that its sealing lip faces the final drive.

TOOLS



No.	Description	Special Tool	Remarks
1	Assembly sleeve	9305	
2	Assembly tool	9304	


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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Parking lock gear	1			
2	Bolt	4		Tighten to specified torque	
3	Lockplate	4			
4	Oil pan	1			
5	Gasket	1		Replace, if necessary	
6	Screw and washer	2		Tighten to specified torque	
7	Oil filter	1		Replace, every 40.000 km/25,000 mi.	
8	Spacer	2			
9	Bolt	11		Tighten to specified torque	
10	Valve body housing	1			Page 38 - 21
11	Kickdown solenoid	1			
12	Seal	1		Replace	
13	Housing	1			
14	O-ring	1		Replace	
15	O-ring	1		Replace	
16	O-ring	1		Replace	
17	Snap ring	1			
18	Cover	1			
19	O-ring	1		Replace, apply light coat of ATF	
20	Guide	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
21	Spring	1			
22	Piston	1	Use 9305	Use 9305	
23	Snap ring	1	Preload piston with 9304	Preload piston with 9304	
24	Cover	1			
25	O-ring	1		Replace	
26	Piston and seal	1			
27	Spring	1			
28	Spring	1			
29	Pin	2	Mark for reinstallation	Redetermine length, if necessary	
30	Nut	1			
31	Adjusting screw	1		Replace	
32	Pin	2			
33	Input shaft	1			
34	Shim	X	Note quantity and thickness for reinstallation	Redetermine thickness, if necessary	
35	Brake band B 3	1			
36	Gear set with brake bands B 1, B 2 and brake band guide	1			
37	Output shaft	1			
38	Transmission case	1			

DISASSEMBLING AND ASSEMBLING TRANSMISSION

Disassembling

Absolute cleanliness is very important when working on an open transmission. Perfect transmission function requires that there be no dirt on transmission parts, command valves or in oil circuits. Consequently disassembled parts must be washed thoroughly, oil bores flushed and dried.
Never use gasoline to wash rubber seals, which would be damaged. Only use alcohol for cleaning.

Also make sure that wool rags are not used on parts, because even minute contamination (e. g. lint) could lead to disturbances.

1. Detach final drive and remove bearing assembly with drive pinion (see page 39 - 22).

2. Remove final drive housing, centrifugal governor and modulation pressure valve housing (see page 37 - 21).

Note

It is essential to first take off the vacuum box for modulation pressure prior to removing the final drive housing.

3. Pull parking lock gear off of output shaft.

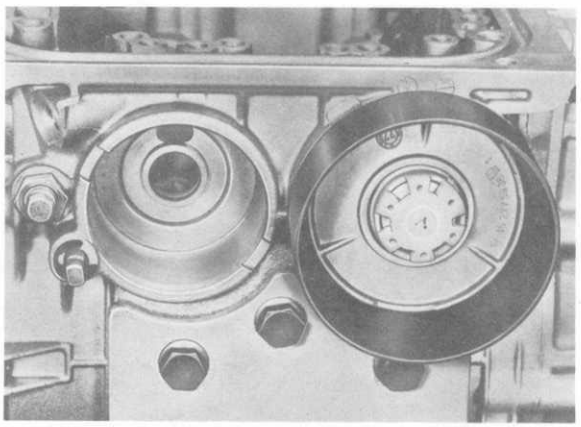
4. Remove front converter housing and torque converter (see page 32 - 1).

5. Remove valve body (see page 38 - 21).

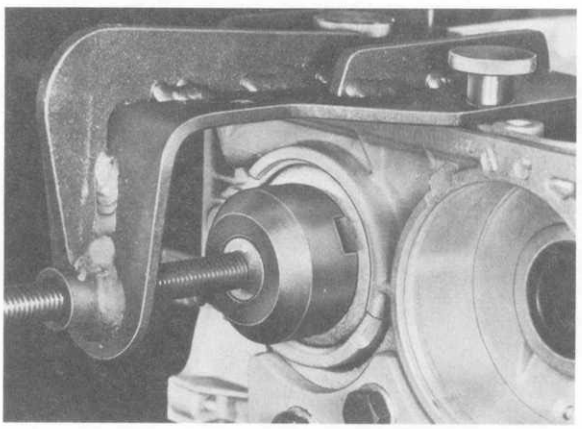
6. Remove solenoid valve.

7. Remove snap ring for cover of brake band B 2 piston and take off cover.

8. Install Special Tool 9305 and press out piston carefully.



9. Attach Special Tool 9304 for cover of brake band B 1 piston. Preload piston and remove snap ring.



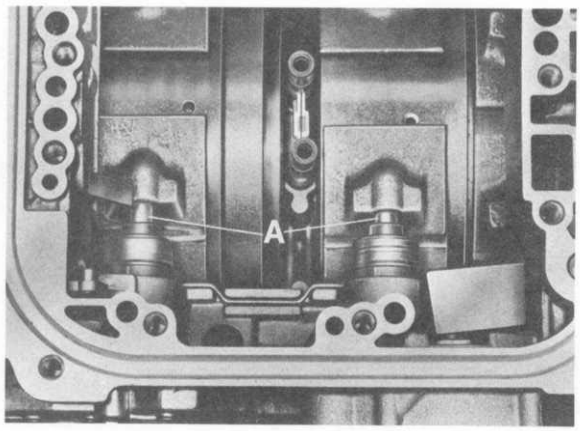
10. Release and unscrew special tool.

11. Remove cover, piston and springs of brake band B 1.

12. Remove pressure pins for B 1 and B 2.

Note

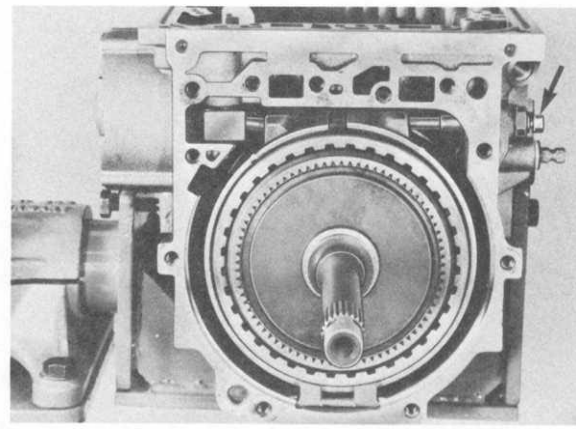
Mark pressure pins for reinstallation.



A - Pressure pins

13. Swing transmission in assembly stand to horizontal position.

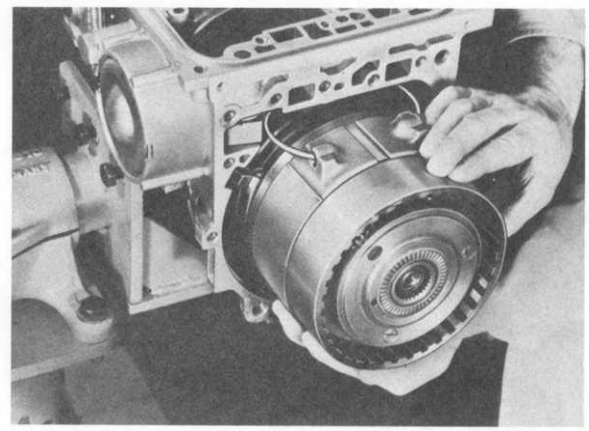
14. Remove adjusting screw B 3 and take out both pressure pins.



15. Remove brake band B 3 forward.

16. Pull input shaft out of gear assembly.

17. Hold brake band B 1 on the drum with a snap ring from cover of brake band B 2 piston and remove gear assembly with brake bands.



18. Drive out output shaft with a plastic hammer.

Assembling

Use specified ATF on bearings and moving parts when assembling the transmission.

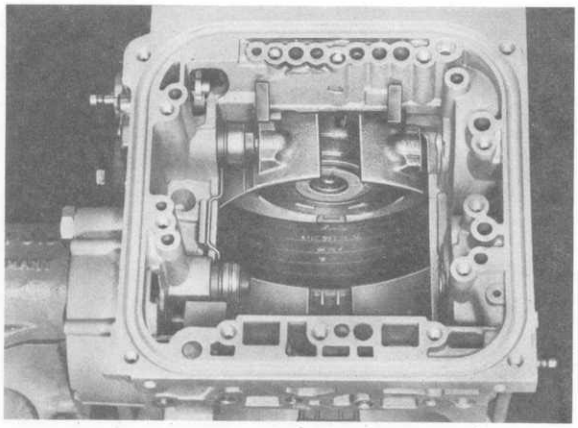
1. Install output shaft with ball bearings in transmission case and drive in with a plastic hammer.

2. Install parking lock gear.

3. Attach final drive housing with centrifugal governor, modulation pressure valve housing and pressure piston (see page 37 - 21).

4. Install the shims (either those noted while disassembling or those of redetermined thickness) with the bearing assembly and tighten drive pinion nut to specified torque (see pages 39 - 23 and 39 - 29).

5. Install brake band B 2 (steel band with radial groove liner) and brake band guide in transmission case.



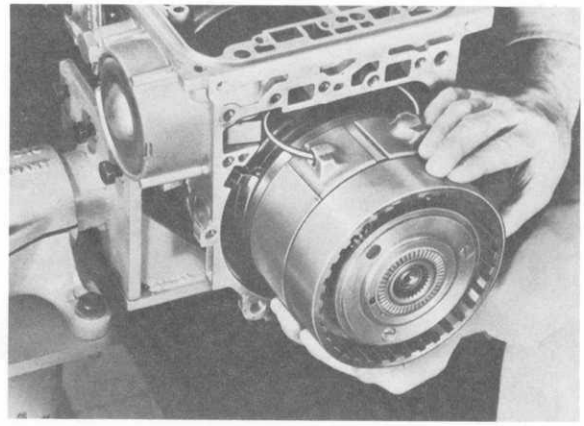
6. Lubricate and install radial bearing.

7. Hold brake band B 1 (steel band with smooth liner) on brake band drum with the snap ring for piston of brake band B 2.

8. Install gear assembly with brake band B 1, guiding the support lever for the oil distribution sleeve into groove of transmission case.

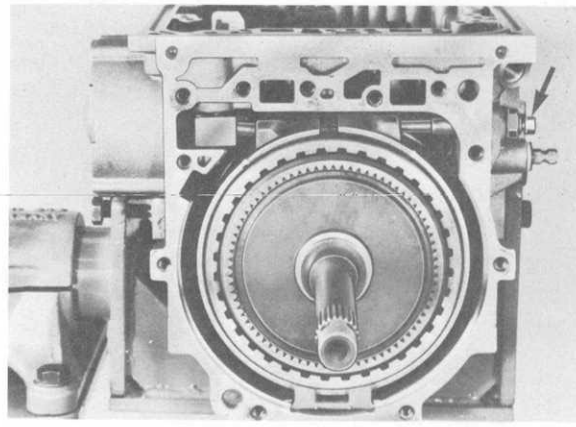
Note

When guiding gear assembly into the transmission case, make sure that segment spline of sun gear on the output shaft meshes correctly in drum of brake band B 2.



9. Install input shaft in gear assembly.

10. Install brake band B 3 (thick steel band with radial groove liner) in transmission case from front. Insert both pressure pins in brake band and screw new adjusting screw coated with a sealant in transmission case so far, until brake band is held.

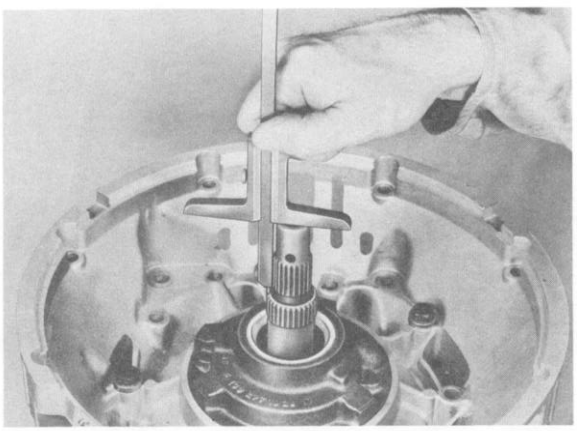


11. Turn transmission until input shaft faces up.

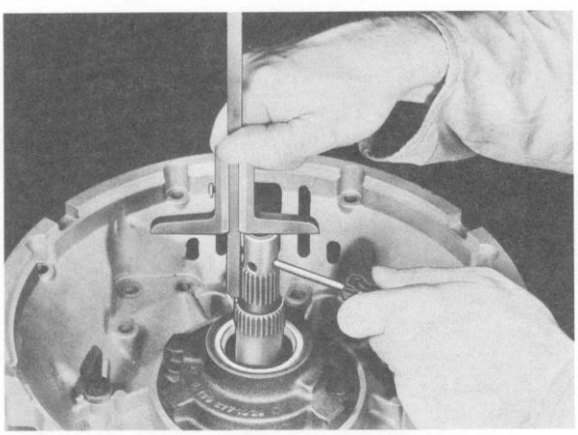
12. Measure axial play of gear assembly. It should be 0.4 to 0.6 mm.

    Install rear converter housing with gasket and tighten four mounting bolts to specified torque.

    Check distance from upper edge of input shaft to upper edge of stator shaft with a depth gauge. This distance is "A".



    Pull up input shaft against the stop and repeat measurement. This distance is "B".



    Axial play will be the difference between "A" and "B".

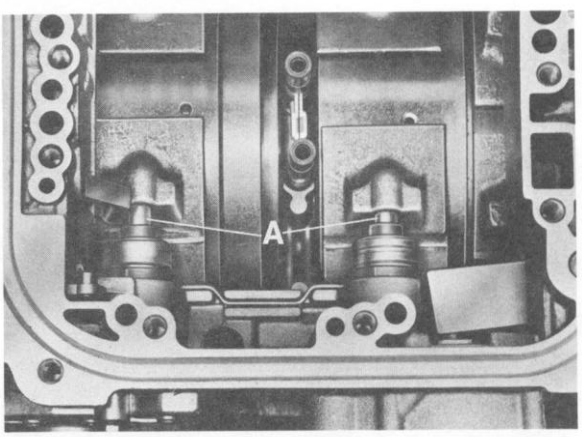
    Adjust axial play to 0.4...0.6 mm by using shims of pertinent thickness on the input shaft.

Note

Prior to checking the axial play of the gear assembly, it will be essential to adjust the bearing assembly and tighten the drive pinion nut to specified torque.

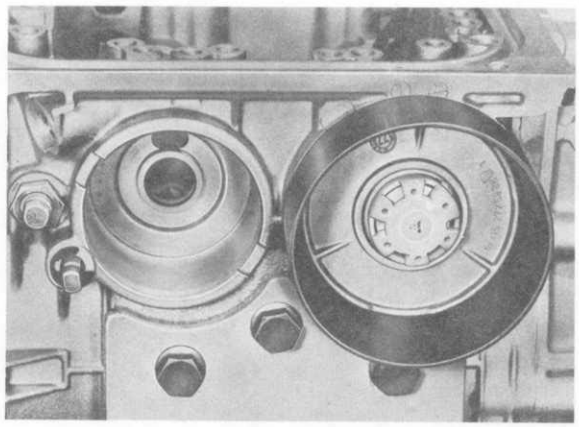
13. Attach rear converter housing (see page 37 - 21).

14. Install pressure pins for B 1 and B 2.



A - Pressure pins

15. Install piston of brake band B 2 by guiding brake band piston into transmission case with Special Tool 9305 and making sure that the pressure pin has proper fit in bore of brake band B 2.



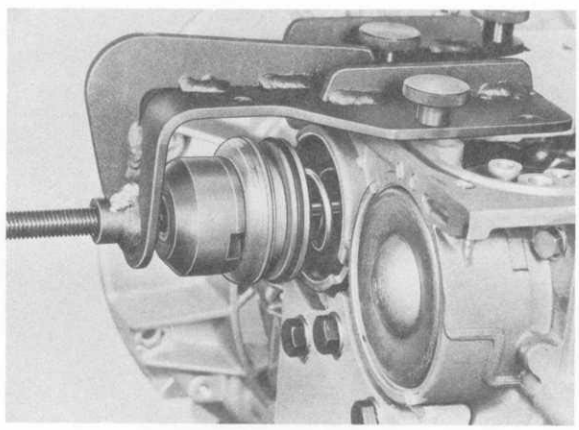
16. Use a new O-ring on cover of B 2 brake band piston and install with a spring.

Note

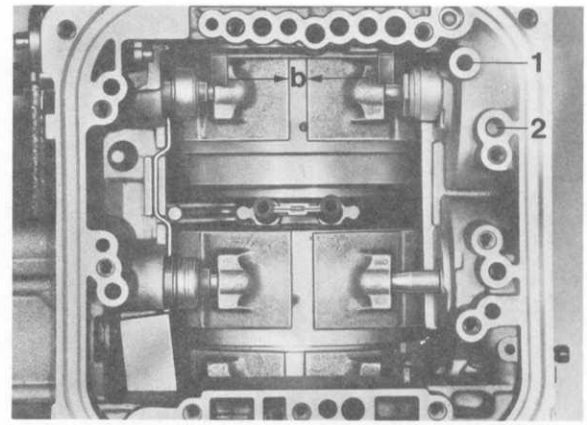
Apply a light coat of ATF on O-ring.

17. Install snap ring for cover.

18. Install piston and cover of brake band B 1 with Special Tool 9304.

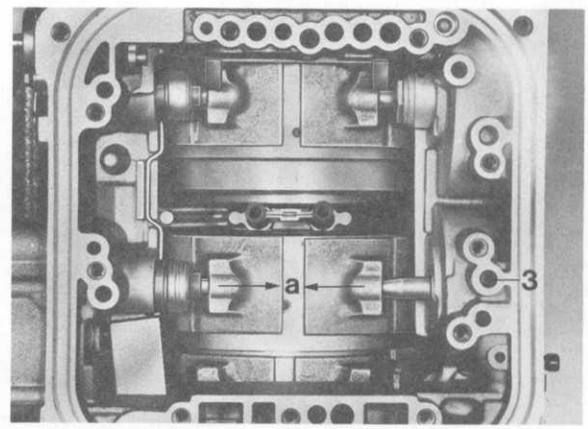


19. Measure distance of dead travel for pistons of brake bands B 1 and B 2. This is done by moving piston of brake band B 2 into lift position with air pressure supplied through lift pressure bore and checking distance "b". Then move the brake band piston into shift position with air pressure supplied through the shift pressure bore and recheck distance "b". The difference of both distances is dead travel "L".



1 - Lift pressure - bore B 2
2 - Shift pressure - bore B 2

Check distance "a" while springs hold the piston of brake band B 1 in lift position. Then move this piston to shift position with air pressure supplied through shift pressure bore B 1 and re-check distance "a". The difference will be dead travel "L".



3 - Shift pressure - bore B 1

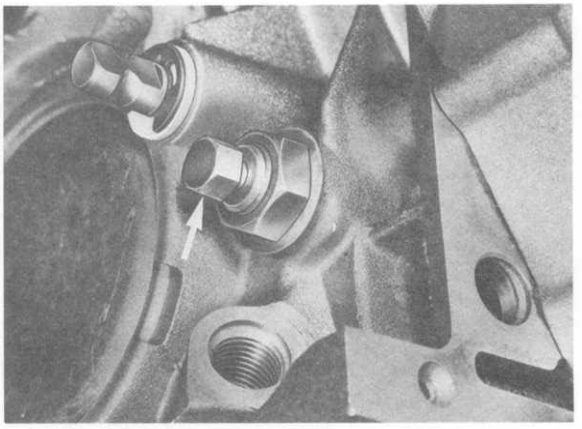
Dead travel "L" of pistons in brake bands B 1 and B 2 should be 3.0 to 4.0 mm.

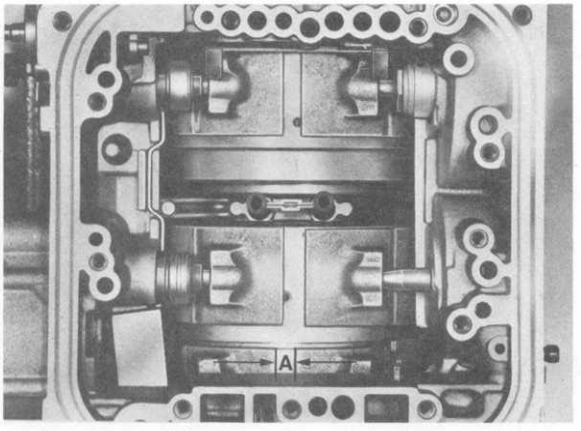
Note

Dead travel "L" excessive - use longer pressure pin.
Dead travel "L" insufficient - use shorter pressure pin.

20. Adjust brake band B 3.

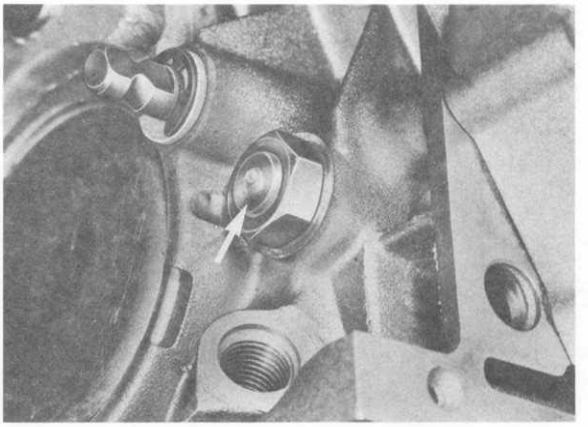
Screw in the adjusting screw after loosening the counternut and tighten to 5 Nm (0.5 kpm). Check gap "A" on brake band.

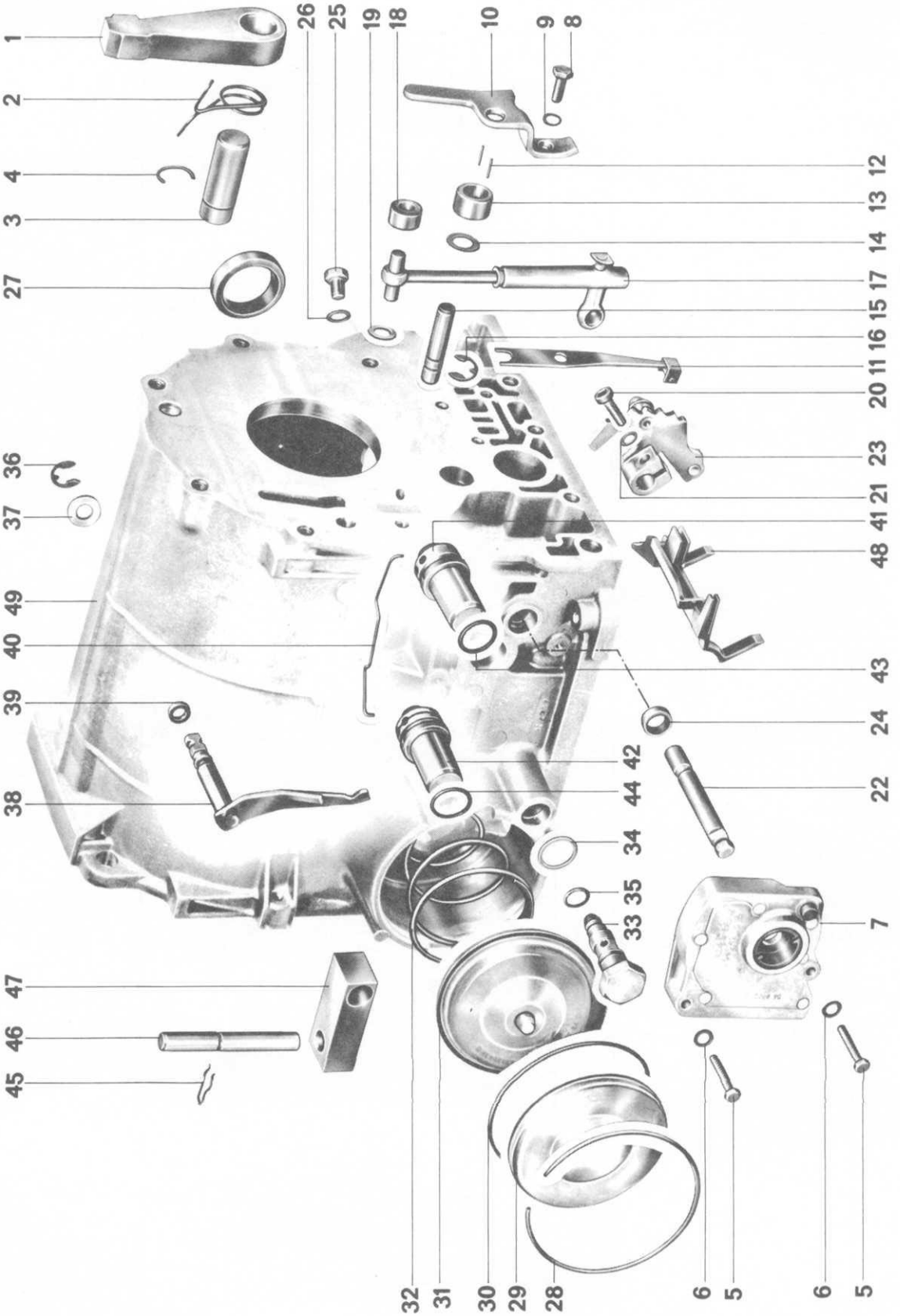




Unscrew adjusting screw by 1 3/4 turns and recheck gap "A". The difference between both distances is the dead travel, which should be at least 3 mm.

Hold the adjusting screw to prevent maladjustment. Tighten counternut and grind off head of adjusting screw.




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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Pawl	1			
2	Spring	1			
3	Pin	1			
4	Circlip	1			
5	Bolt	2		Tighten to specified torque	
6	Washer	2			
7	Anti-restart and backup light switch	1		Adjust	Page 37 - 15
8	Bolt	1		Tighten to specified torque	
9	Washer	1			
10	Holder	1	Remove together with leaf spring and roller running on needle bearing		
11	Leaf spring	1			
12	Needle	X			
13	Roller	1			
14	Washer	1			
15	Pin	1			
16	Lockwasher	1			
17	Linkage	1			
18	Roller	1			
19	Washer	1			

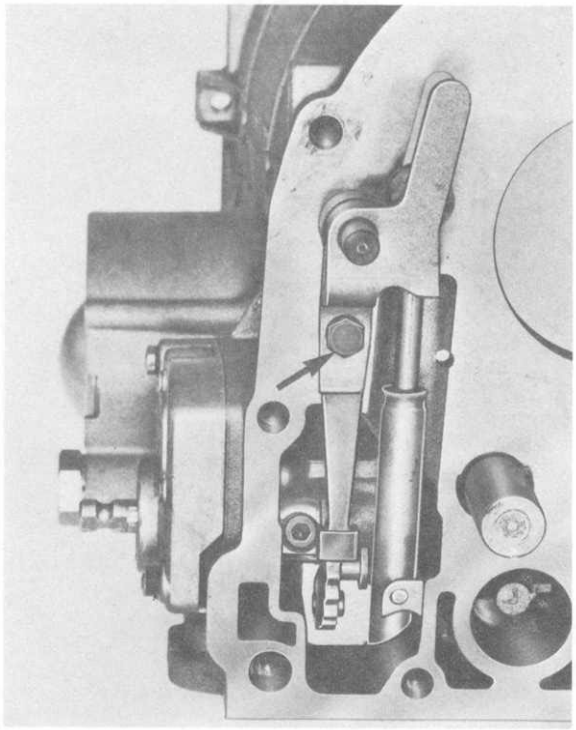
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
20	Screw	1		Tighten to specified torque	
21	Washer	1			
22	Shaft	1			
23	Catch plate	1			
24	Seal	1	Lever out with suitable screw-driver	Drive in with suitable tool	
25	Plug	1		Tighten to specified torque	
26	Seal	1		Replace	
27	Seal	1	Drive out with suitable screw-driver	Drive in to correct position with suitable tool; lip faces out	
28	Snap ring	1			
29	Cover	1			
30	Seal	1		Replace, coat with ATF	
31	Piston	1		Coat seal with ATF	
32	Spring	1			
33	Fast charging valve for reverse gear	1			
34	Seal	1		Replace	
35	Seal	1		Replace, coat with ATF	
36	Circlip	1			
37	Washer	1			
38	Lever	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
39	Seal	1		Replace, coat with ATF and position correctly	
40	Spring retainer	1			
41	Pressure unit B 2	1		Do not mix up with pressure unit B 1	
42	Pressure unit B 1 (identified by a groove all around)	1		Do not mix up with pressure unit B 2	
43	Seal	1		Replace, coat with ATF	
44	Seal	1		Replace, coat with ATF	
45	Spring	1			
46	Pin	1	Remove downward		
47	Lever	1			
48	Brake band guide	1			
49	Case	1			

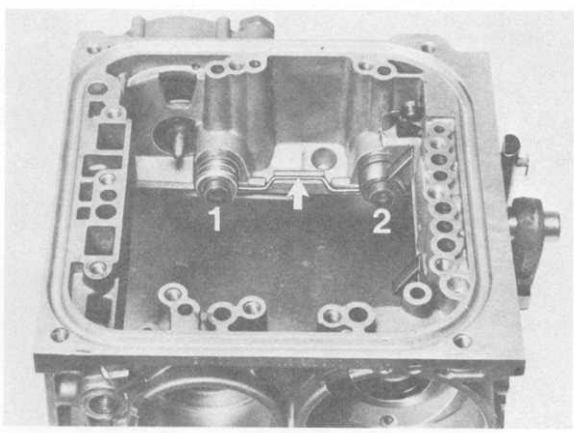
DISASSEMBLING AND ASSEMBLING TRANSMISSION CASE

Disassembling

1. Unscrew holder and remove with leaf spring and roller running on needles.

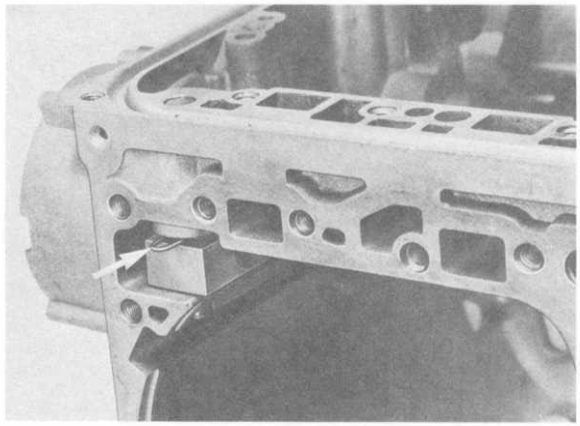


2. Remove lock for pressure units B 1 and B 2, and remove both pressure units.



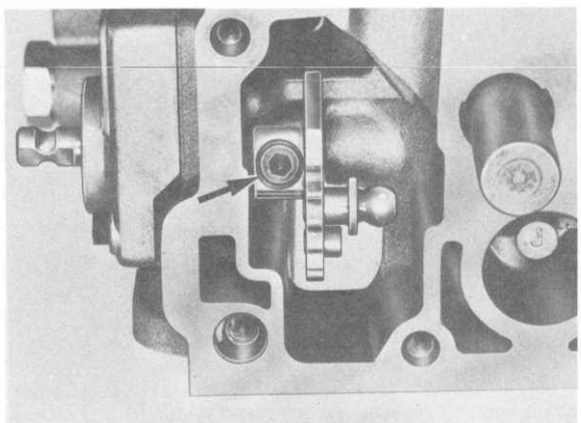
1 - Pressure unit B 1
2 - Pressure unit B 2

3. Pull out spring for bearing pin from lever of brake band B 3 and drive out pin downward.

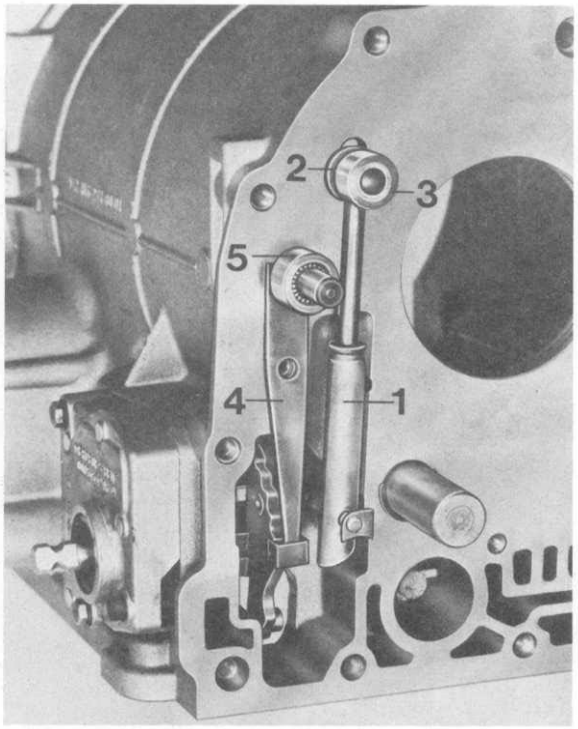


Assembling

1. Install catch plate in housing. Guide shaft into spline of catch plate and tighten holding screw to specified torque.



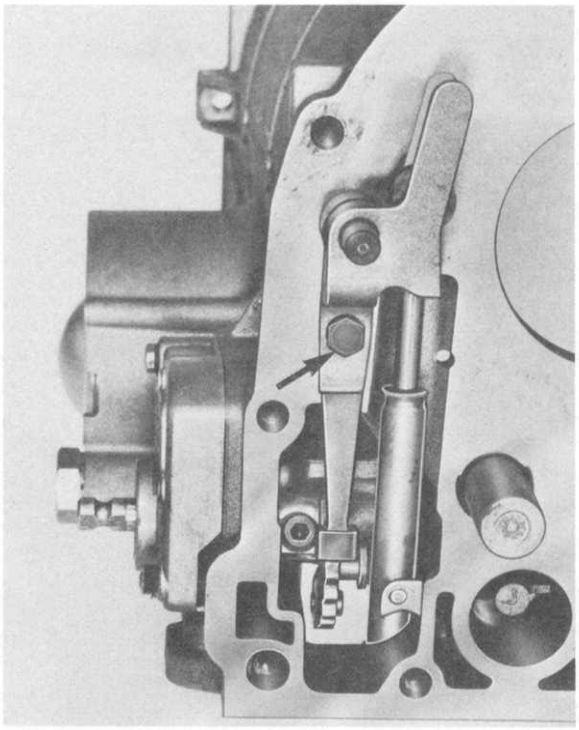
2. Install linkage with washer and roller.



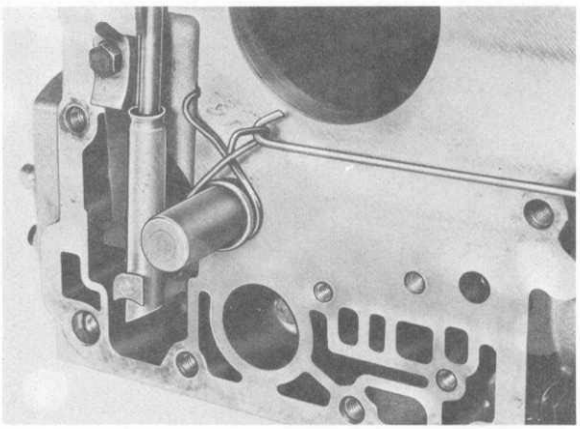
1 - Linkage
2 - Washer
3 - Roller
4 - Leaf spring
5 - Roller on needles

3. Install leaf spring and roller running on needles.

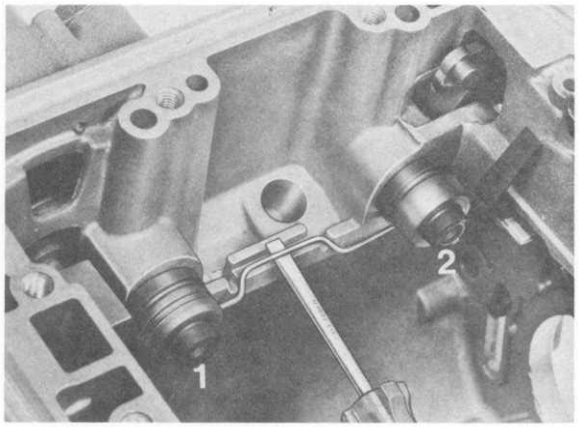
4. Install holder and tighten bolt to specified torque.



5. Push spring on to bearing pin and attach in transmission case. Tension spring with a scribe or suitable wire hook and slide on the parking lock pawl.



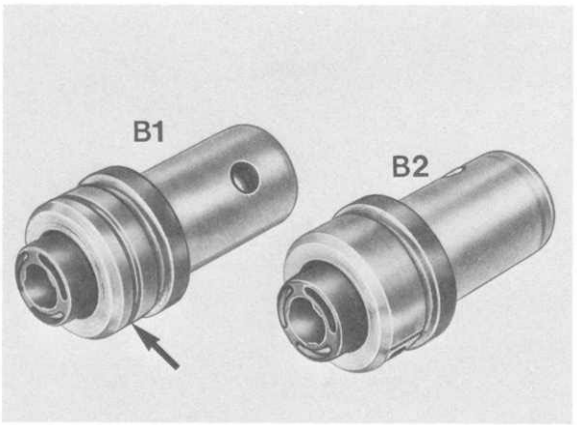
6. Install pressure units B 1 and B 2 in correct position and secure with lock.



1 - Pressure unit B 1
2 - Pressure unit B 2

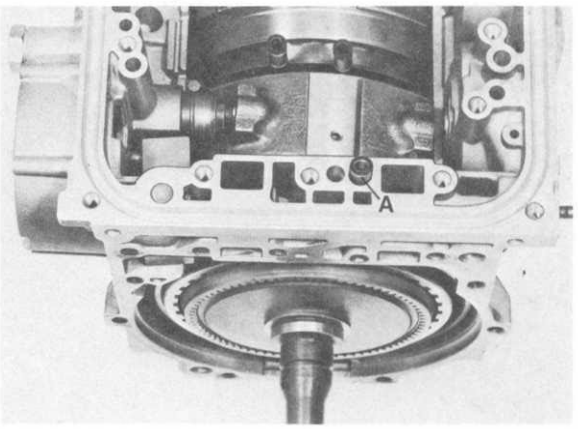
Note

Pressure units B 1 and B 2 have different designs and therefore must not be mixed up. For identification B 1 pressure unit has a groove running all around.



Note

A rubber insert is installed as from May 7, 1979 to eliminate hydraulic noise in the lubricating circuit. This rubber insert can be service installed in transmission without one.

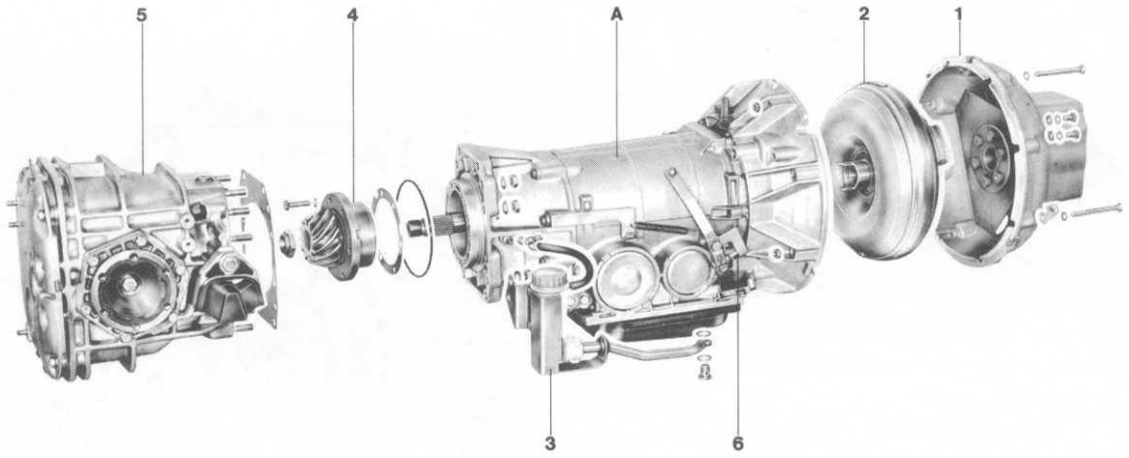


A - Rubber insert

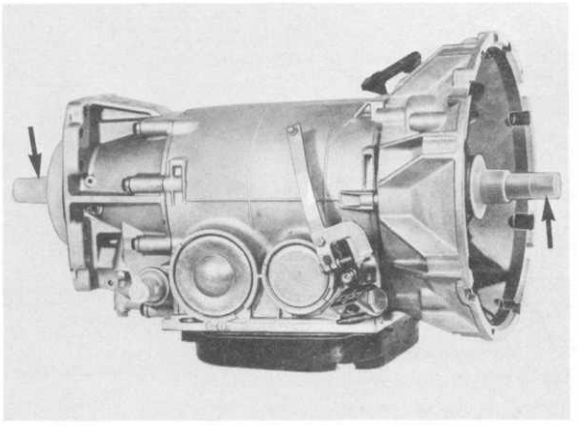
INSTALLING AUTOMATIC TRANSMISSION SECTION

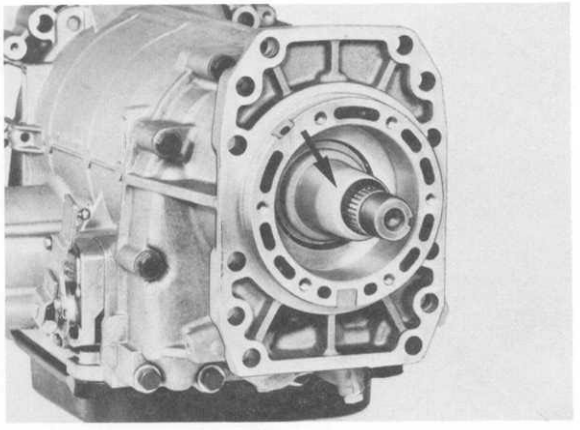
If transmission (A) section is installed, the following parts must be transferred from the defective transmission to the new transmission.

1 – Front converter housing with mounting parts
2 – Torque converter
3 – ATF tank
4 – Bearing assembly with drive pinion and mounting parts (replace O-ring)
5 – Final drive
6 – Adjusting nut



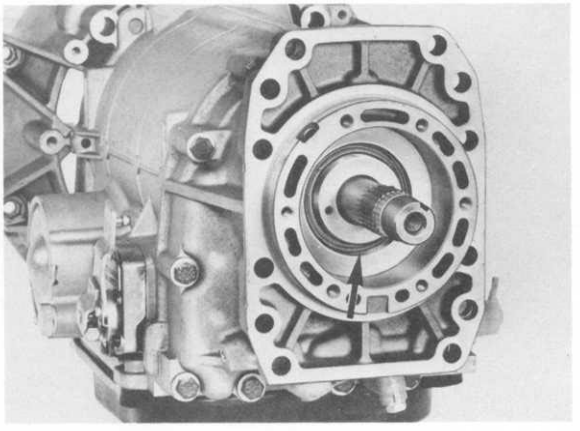
1. Take transmission section out of crate and remove protective caps.



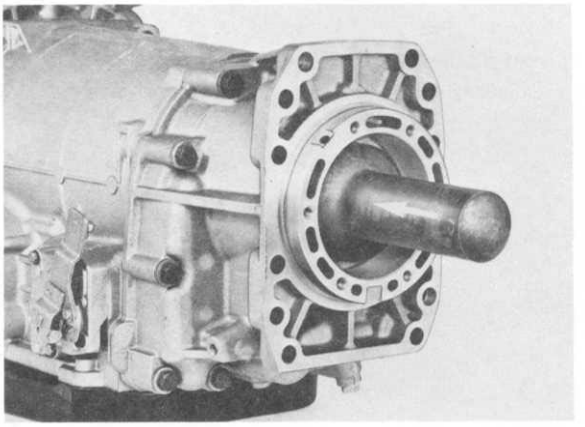


Note:

The outer seal between the transmission case and final drive is missing on transmission section for manufacturing reasons.

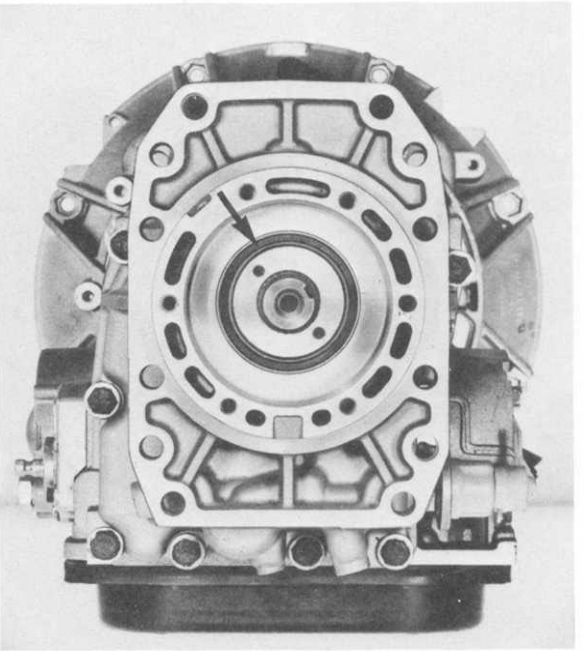


2. Drive in outer seal to correct position with Special Tool 9180 (also refer to page 37 - 34).



Note:

The outer seal must be installed so that its sealing lip and spring supporting the sealing lip face the final drive.

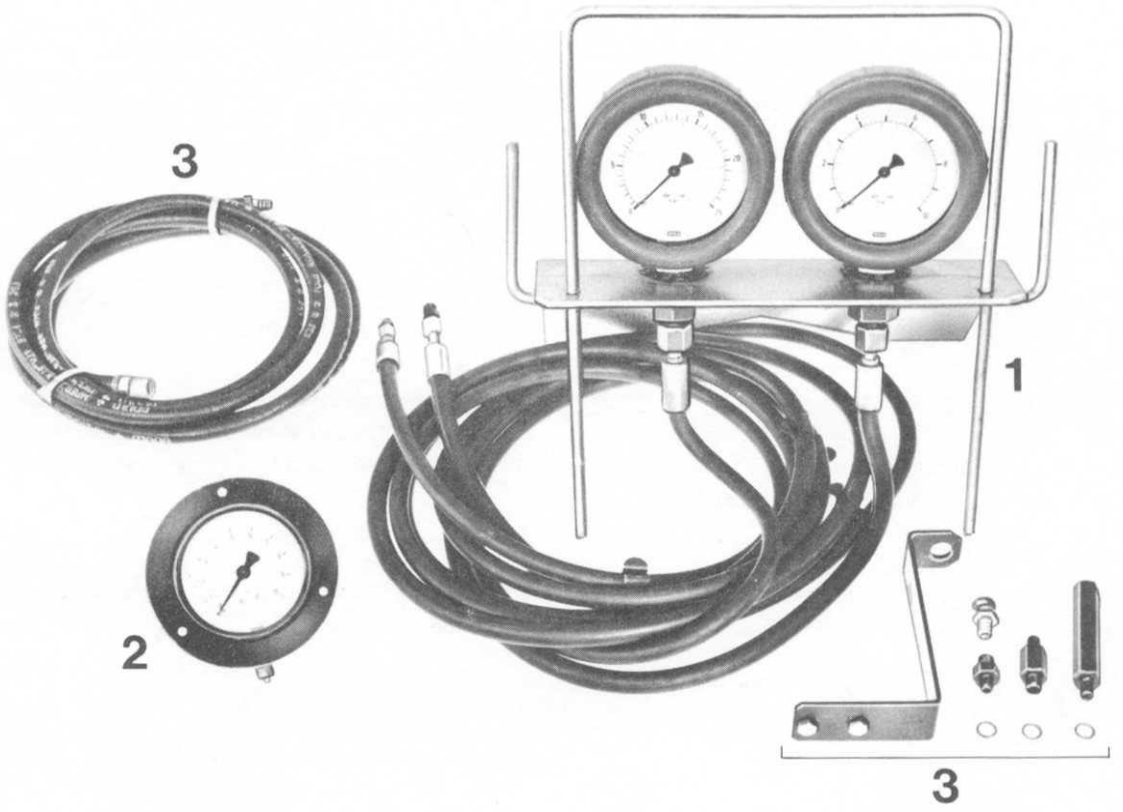


3. Install torque converter and front converter housing (see page 32 - 1).

4. Redetermine thickness of shims for bearing assembly and install bearing assembly (see pages 39 - 24 and 39 - 29).

5. Adjust drive pinion and ring gear (see page 39 - 31).

TOOLS



No.	Description	Special Tool	Remarks
1	Gauge set	US 1090	
2	Gauge and coupling	VW 1318	or P 378
3	Hose, adapters and bracket	US 8030	

CHECKING TRANSMISSION OPERATION

Prior to making repairs on an automatic transmission, troubleshoot transmission as instructed below and with help from the following tests.

A - General Checks

B - Transmission Fluid Level

C - Stall Test

D - Test Drive

E - Pressure Test

Important

All jobs, which require that engine runs, should only be carried out with selector lever in "N" or "P" and parking brake applied.

Exceptions: Tests, which require briefly a different selector lever position.

A - General Checks

Following jobs must be performed prior to any testing of transmission, and if defects are found, they must be eliminated before continuing with other work on transmission.

1. Check engine tuning (ignition timing, idle and transition).

2. Check for external damage, e.g. leaks on transmission (ATF) or final drive (hypoid oil) and missing or loose mounting bolts.

B - Transmission Fluid Level

The specified fluid level is extremely important for proper operation of automatic transmission, so that following test must be carried out with great care.

Checking ATF Level

Also check appearance and odor of ATF. Burnt friction linings cause a burnt odor. Contaminated oil could cause failure in valve body.

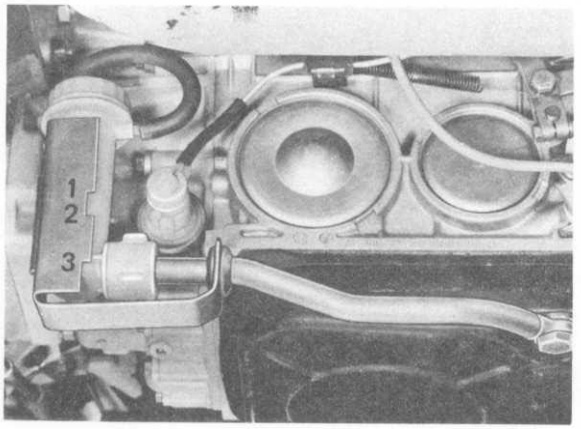
In this case transmission must be removed and repaired or replaced.

Test is carried out at engine idle speed, parking brake applied and selector lever at "N". Car must be on level surface.

Let engine run at idle speed 1 to 2 minutes before checking fluid level, so that torque converter will be full.

ATF level can be checked on a cold or warm transmission. However, the level will be more accurate on a cold transmission (20° - 30°C/ 68° - 86° F ATF temperature). An ATF temperature of 80° C/176° F can only be guesstimated.

ATF level in transmission will change with fluid temperature. Max. and min. marks on transparent tank are in reference to an ATF temperature of 80° C/176° F. When ATF temperature is 20 to 30° C/68 - 86° F, the ATF level will be 30 mm/ 1 3/16 in. below minimum mark (see figure). The amount of ATF between min. and max. marks is 0.2 liters/6.75 fluid ounces.



1 = max. at 80° C/176° F ATF temperature
2 = min. at 80° C/176° F ATF temperature
3 = max. at 20 to 30° C/68 - 86° F ATF-temperature

Add ATF to correct level. Cleanliness is essential!

If ATF level is too low, oil pump will draw in air, which can be heard. ATF will foam and cause incorrect readings when checking ATF level. Stop engine until ATF foam disappears (approx. 2 minutes). Add ATF and recheck ATF level.

Excessive ATF must be drained or drawn off, since otherwise transmission components would splash excessively and raise the temperature too much, until finally foamed oil is forced out through vent. This condition could damage transmission on a longterm basis.

After correcting ATF level to specifications, operate brake pedal, leave selector lever in each position (R - N - D - N - R) several seconds and then return it to "N", so that working pistons of power parts are filled with ATF. Recheck and, if necessary, correct ATF level.

C - Stall Speed

This check provides information on operation of engine, converter and transmission. It is applied, when top speed cannot be reached or acceleration is insufficient.

Note

During this check all the engine power is converted into heat in the converter, which is why this check must not last longer than 5 seconds.

Rear wheels must not be permitted to turn for this check.

Also engine must be at operating temperature and develop its full power.

Extra equipment, e.g. compressor for air conditioning, must be turned off.

Check must not be made with car's tachometer.

1. Connect tachometer that it can be read from driver's seat.
2. Run engine at about 2000 rpm approx. 2 minutes prior to testing.
3. Apply parking brake all the way and depress brake pedal with left foot.

4. Position selector lever at "D", floor accelerator pedal with right foot and check whether specified stall speed is reached.

Stall speed must be 2400 $\pm$ 200 rpm.

Note

If stall speed drops by approx. 400 to 700 rpm below specified value, one-way clutch in torque converter is slipping.

If stall speed is faster than specified value by about 300 rpm, slip is in transmission.

If stall speed is correct and top speed is still not reached, one-way clutch is locking in both directions or has seized. This will usually be noticed during fast highway driving by ATF leaking through the vent.

The stall speed will drop by approx. 125 rpm for each 1000 meters/3900 feet altitude above sea level because of a drop in engine power.

Even excessively high outside temperatures could cause stall speed to drop slightly below the minimum value.

D - Test Drive

Vehicle should be driven in all gear ranges and under all possible road conditions. Do not test drive if there is obvious mechanical damage.

Shift points in km/h (mph)

Selector lever position "D"		Upshift	Downshift
Accelerator pedal position		km/h (mph)	km/h (mph)
Part throttle	1-2-1	26 - 33 (16 - 21)	16 - 23 (10 - 14)
	2-3-2	42 - 48 (26 - 30)	32 - 37 (20 - 23)
Full throttle	1-2-1	97 - 105 (60 - 65)	45 - 52 (28 - 32)
	2-3-2	150 - 158 (93 - 98)	57 - 85 (35 - 53)
Kickdown	1-2-1		57 - 78 (36 - 48)
	2-3-2		122 - 133 (76 - 83)

1. Note shift points and compare to chart above. Shifts should be smooth. Shifts should take place quickly and without lag in power transmission.

2. Listen for any sign of engine speedup between shifts. Speedup between shifts indicates slipping brake bands or clutches.

3. After road test check transmission for fluid leaks.

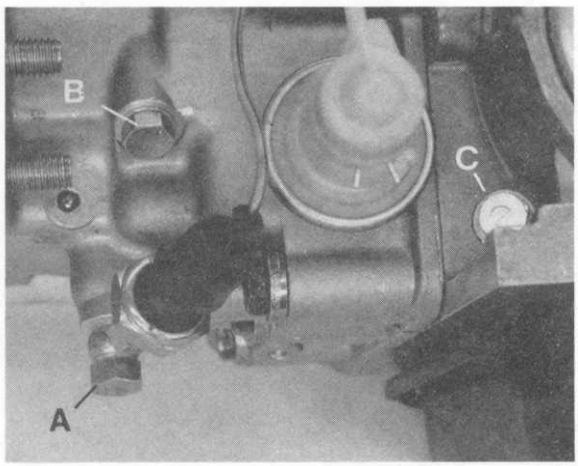
Note

All specified speeds are approximate.

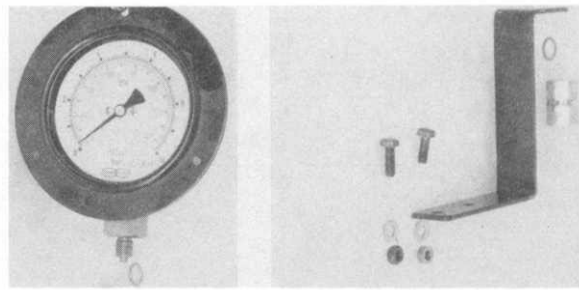
E - Pressure Test

Note

This test will locate defects in ATF circuit (internal leakage, wear, sticking control valves, dirt in ATF system).



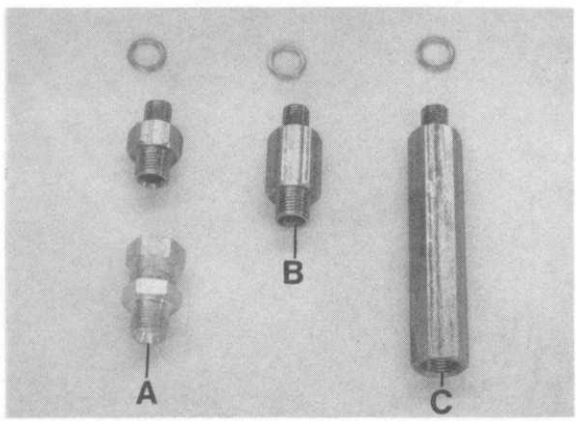
a = main pressure
b = governor pressure
c = modulator pressure



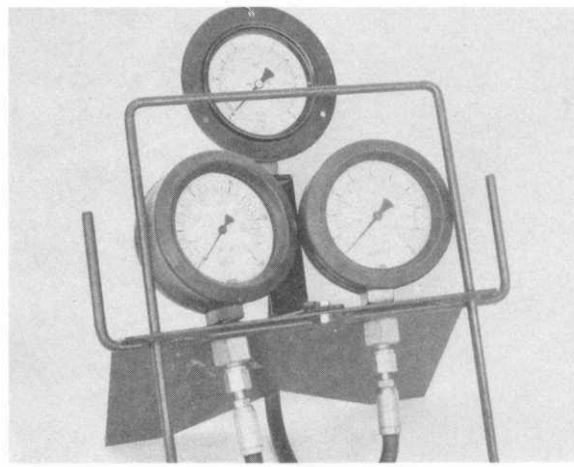
Gauge and coupling from VW 1318 plus bracket and parts from US 8030.

Note

After removing gauges, install plugs with new seals.



Hose adapters for pressure gauges (from US 8030)



Third gauge setup with US 1090

Work sequence

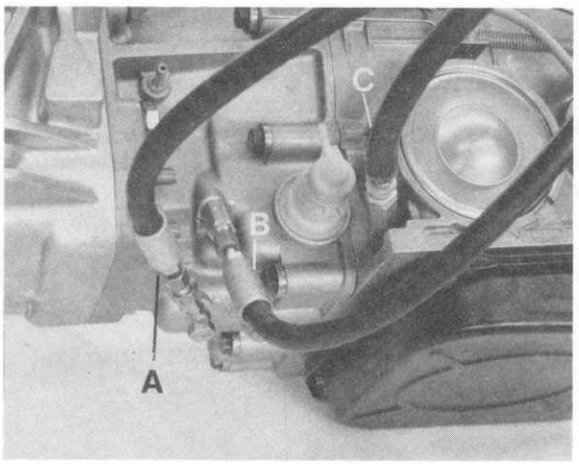
1. Connect gauge with 0 - 25 bar (0 - 350 psi) range to main pressure gauge connection a.

2. Connect gauge with 0 - 10 bar (0 - 140 psi) range to governor pressure gauge connection b.

3. Connect gauge with 0 - 10 bar (0 - 140 psi) range to modulator pressure gauge connection c.

Note

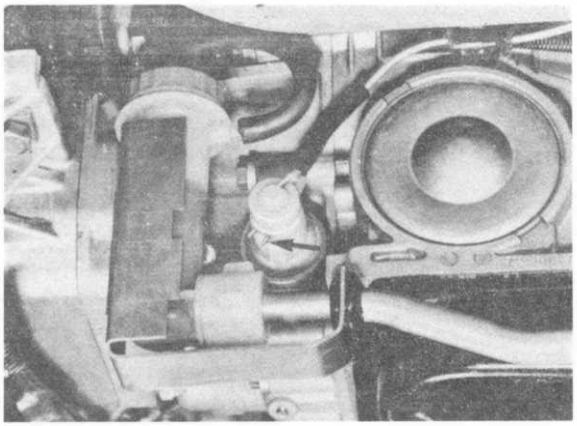
Pressure gauge set is set up in footwell of front passenger seat. Hoses are routed through window of right door.

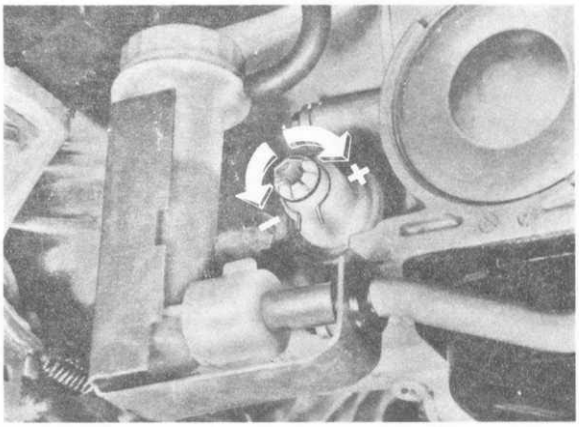


Hose adapters installed

Note

Before any other pressures are checked, modulator pressure must be measured at full throttle in "D" range at 88 km/h (55 mph) with vacuum line connected (see page 38 - 9). Adjust if necessary. Correct modulator pressure automatically affects main pressure.





Checking Modulator Pressure

1. Compress circlip (arrow) and remove cover.
2. If inside of cover is wet with ATF, replace modulator.
3. Adjust if necessary.

Checking Main Pressure

Not adjustable, modulator pressure automatically affects main pressure.

Checking Governor Pressure

Not adjustable.

Adjusting Modulator Pressure

1. Compress circlip and remove vacuum modulator cover.
2. Slightly pull adjusting key out and turn screw.
3. After adjusting, push key into nearest slot. One turn of setting screw results in 0.2 bar (2.8 psi) pressure change.

Note

Changing modulator pressure also changes shift points.

Replacing Vacuum Modulator

1. Pull off vacuum hose.
2. Compress circlip and remove cover.
3. Remove modulator using 22 mm open end wrench.
4. When installing, apply non-hardening sealing compound to threads.

Nominal Pressures in Bar (PSI)

Test for	Transm. Type A 22.01 (1980)	Transm. Type A 22.02 (1978, 1979)	Testing Conditions
Modulator pressure	3.1 - 3.15 (44 - 45)	3.1 - 3.15 (44 - 45)	Full throttle in range "D" (3rd gear) with connected vacuum line. Transmission temperature below 90° C/194° F.
	4.6 - 4.9 (65 - 70)	4.6 - 4.9 (65 - 70)	Measured on stationary car at stall speed in range "D", vacuum line disconnected.
Main pressure	10.0 - 11.6 (145-168)	10.5 - 11.2 (149 - 159)	Measured on stationary car at stall speed in range "D", vacuum line disconnected.
	19.2 - 20.3 (278 - 294)	18.5 - 19.6 (263 - 279)	Measured on stationary car at stall speed in range "R", vacuum line disconnected.
	5.5 - 5.9 (80 - 86)	5.2 - 5.6 (74 - 80)	Full throttle in range "D" (3rd gear) at approx. 100 km/h, vacuum line connected.
Governor pressure	0.5-0.6 (7-9) 1.5-1.7 (21-24) 2.1-2.2 (30-31) 2.5-2.6 (36-37) 3.1-3.3 (44-47) 3.9-4.1 (55-58)	0.5-0.6 (7-9) 1.5-1.7 (21-24) 2.1-2.2 (30-31) 2.5-2.6 (36-37) 3.1-3.3 (44-47) 3.9-4.1 (55-58)	20 km/h (12 mph) 50 km/h (31 mph) 75 km/h (47 mph) 100 km/h (62 mph) 130 km/h (81 mph) 160 km/h (99 mph) } Vacuum line

TROUBLESHOOTING AUTOMATIC TRANSMISSION

Note: If transmission oil is black and smells burnt or there is an unusual large amount of metal burrs in oil pan, either repair or replace transmission.

Conditions and Correction

Condition: Transmission slips in all selector lever positions

Correction:

1. Check modulating pressure, adjusting if necessary. If not adjustable, check movement of modulating pressure control valve. Clean modulating pressure safety valve in shift valve housing upper section.
2. Check whether vacuum line from intake branch to vacuum box is plugged. If yes, replace.
3. Check operating pressure. If too low or not available:
   a) Disassemble and clean shift valve housing, and service operating pressure control valve.
   b) Remove and inspect primary pump, replacing if necessary.

Condition: Transmission grabs or car vibrates when moving off

Correction:

1. Check modulating pressure, adjusting if necessary.
2. Pull off vacuum line from vacuum box, checking whether ATF or fuel escapes.
   a) If ATF, replace vacuum box.
   b) If fuel, check fuel injection system and repair.

Condition: 1st gear slips

Correction:

1. Check easy movement of control valve B 1, replacing shift valve housing if necessary.
2. Remove and install brake band piston B 1, check seal and replace if necessary.
3. Replace brake band B 1 and pressure part for B 1. Check easy movement of vent valves in support flange K 1, replacing support flange if necessary.

Condition: Transmission slips during 1st/2nd shift or in 2nd and 3rd gear

Correction:

1. Check modulating and operating pressures, adjusting if necessary.
2. Replace shift valve housing, also replacing sealing bushings on plug tubes.
3. Repair clutches K 1 and K 2 depending on findings. Visually inspect oil distribution sleeve, replacing if necessary.

Condition: Transmission slips in 3rd gear

Correction:

1. Remove shift valve housing, check sealing bushings on plug tubes and replace same if necessary.
2. Repair clutch K 2 depending on findings. Visually inspect oil distribution sleeve, replacing if necessary.

Condition:	Transmission slips when moving off in 1st and 2nd gear, or moving off not possible in forward gear. Reverse gear is still good
	Brake band B 2 seriously worn or broken
Correction:	Adjust brake band B 2 by installing a longer pressure pin. Replace brake band, if seriously worn or broken.

Condition:	Transmission slips in all gears
	No or insufficient modulating pressure
Correction:	1. Check modulating pressure, adjusting if possible. 2. Remove and service modulating pressure control valve. 3. Check and clean modulating pressure safety valve in shift valve housing upper section.

Condition:	After installation, transmission has no power flow or fails after a brief time of operation
	Torque converter not installed according to instructions. Drive dogs do not engage accurately in drive gear of primary pump. Follow-up damage: Drive dogs of torque converter and primary pumps will be destroyed.
Correction:	Install torque converter according to instructions.

Condition:	No power flow in all selector lever positions for a brief period immediately after starting engine (especially when car had not been used for a while)
	Torque converter drains partially via leaky or defective lubricating ring or valve in input shaft.
Correction:	1. Check lubricating ring on input shaft, replacing if necessary.
	2. Checking ball valve in input shaft, replacing input shaft if necessary.
	3. Check and clean lubricating pressure valve in shift valve housing.

Condition:	No power flow in reverse gear
Correction:	1. Remove shift valve housing, check brake band B 3 and adjustment.
	2. Remove brake band piston B 3 and check seal.
	3. Replace one-way clutch in gear set.

Condition:	Strong jolt when engaging selector lever in "D"
Correction:	1. Adjust idle speed and CO level to specifications.
	2. Check modulating and operating pressures, correcting modulating pressure if necessary.
	3. Check vacuum line and connections for leaks.
	4. Check whether pressure acceptance piston in rear transmission case moves easily and is installed correctly.
	5. Check whether feed bore for pressure acceptance piston in rear transmission case is plugged.
Note:	If there is a hard engagement jolt when quickly shifting back and forth between "N" and "D" several times, there is no fault. The pressure pick-up requires a running time of approx. 2 seconds. If this time is given, the engagement jolt will also be correct.

Condition:	Strong jolts when changing gears
Correction:	1. Check modulating and operating pressures, adjusting modulating pressure if necessary. If operating pressure is too high, replace shift valve housing. 2. Check vacuum line and connections for leaks. 3. Service control valve for converter adaptation.

Condition:	Strong jolt in downshift from 3rd to 2nd gear
Correction:	1. Replace seal on release end of B 2. 2. Replace brake band piston B 2.

Condition:	No upshifts
Correction:	1. Check governor pressure. If there is no governor pressure reading, continue with point 1. If governor pressure is correct, continue with point 2. 2. Disassemble, clean and service centrifugal governor. 3. Disassemble and clean shift valve housing, replacing if necessary (use new sealing bushings on plug tubes).

Condition:	No upshift on cold transmission, upshifts okay after short distance
Correction:	1. Replace shift valve housing (use new sealing bushings on plug tubes).

Condition: Upshifts only in upper speed range of gears

Correction:

1. Check and adjust control pressure cable.
2. Check governor pressure and replace centrifugal governor, if governor pressure is too low.
3. Service control pressure valve.

Condition: Upshifts only in lower speed range of gears

Correction:

1. Tighten bolt for control pressure lever on transmission. Then check control pressure cable, adjusting if necessary.
2. Check full throttle stop. Move accelerator pedal to kickdown and check whether throttle is against full throttle stop, adjusting if necessary.
3. Check governor pressure and replace centrifugal governor, if governor pressure is too high.

Condition: No kickdown downshifts

Correction:

1. Check voltage at solenoid valve. If necessary, check wire connections against current flow diagram.
2. Remove solenoid valve. Connect removed valve to power supply and check function, replacing if necessary.
3. Tighten control pressure lever bolt on transmission. Then check control pressure, adjusting if necessary.
4. Check movement of kickdown control valve in shift valve housing upper section, replacing shift valve housing if necessary.

Condition: No brake shifts from 3rd to 2nd and 2nd to 1st

Correction:
1. Adjust control pressure cable.
2. Service brake shift piston, replacing shift valve housing if necessary.

Condition: Automatic, unwanted downshifts outside of partial throttle downshift range, without operation of kickdown switch

Correction:
1. Remove kickdown solenoid valve. Check O-ring on solenoid valve for damage.
2. Check whether kickdown switch sticks in pressed position, replacing if necessary.
3. Check whether solenoid valve sticks in open position, replacing solenoid valve if necessary.
4. Check movement of control pressure valve, cleaning shift valve housing and servicing valve if necessary, or replacing shift valve housing.

Condition: Poor acceleration when moving off

Correction:
1. Check stall speed.
2. If stall speed drops below specified value by approx. 400 to 700 rpm, one-way clutch in converter is slipping. Replace torque converter.

Condition: Transmission does not make upshifts

Correction:
1. Check governor pressure and when not correct, clean and service centrifugal governor. If correct, continue with point 2.
2. Service master valve in shift valve housing, replacing shift valve housing if necessary.

Condition:	Parking lock does not engage
Correction:	Check adjustment of selector lever cable, correcting if necessary.

Condition:	Selector lever cannot be engaged in "R" and "P" a) With engine running b) With engine stopped
Correction:	1. a) Disassemble, clean and service centrifugal governor. 2. b) Service blocking piston in rear transmission case.

Condition:	Engine cannot be started with selector lever in "P" or "N"
Correction:	1. Adjust selector lever cable and starter interlock switch. 2. Replace starter interlock and backup light switch.

Condition:	Invisible oil loss (leak cannot be seen on outside) Diaphragm in vacuum box defective. ATF drawn in by engine via vacuum line.
Correction:	Replace vacuum box.

Condition:	Sudden thick smoke caused by defective vacuum box
Correction:	Replace vacuum box.

Condition:	ATF lost between torque converter and primary pump
Correction:	1. Install and tighten drain plug for torque converter, using a new seal. Coat threads with Hyloma. If still leaking ATF, continue with points 2 and 3. 2. Replace radial seal and O-ring of primary pump, checking O-ring groove in primary pump for porous spots. Replace primary pump, if necessary. 3. Apply a good coat of Hyloma to threads of bottom mounting bolts.

Condition:	Oil leak behind starter interlock and backup light switch
Correction:	Replace O-ring on pressure part B 2.

Condition:	2nd gear loud
Correction:	Replace rear planet gear set.

Condition:	Whining noise only when changing gears with full load
Correction:	Replace oil filter.

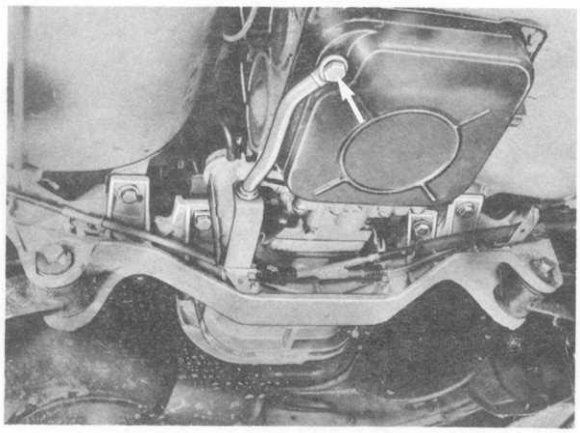
Condition:	Whining noise, which increases in loudness as engine speed rises
Correction:	Check primary pump, replacing if necessary.

REMOVING AND INSTALLING SHIFT VALVE HOUSING

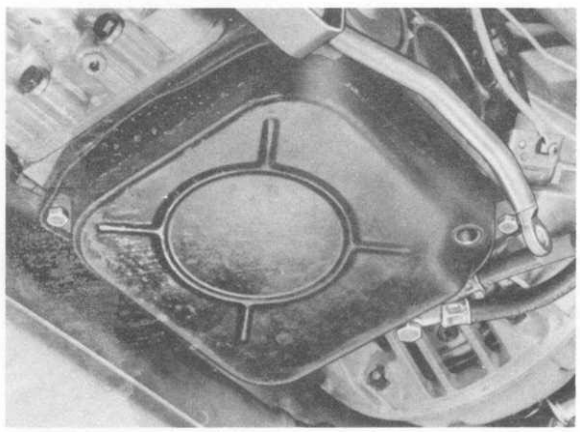
Removing

1. Move selector lever to "P".

2. Unscrew oil filler tube from oil pan and let ATF drain.



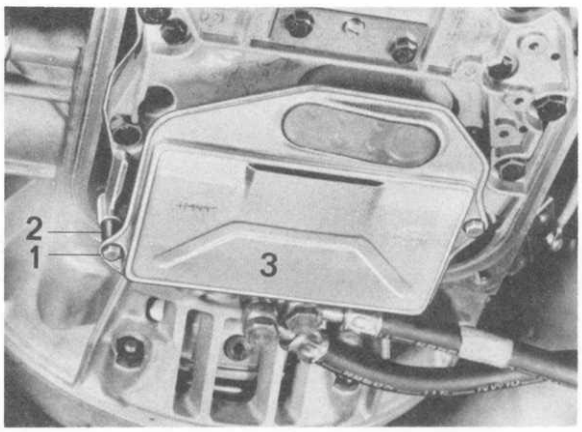
3. Unscrew oil filler tube coupling and turn out filler tube.



4. Unscrew oil pan mounting bolts and remove oil pan with gasket.

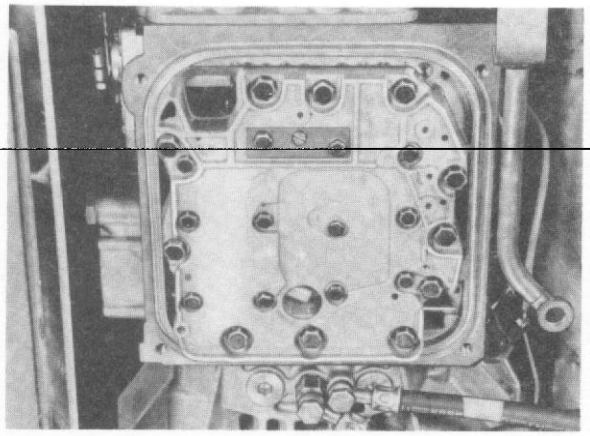
Note:
If ATF smells burnt and there is metal abrasion in oil pan, sludge or an unusual large amount of burrs, it is not sufficient to only replace shift valve housing. The entire transmission and torque converter will have to be replaced. Further oil lines and oil cooler will have to be flushed clean thoroughly.

5. Remove oil filter.



1 - Mounting bolts
2 - Spacer
3 - Oil filter

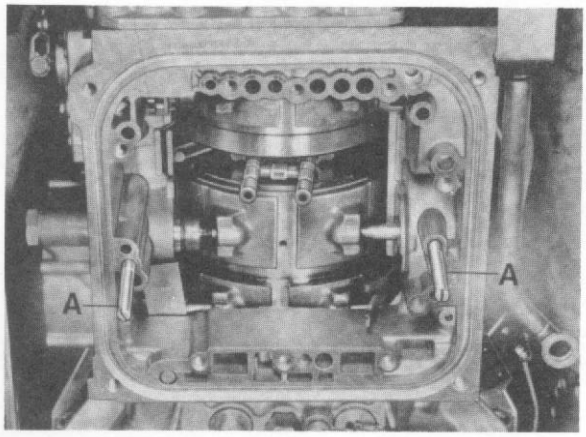
6. Unscrew mounting bolts of shift valve housing and remove shift valve housing.



7. Remove plug tubes with sealing bushings and pull off sealing bushings from plug tubes.

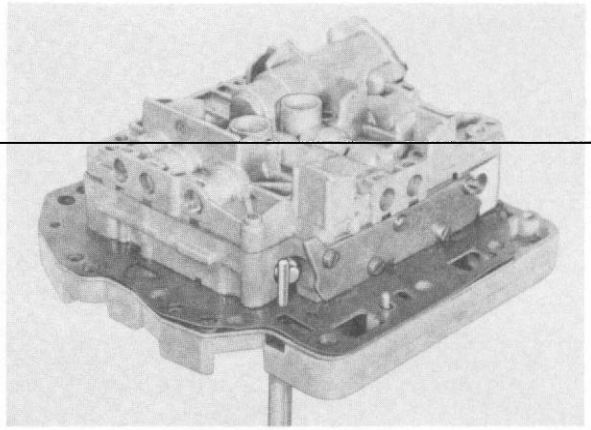
Installing

1. Fit new sealing bushings on both ends of plug tubes and install tubes in transmission. Screw two locally made centering pins in transmission case.

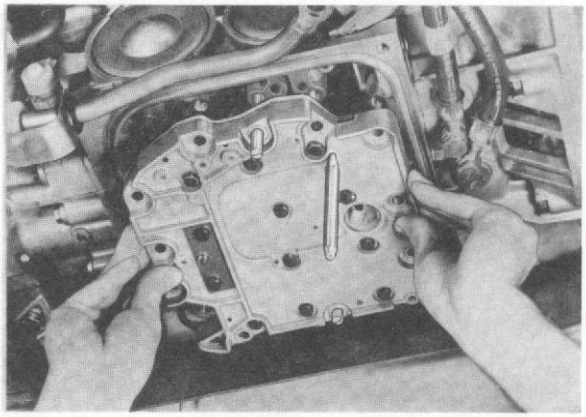


A - Centering pins

2. Install locating pin (suitable punch) for control pressure valve in shift valve housing.



3. Guide in shift valve housing carefully. Make sure in particular that range valve engages correctly in catch plate.



4. Install mounting bolts with spring washers and tighten to specified torque.

5. Remove locating pin for control pressure valve.

6. Install oil filter.

7. Install oil pan with gasket and tighten mounting bolts to specified torque.

8. Screw oil filler tube on oil pan and tighten coupling nut.

9. Add ATF as specified.

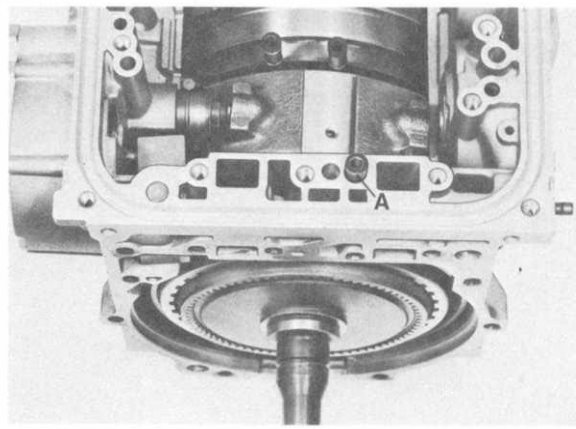
10. Check shifts during test drive.

11. Check ATF level while warm.

12. Tighten bolts on oil pan to specified torque.

Note

As from May 7, 1979 a rubber insert is installed to eliminate hydraulic noise in the lubricating circuit.
Rubber inserts can be service installed in a transmission without one.



A - Rubber insert

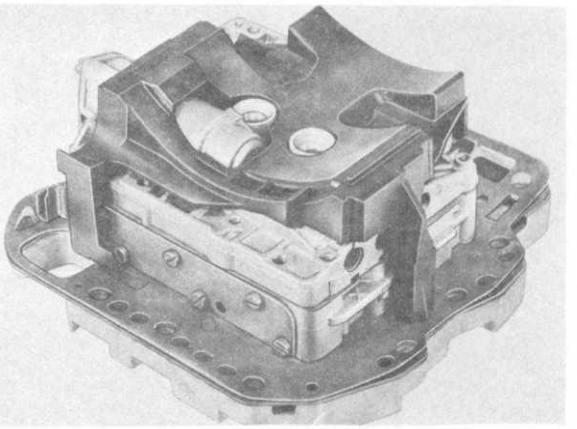
MODIFICATIONS ON SHIFT VALVE HOUSING

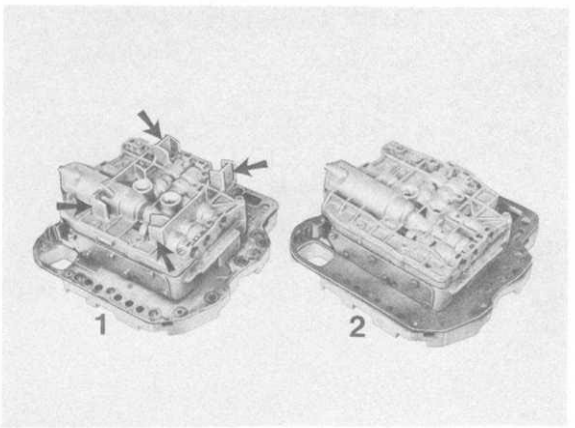
Note

The shift valve housing has an additional plastic brake band holder from transmission numbers

169 0626 A 22.01 Europe, Rest of World
and 169 3254 A 22.02 USA, Japan.

The cast brake band holders have been omitted on these housings.





1 - Old version with cast brake band holders (arrow)
2 - New version (install only with plastic brake band holder)

Only the new version will be available after depletion of old version shift valve housing stocks. Old and new version shift valve housings are interchangeable, however the new version (without cast brake band holders) will always require installation of the plastic brake band holders.

TOOLS



No.	Description	Special Tool	Remarks
	Filler		Standard, e.g. Dresser-Wayne Model 3009

REPLACING ATF AND FILTER

ATF Capacity:

Initial filling: approx. 6.0 liters/6.3 US.qt
ATF change: approx. 5.5 liters/5.7 US.qt

Type of ATF:

ATF Dexron ® or Dexron II ®

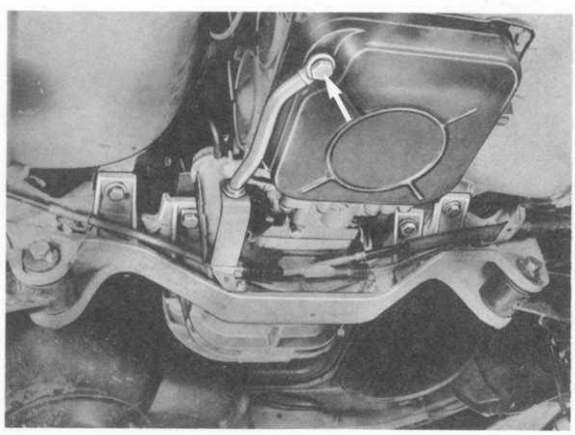
ATF and filter must be replaced every 48,000 km/30,000 miles.

Note:

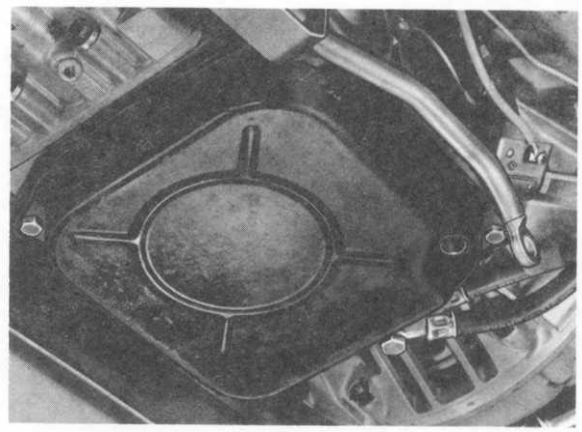
ATF (not filter) should be replaced more often, if car is subjected to severe operating conditions (trailer hauling etc.).

Car must be on level surface when replacing ATF. Also have transmission at operating temperature and engine stopped.

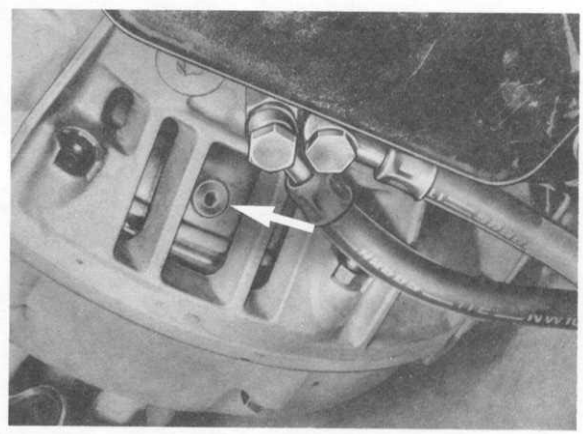
Unscrew oil filler tube from oil pan and let ATF drain.



Unscrew filler tube coupling nut and turn out filler tube.



Turn crankshaft until converter drain plug can be seen and removed.



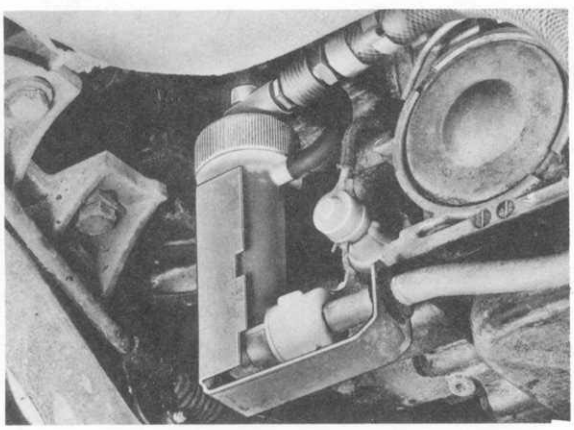
Remove transmission oil pan and replace oil filter when ATF stops draining from transmission and torque converter.

Install oil pan with gasket and tighten mounting bolts to 7.0 Nm/5 ftlb torque.

Install converter drain plug with a new seal.

Adding ATF

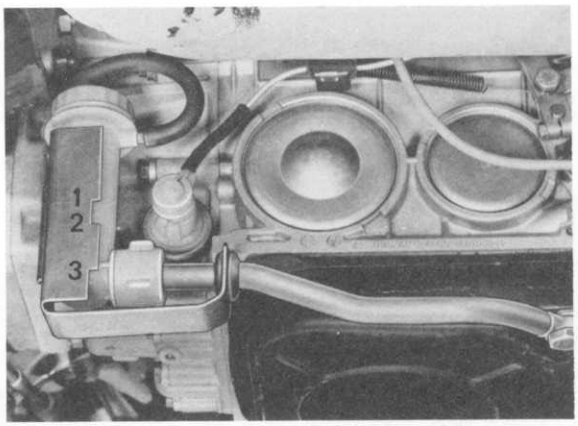
First add a large amount (approx. 4 liters/4 US.qt) of ATF with the engine stopped. Start engine with selector lever in "P" and let engine run at idle speed. Observe ATF level in tank and add remaining ATF immediately.



Operate brake pedal and leave selector lever in each position several seconds. Then recheck ATF level.

Note:

ATF level in transmission will change with any change in ATF temperature. Max. and min. marks on tank are in reference to an ATF temperature of 80 °C/176 °F. At a temperature of 20 to 30 °C/ 68 to 86 °F, on the other hand, the maximum ATF level will be approx. 30 mm below the min. mark (see figure). This information is important for replacing ATF, which normally takes place at this temperature.



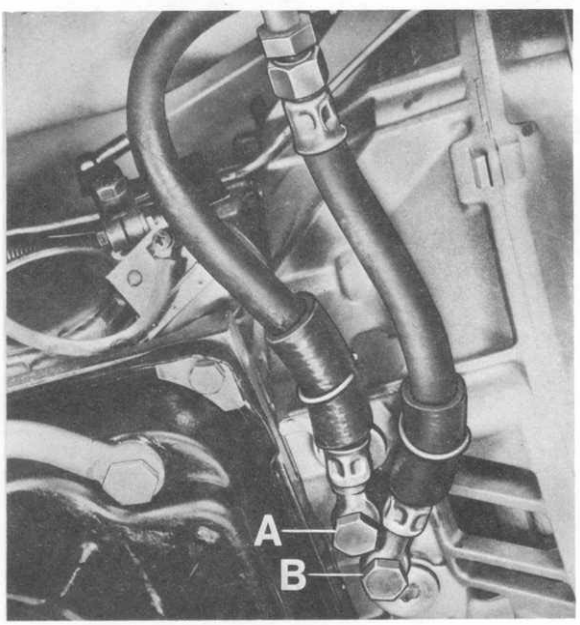
1 = Max. at 80 °C/176 °F ATF temperature
2 = Max. at 80 °C/176 °F ATF temperature
3 = Max. at 20 to 30 °C/68 to 86 °F ATF temperature

FLUSHING ATF COOLER AND LINES

Note

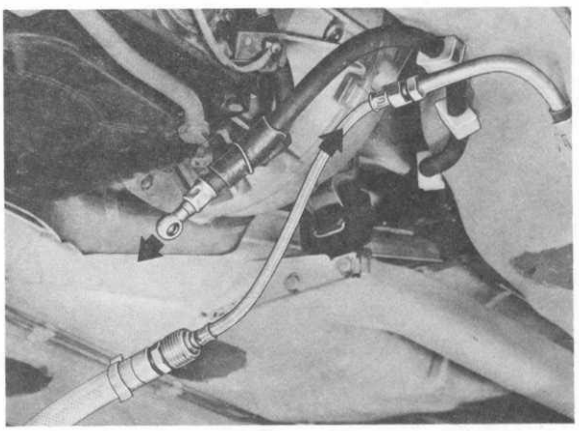
If ATF smells burnt and there are metal particles or sludge in oil pan, it is not sufficient to only replace the valve body or transmission. The ATF cooler and lines will also have to be flushed with ATF.

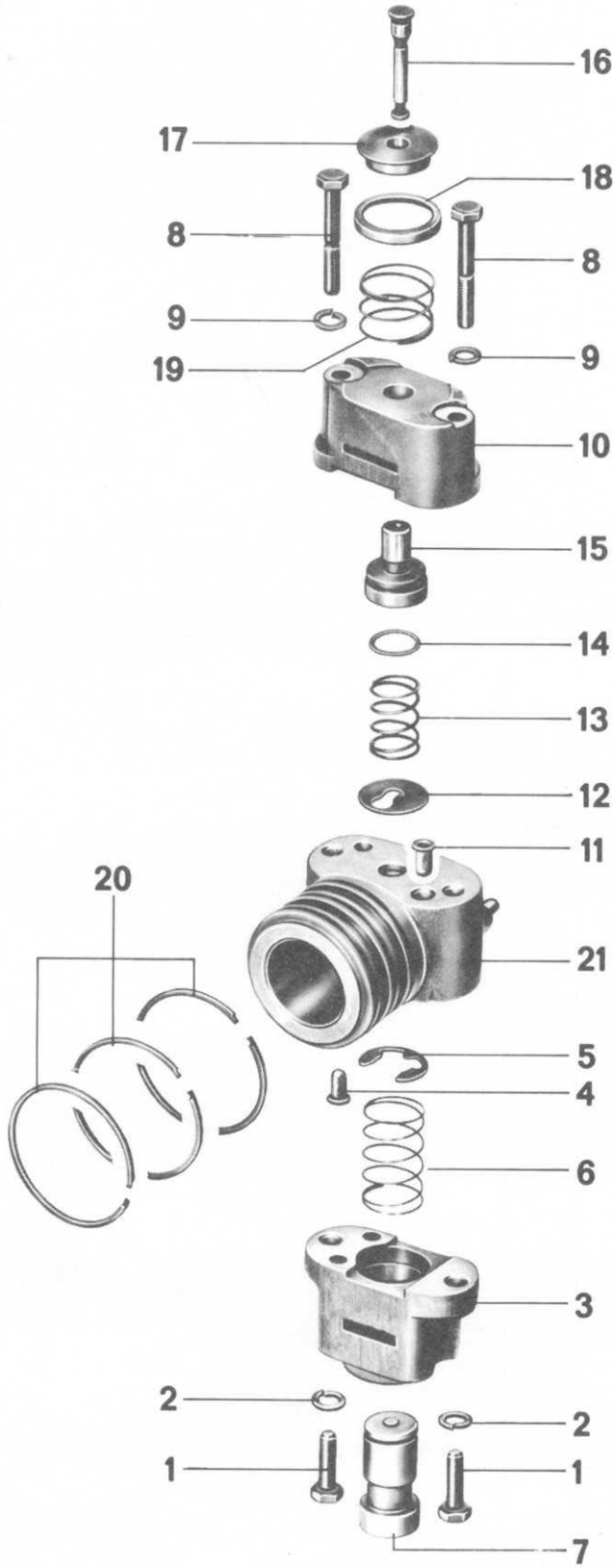
1. Detach feed and return lines at converter housing and take off short hose from return line.



A – To cooler inlet (bottom connection)
B – From cooler outlet (top connection)

2. Attach extra hose from ATF charger (see Workshop Equipment Group of Special Tool Catalog) on return line and flush cooler as well as lines with the charger.




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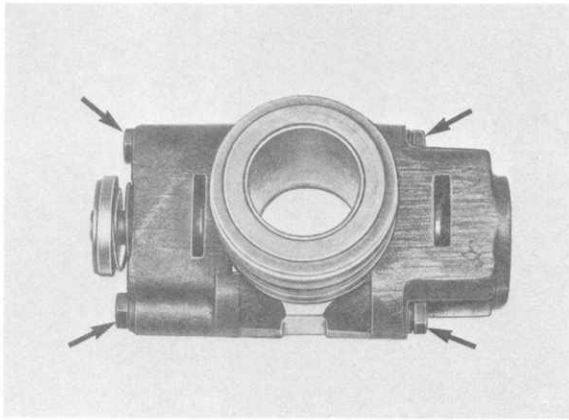
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	2		Tighten to specified torque	
2	Lockwasher	2		Replace, if necessary	
3	Valve body	1		Position correctly on flange	
4	Filter screen	1			
5	Circlip	1			
6	Spring	1			
7	Shift valve	1		Check for easy movement and damage	
8	Bolt	2		Tighten to specified torque	
9	Lockwasher	2		Replace, if necessary	
10	Governor housing	1		Position correctly on flange	
11	Filter screen	1			
12	Spring retainer	1		Position correctly	
13	Spring	1			
14	Shim	X	Note quantity and thickness for reinstalling		
15	Governor valve	1		Check for easy movement and damage	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
16	Pin	1			
17	Centrifugal weight	1			
18	Guide ring	1			
19	Spring	1			
20	Oil seal	3	Detach and remove carefully		
21	Flange	1			

DISASSEMBLING AND ASSEMBLING CENTRIFUGAL GOVERNOR

Disassembling

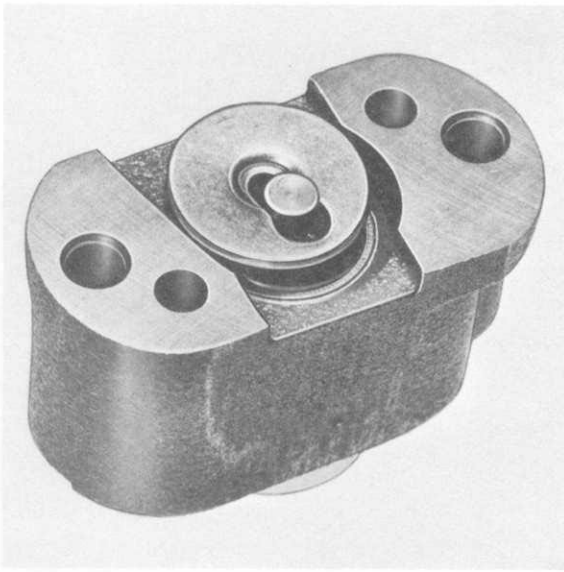
1. Unscrew bolts and remove valve body as well as governor housing from flange.



Note

Be careful not to damage filter screen in flange when taking off housing.

2. Press off spring retainer. Remove centrifugal weight with valve and springs.

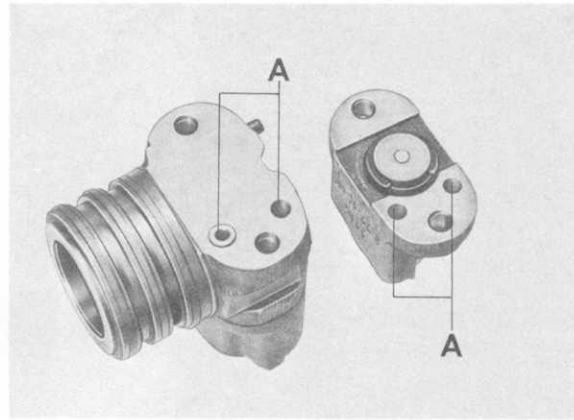


Assembling

Note

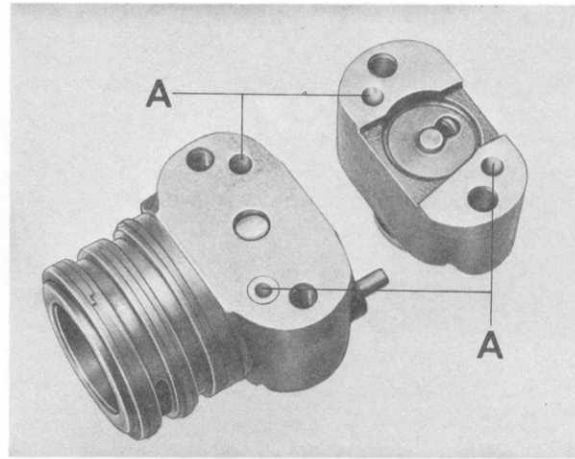
Clean all parts in clean gasoline thoroughly. Check shift valve and governor valve for damage and easy movement in their bores.

1. Place filter screen in seat provided for this purpose in oil bore and install valve body on flange that oil outlet slot faces oil seals and oil bores align.



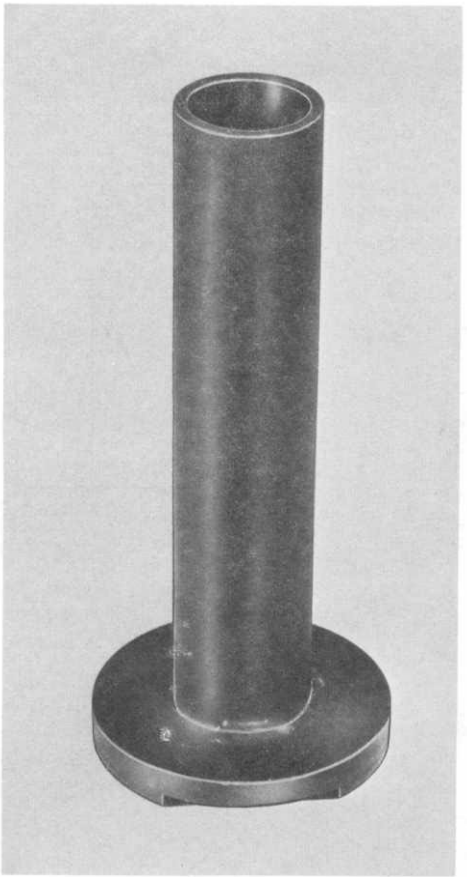
A - Oil bores

2. Place filter screen in seat provided for this purpose in oil bore and install governor housing that oil outlet slot faces oil seals and oil bores align.

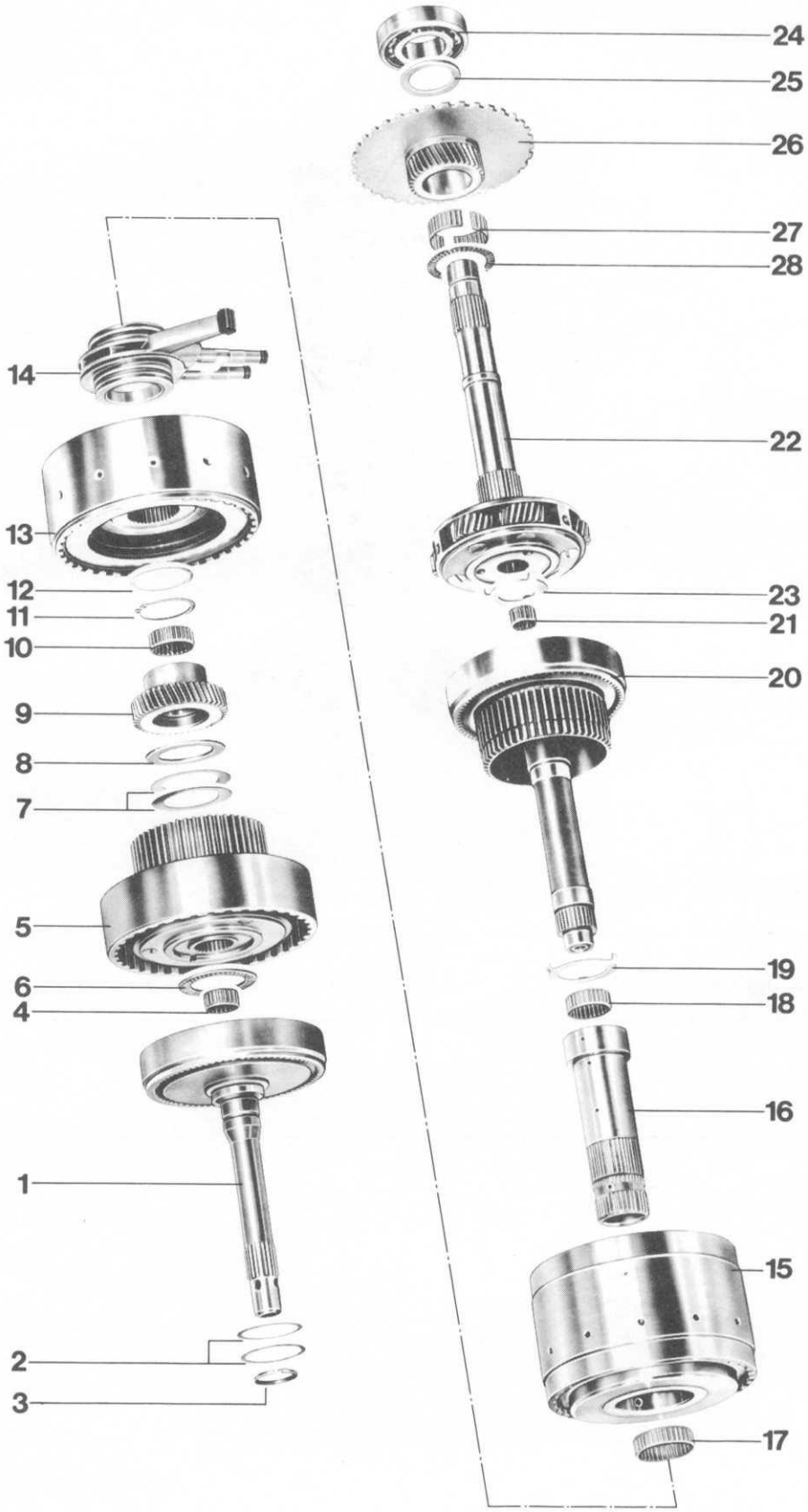


A - Oil bores

TOOLS



No.	Description	Special Tool	Remarks
1	Assembly tool	9307	


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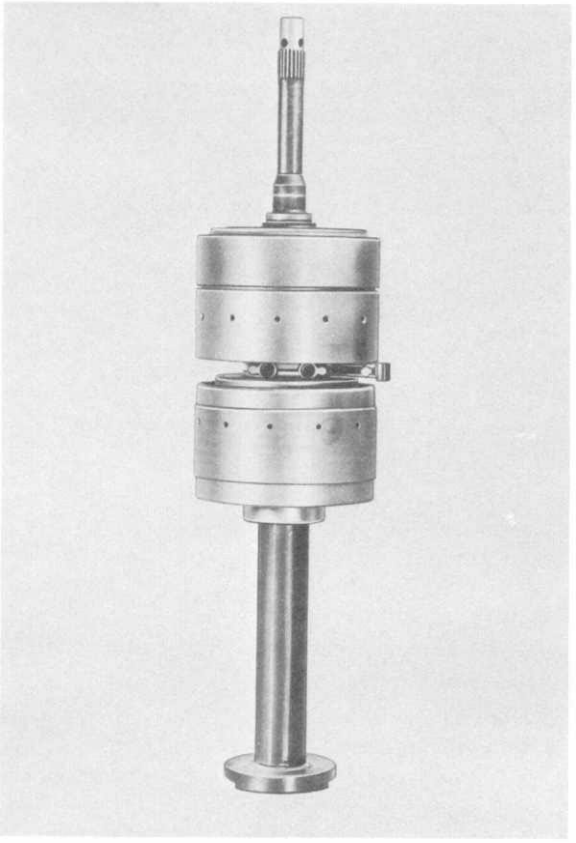
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Input shaft	1			
2	Shim	X	Note quantity and thickness for reinstalling	Redetermine thickness, if necessary	
3	Lubricating pressure ring	1			
4	Radial bearing	1			
5	Planet gear carrier	1			
6	Axial bearing	1			
7	Shim	X	Note quantity and thickness for reinstalling	Redetermine thickness, if necessary	
8	Axial bearing	1			
9	Sun gear	1			
10	Radial bearing	1			
11	Circlip	1			
12	Shim	X	Note quantity and thickness for reinstalling	Redetermine thickness, if necessary	
13	Clutch K 1	1			
14	Oil distribution sleeve	1		Position correctly	
15	Clutch K 2	1			
16	Hollow shaft	1			
17	Radial bearing	1			
18	Radial bearing	1			
19	Thrust washer	1			
20	Intermediate shaft	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
21	Radial bearing	1			
22	Output shaft	1			
23	Thrust washer	1			An aramide plastic washer without turning lock is installed instead of metal thrust washer betw. rear planet set and intermediate shaft for transm type A 22.04 as well as for type 22.01 from 1981 models
24	Ball bearing	1			
25	Thrust washer	1			
26	Sun gear	1			
27	Split needle bearing	1			
28	Axial bearing	1			

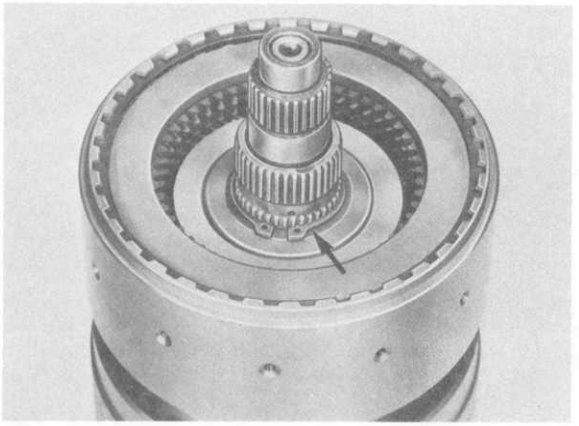
DISASSEMBLING AND ASSEMBLING GEAR ASSEMBLY

Disassembling

1. Slide Special Tool 9307 on to the output shaft and position the entire gear assembly upright carefully.

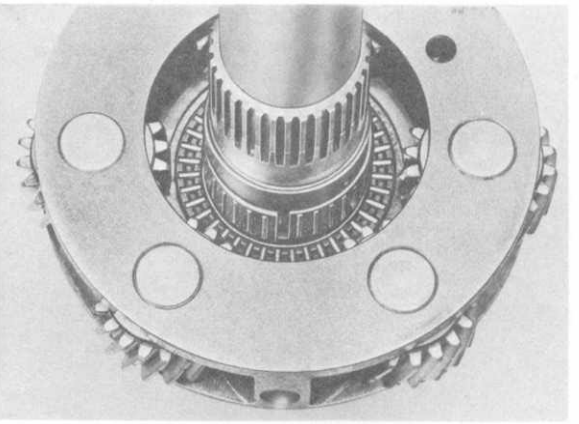


2. Remove snap ring and take off clutch K 1 and shims.



Assembling

1. Lubricate and install axial bearing and split needle bearing.



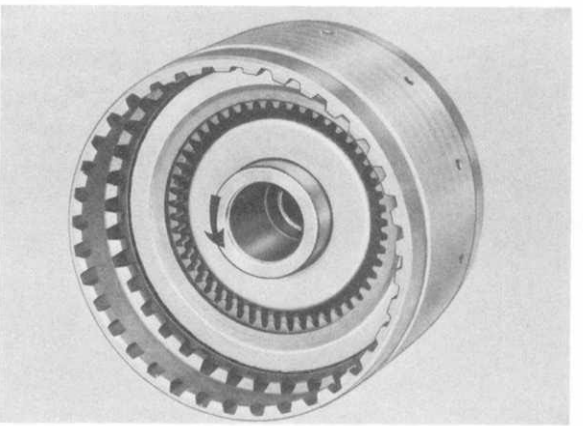
2. Install sun gear and thrust washer.

Note

Coated side of thrust washer faces sun gear.

3. Heat ball bearing to about 120° C and press on with a suitable piece of pipe.

4. Install hollow shaft in one-way clutch that shaft turns in direction of arrow.

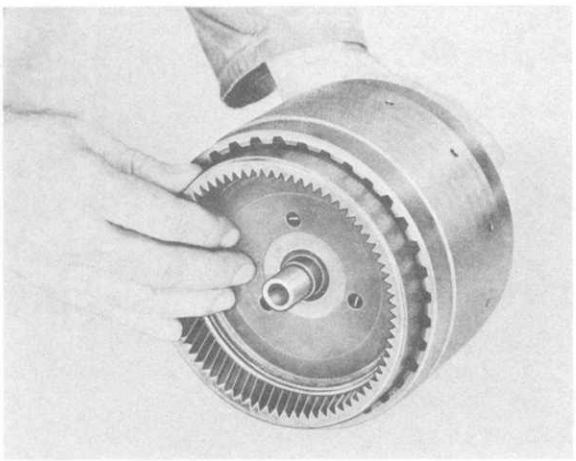


Note

After installation of hollow shaft it must lock when turned in opposite direction of arrow.

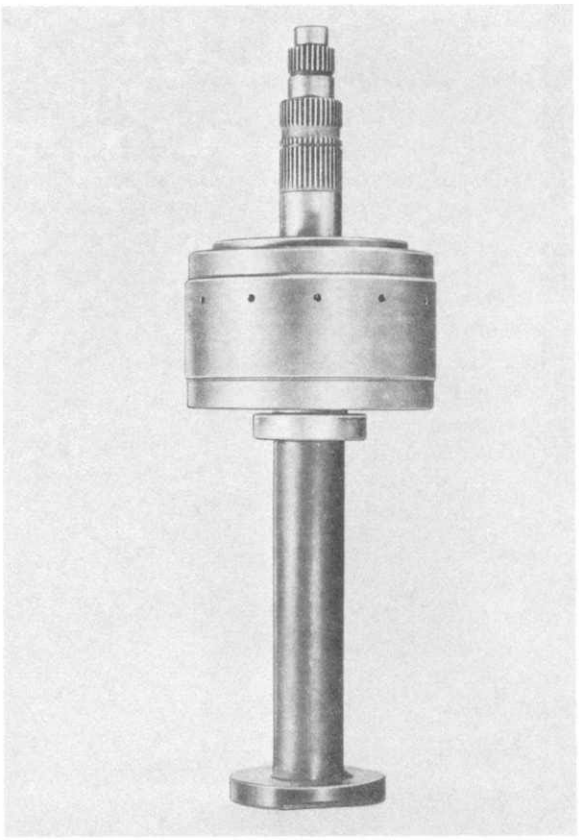
5. Lubricate thrust washer and needle bearing slightly and slide them on the intermediate shaft.

6. Install intermediate shaft in clutch K 2, turning slightly that spline of inner plate carrier engages in inner plates.



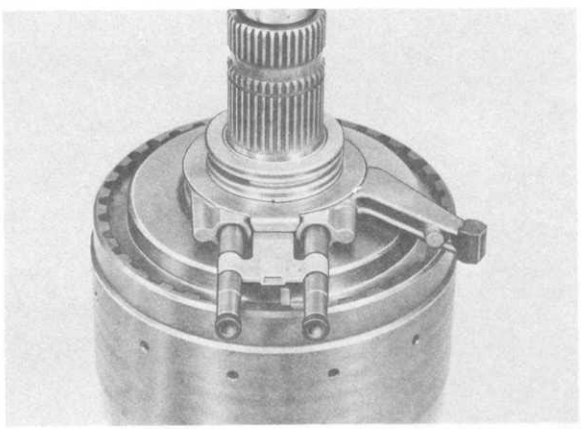
7. Install output shaft with needle bearing in brake band drum.

8. Install Special Tool 9307 on output shaft and position preassembled gear assembly upright carefully.



9. Install radial bearing between hollow shaft and support flange.

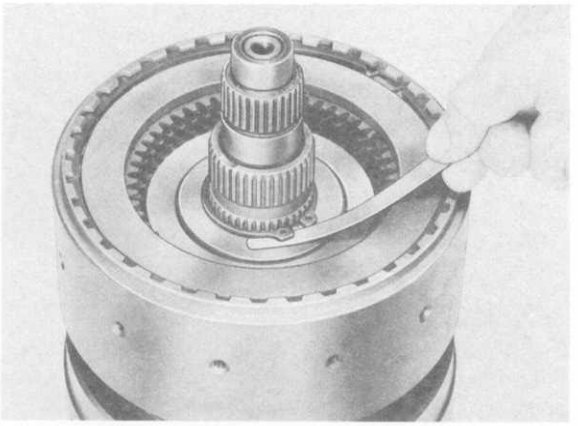
10. Install oil distribution sleeve in support flange K 2 so far carefully, that both oil seals engage in support flange.



11. Install clutch K 1 carefully, making sure that oil seals engage properly.

12. Check axial play of hollow shaft.

Install circlip without shims and check play with a feeler gauge.

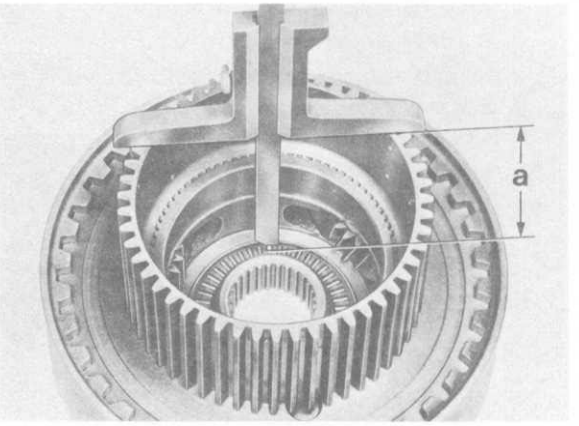


Install shims to adjust play to specified value of 0.3 to 0.4 mm.

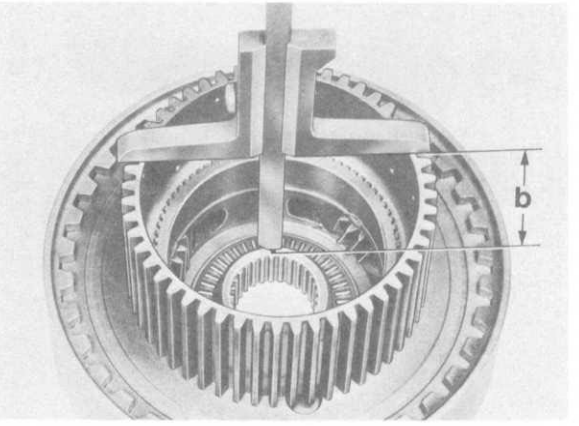
13. Check axial play of sun gear.

Lubricate and install axial bearing in planet gear carrier.

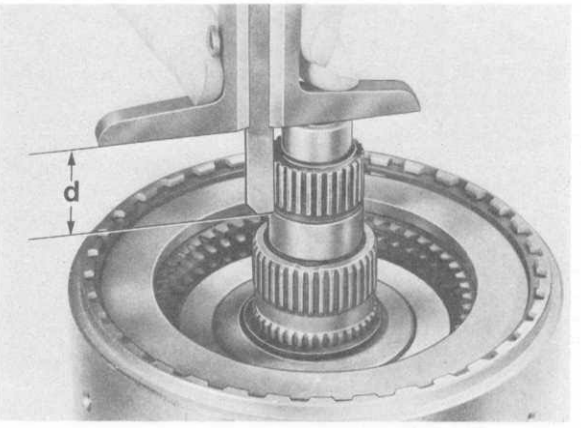
Measure distance "a" from face of inner plate carrier to roller of axial bearing with a depth gauge.



Measure distance "b" from face of inner plate carrier to shoulder of planet gear carrier.

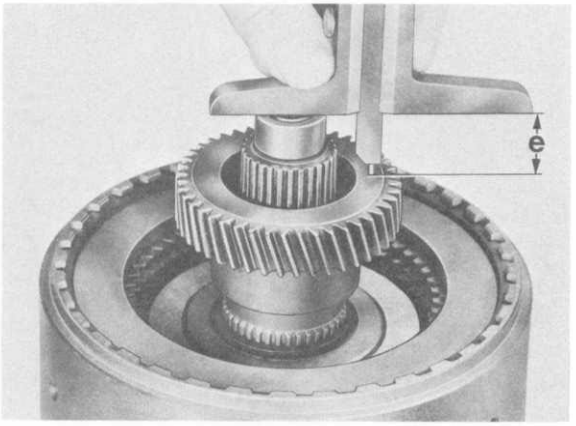


Measure distance "d" from face of intermediate shaft to shoulder of intermediate shaft.



Install sun gear and needle bearing.

Measure distance "e" from face of intermediate shaft to face of sun gear.



Calculate play:
Distance "a" - "b" = "c"
Distance "d" - "e" = "f"
Distance "c" - "f" = play

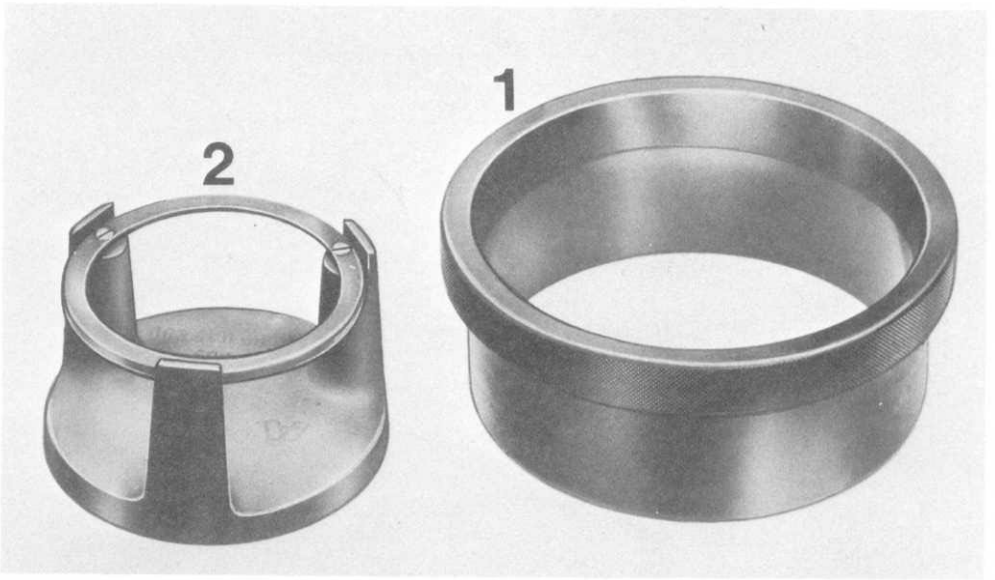
Adjust play to specified value of 0.2 to 0.3 mm by installing shims underneath the axial bearing.

14. Install planet gear carrier, turning it back and forth to have inner plate carrier engage in spline of plates.

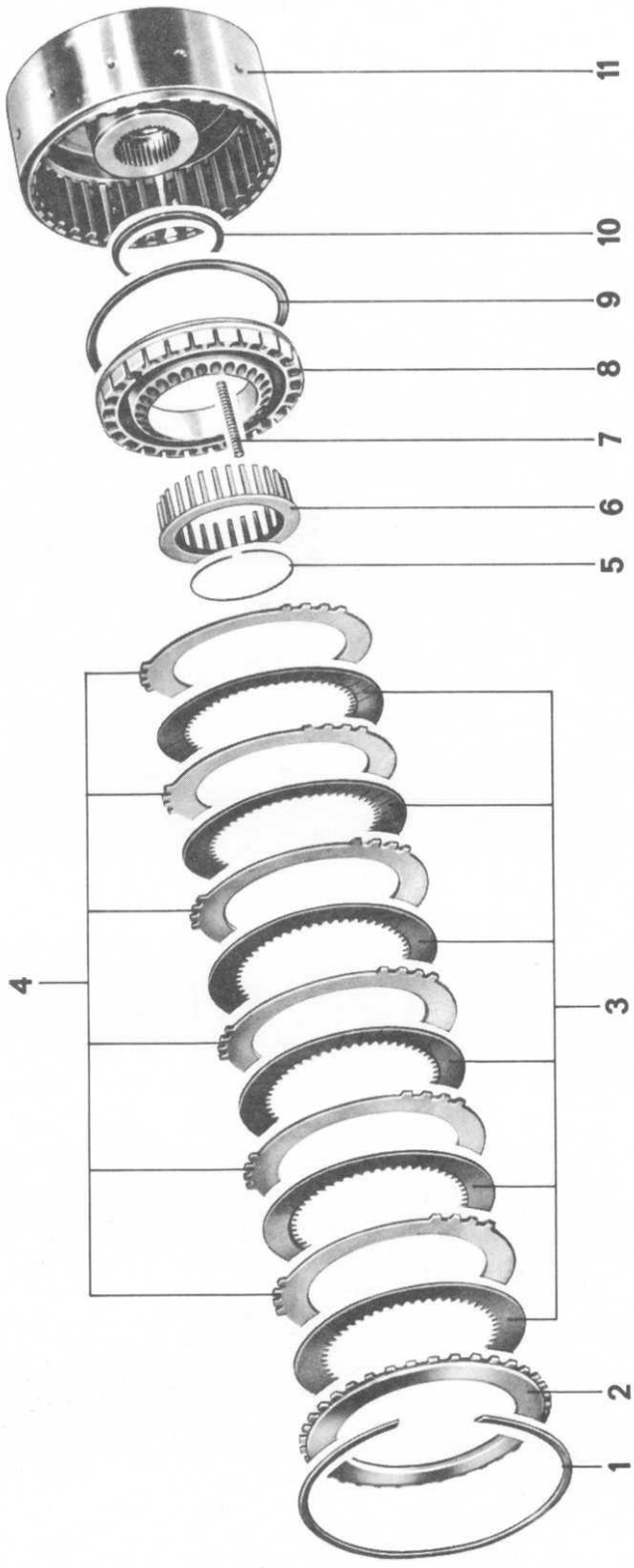
15. Install radial bearing and input shaft.

16. Install and attach lubricating pressure ring in groove of input shaft.

TOOLS



No.	Description	Special Tool	Remarks
1	Assembly sleeve	9308	
2	Assembly tool	9309	

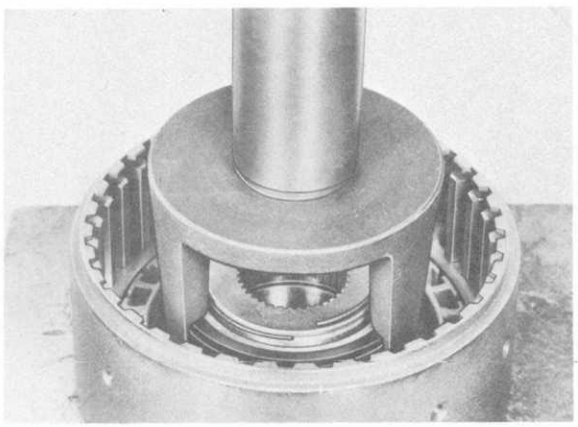

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Snap ring (corrugated)	1		Do not mix up with snap ring of K 2 (different spring force)	
2	Outer plate (5.0 mm thick)	1		Shouldered side faces snap ring	
3	Inner plate	6		Dip in ATF bath prior to installation	
4	Outer plate (optionally 3.0 or 3.5 mm thick)	6			
5	Snap ring	1			
6	Spring retainer	1			
7	Spring	X	Note quantity for reinstalling	Install same quantity as removed	
8	Piston	1	Pull out with two pointed pliers	Coat piston and lip seals with ATF and press in carefully with 9308	
9	Seal	1		Replace. Sealing lip faces support flange	
10	Seal	1		Replace. Sealing lip faces bottom of support flange	
11	Support flange	1			

DISASSEMBLING AND ASSEMBLING CLUTCH K 1

Disassembling

1. Install Special Tool 9309 on spring retainer that pressure ring has an uniform fit. Press down the spring retainer in a press far enough, that snap ring is clear and can be removed.



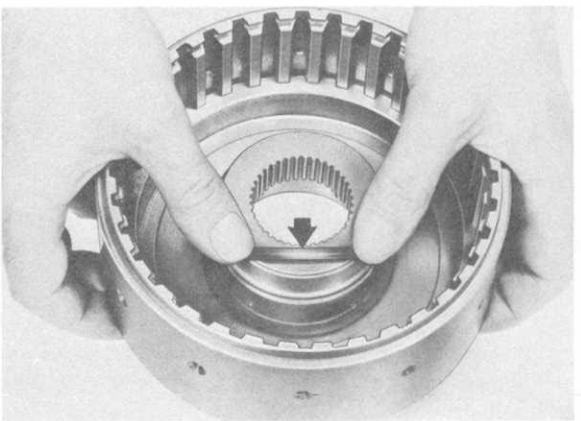
2. Release press carefully and remove spring retainer and springs.

Note

The quantity of springs for the clutch pistons will vary. If new springs are required, the same quantity must be used again.

Assembling

1. Install lipped seal carefully that it is positioned correctly in the groove and its lip faces down (in direction of arrow).



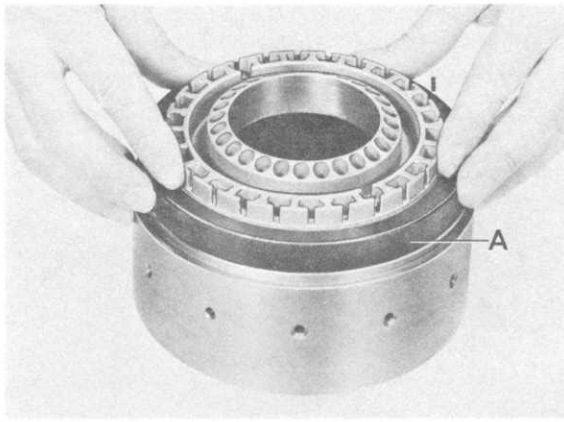
Note

Never use sharp edged tools to install seals.

2. Insert Special Tool 9309 in support flange.

3. Install lipped seal for piston that its sealing lip faces down to bottom of support flange.

4. Give piston and seal a light coat of ATF and press in against bottom of housing without tilting.



A - Special Tool 9308

Note

Don' t force in piston to prevent damaging the seals.

5. Assemble plates according to exploded view and install assembly in clutch drum.

Note

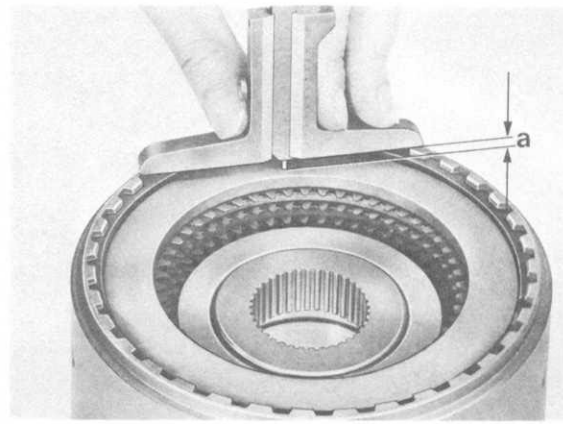
New (coated) plates must be dipped briefly in ATF prior to installation.

6. Install wavy snapring in groove and press it into groove with a suitable tool.

Note

The wavy snap rings of clutches K 1 and K2 have different spring forces, for which reason they must not be mixed up.

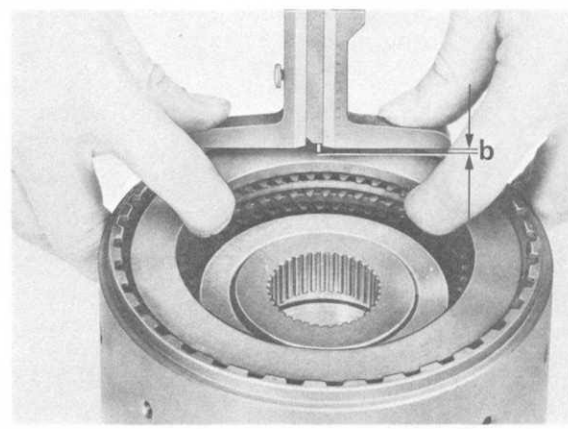
7. Check clutch play "L", which should be 1.0 ± 0.2 mm. Measure distance "a" from upper edge of clutch drum to plate assembly with a depth gauge.



Note

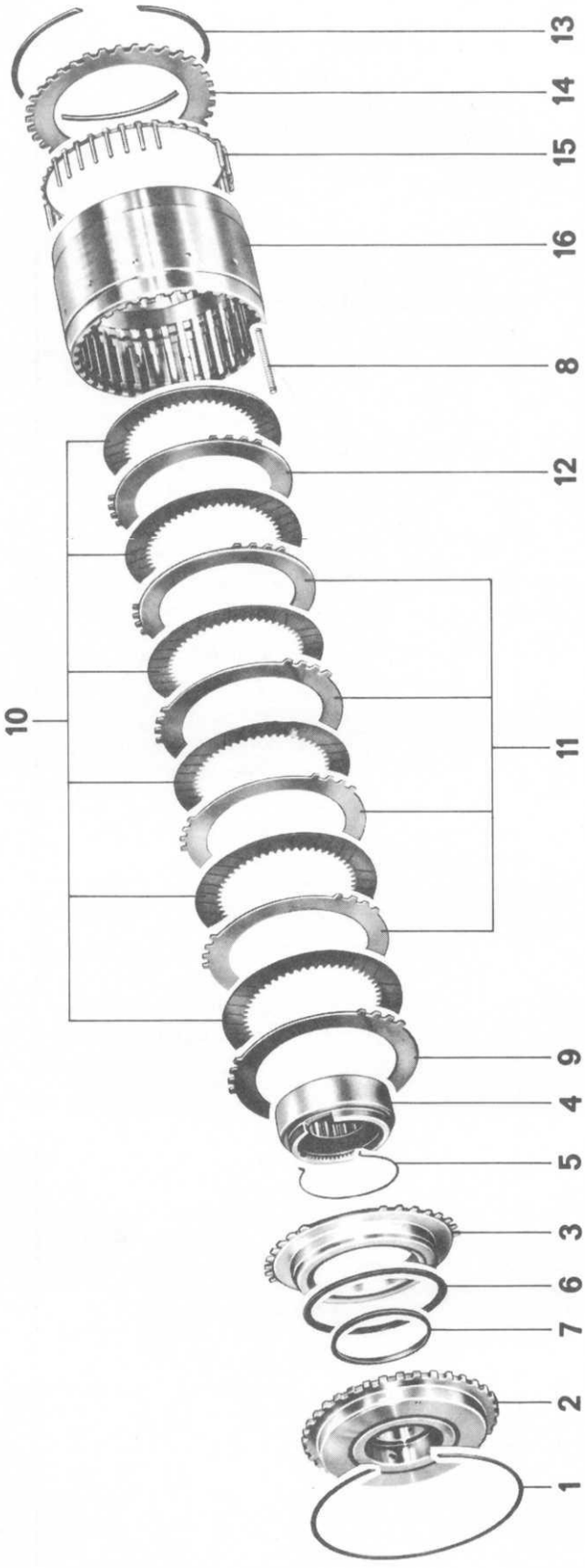
When measuring distance "a" have tip of depth gauge just touch the plate assembly without pressure.

Press up outer plates all the way and measure distance "b" from upper edge of clutch drum to plate assembly. Clutch play "L" is a - b.



Note

The play can be adjusted with the outer plates, which are available 3.0 and 3.5 mm thick.


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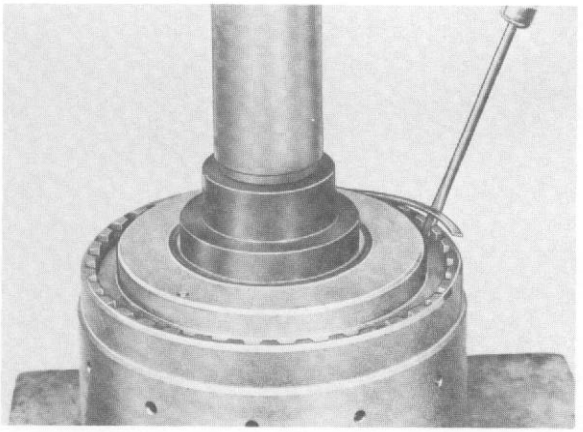
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Snap ring (flat)	1	Press down support flange slightly with a press and suitable thrust pad		
2	Support flange	1	Remove with piston from brake band drum		
3	Piston	1			
4	One-way clutch outer race	1	Remove snap ring with pointed pliers by squeezing together		
5	Snap ring	1			
6	Lipped seal	1		Replace. Sealing lip faces support flange	
7	Lipped seal	1		Replace. Sealing lip faces down	
8	Spring	X	Note quantity for reinstalling	Install same quantity as removed	
9	Outer plate (2.0 mm thick)	1			
10	Inner plate	6		Dip in ATF bath prior to installation	
11	Outer plate (optionally 3.0 or 3.5 mm thick)	4			
12	Outer plate (optionally 4.5 or 5.0 mm thick)	1		Shouldered side faces corrugated snap ring	
13	Snap ring (corrugated)	1		Don't mix up with snap ring of K 1 (different spring force)	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
14	Outer plate (5.0 mm thick)	1		Shouldered side faces corrugated snap ring	
15	Guide ring	1			
16	Brake band drum	1			

DISASSEMBLING AND ASSEMBLING CLUTCH K 2

Disassembling

1. Remove flat snap ring with a suitable tool, while pressing the support flange down slightly in a press with a suitable thrust pad (e.g. VW 511).



2. Take support flange and piston out of brake band drum.

Note

Support flange and piston must be held together to prevent the piston from falling out.

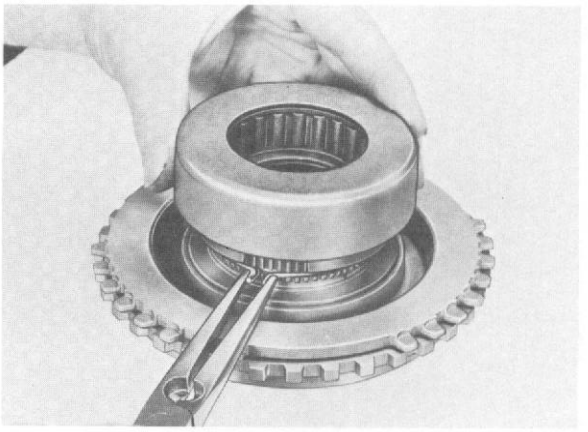
3. Remove all springs and plates from the brake band drum.

Note

The quantity of springs for clutch pistons will vary. If new springs are required, the same quantity as removed must be installed.

4. Remove corrugated snap ring and outer plate as well as guide ring for springs.

5. Squeeze snap ring together with a pointed pliers and remove one-way clutch outer race.



Assembling

1. Install guide ring for springs and outer plate that shouldered side faces snap ring.

2. Install corrugated snap ring.

Note

The corrugated snap rings of clutches K 1 and K 2 are different in spring force, for which reason they must not be mixed up.

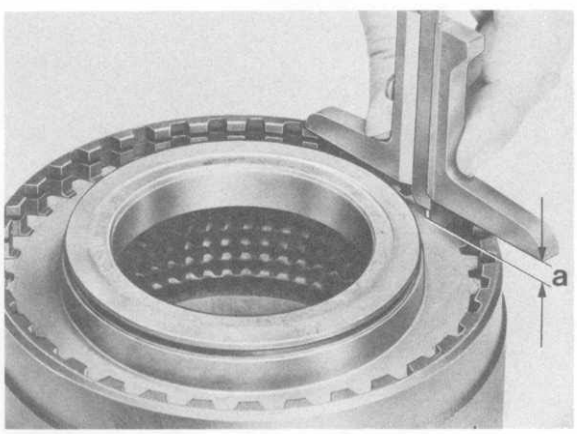
3. Assemble plates according to explosion view drawing and install assembly in outer plate carrier.

Note

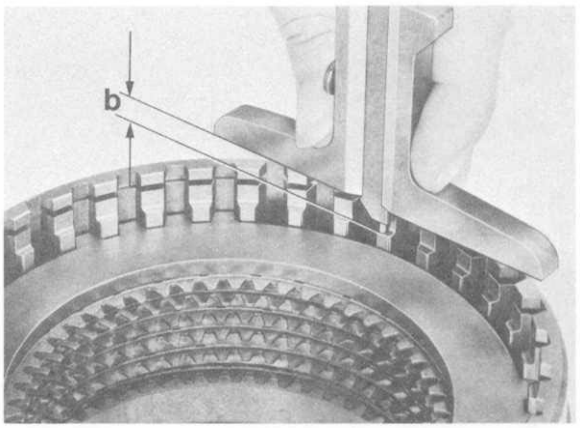
New coated plates must be dipped briefly in an ATF bath prior to installation.

4. Check clutch play "L", which should be $1.0 \overset{+}{-} 0.2$ mm.

Place clutch piston on plate assembly and measure distance "a" from upper edge of outer plate carrier to clutch body with a depth gauge.



Measure distance "b" from upper edge of outer plate carrier to bearing surface of support flange with a depth gauge.

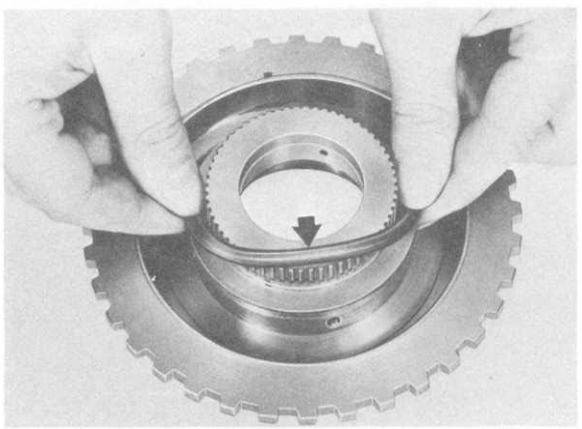


Clutch play "L" is a - b.

If applicable, adjust play by selecting outer plates of pertinent thickness.

5. Place all springs on guide pin.

6. Install seal carefully that it fits properly in the groove and its sealing lip faces down (in direction of arrow).

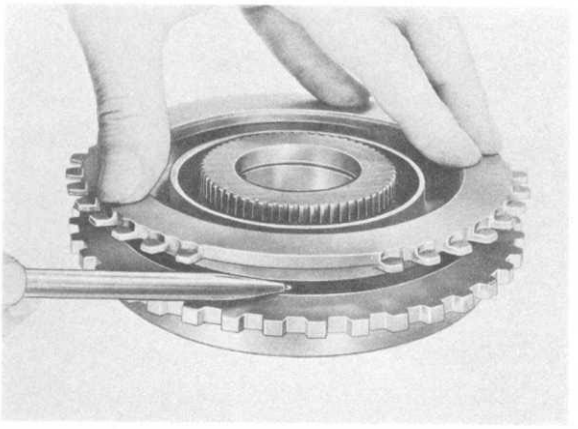


Note

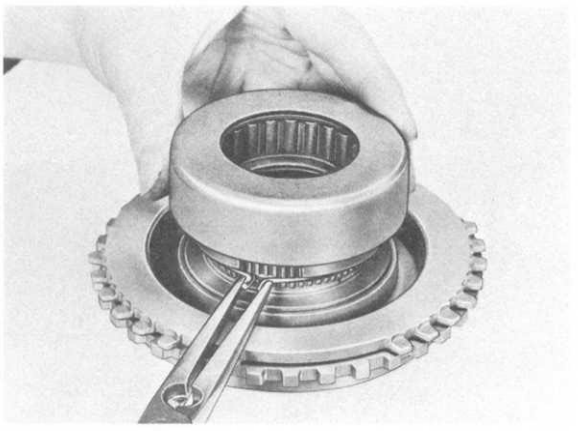
Never use sharp edged tools to install seals.

7. Install seal for piston so that its sealing lip faces down.

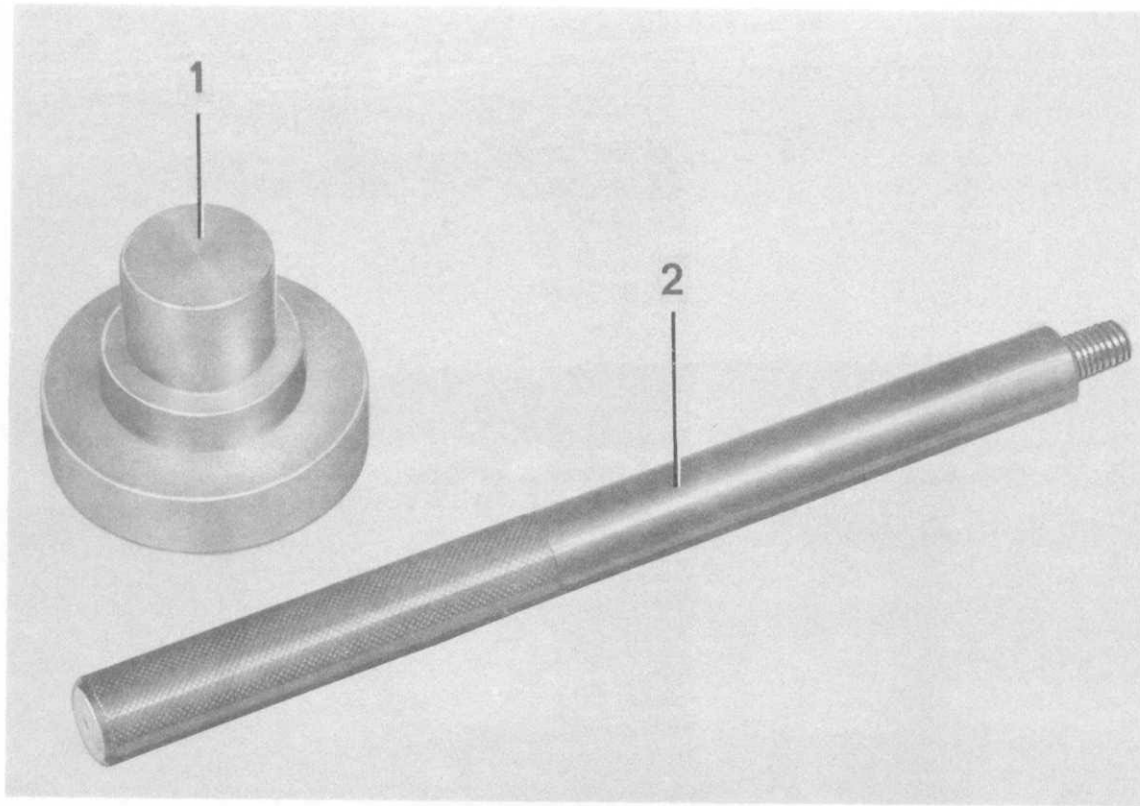
8. Apply a light coat of ATF to seals and install piston in support flange, pressing the sealing lip into the support flange with a pencil or ball point pen and moving in the piston carefully without tilting.



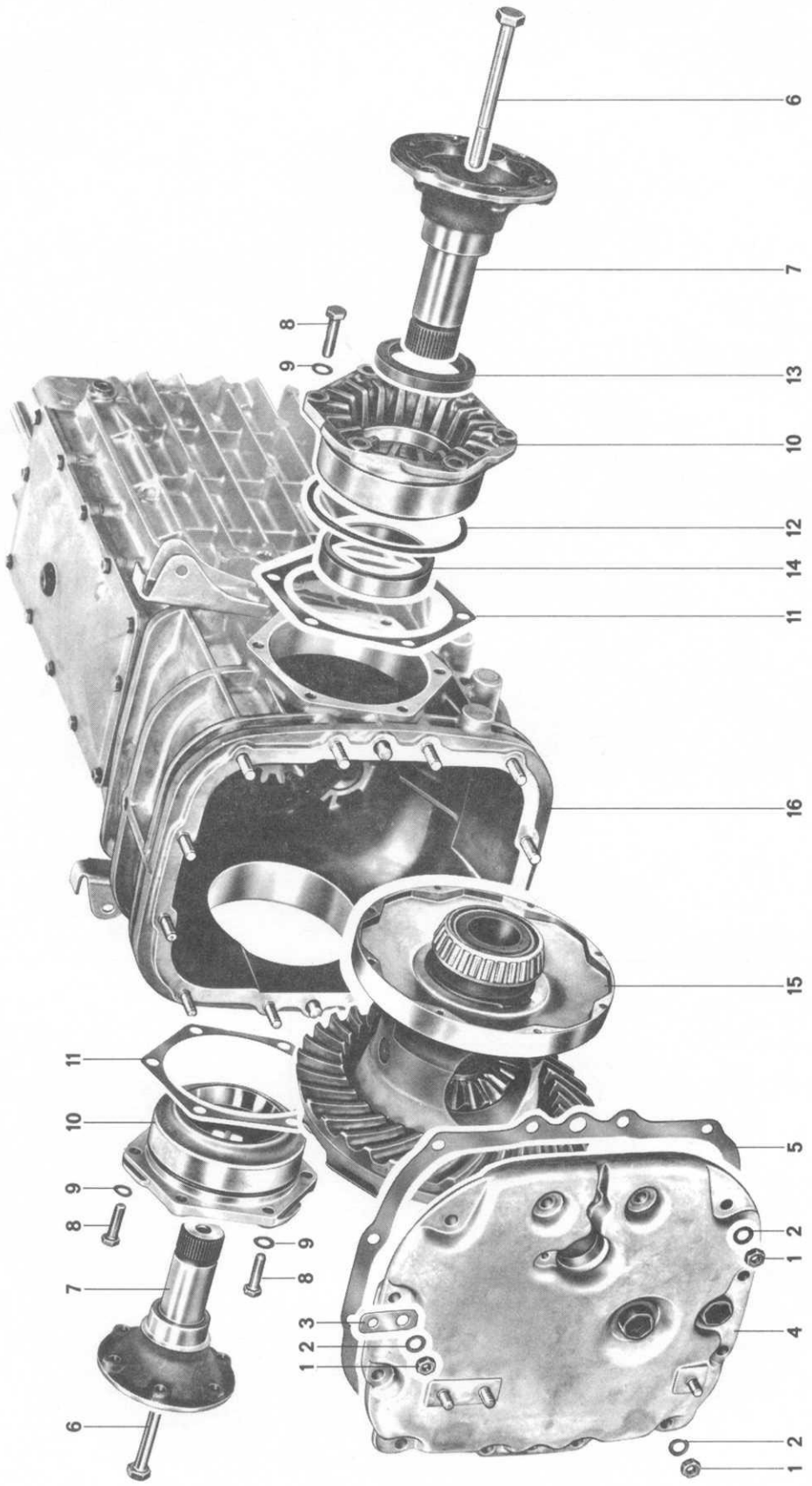
9. Install snap ring in groove of support flange, squeeze together with a needle-nose pliers and insert one-way clutch outer race.



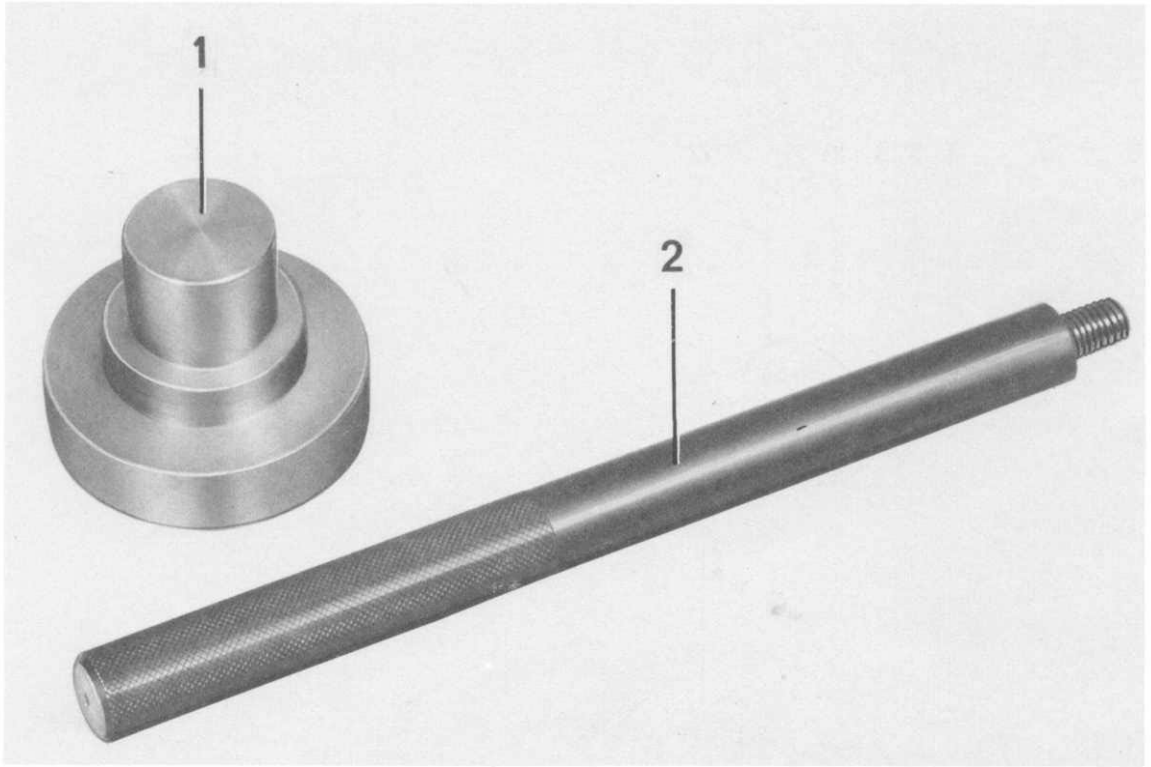
TOOLS



No.	Description	Special Tool	Remarks
1	Mandred	US 8050/10	
2	Pin	US 8050	

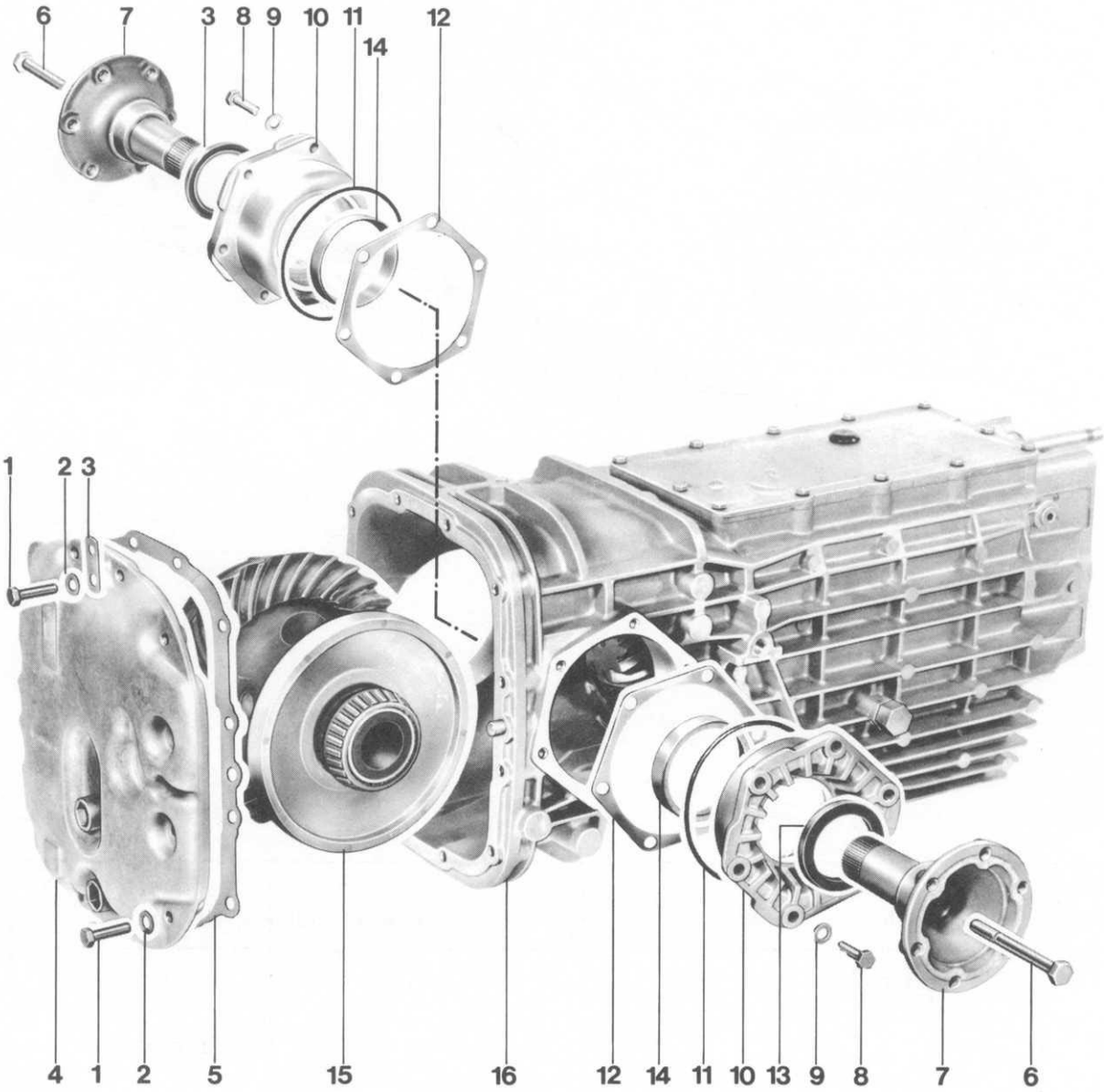

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TOOLS



No.	Description	Special Tool	Remarks
1	Pressure pad	9147	
2	Rod		From P 254

REMOVING AND INSTALLING DIFFERENTIAL



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bolt	12		Torque: 22 Nm (16 ftlb)	
2	Washer	12			
3	Holder	1			
4	Case cover	1			
5	Gasket	1		Replace	
6	Bolt	2		Torque: 43 Nm (31 ftlb)	
7	Joint flange	2			
8	Bolt	12		Torque: 22 Nm (16 ftlb)	
9	Washer	12			
10	Bearing cap	2	Mark for reassembly	Must be installed on same side	
11	O-ring	2		Replace, coat with transmission oil	
12	Shim	X	Note number and thickness on each side for reassembly	Determine again, if necessary	

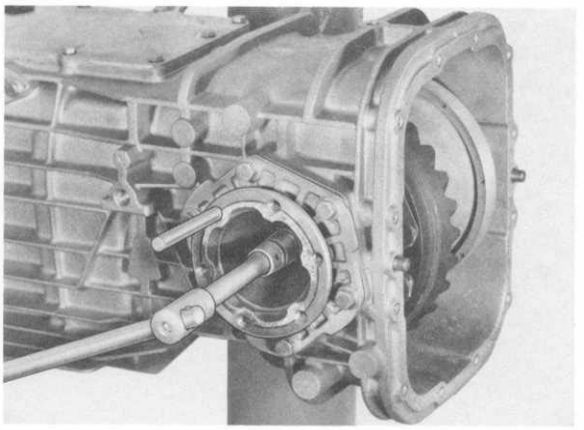
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
13	Seal	2	Drive out with suitable screw-driver	Drive in with Special Tool 9147	
14	Taper roller bearing outer race	2	Mark for reassembly	Install in same bearing cap, heat bearing cap to approx. 100° C/ 212° F and press in with a pertinent pressure pad	
15	Differential	1		Adjust, if necessary	
16	Case	1			

REMOVING AND INSTALLING DIFFERENTIAL

Removing

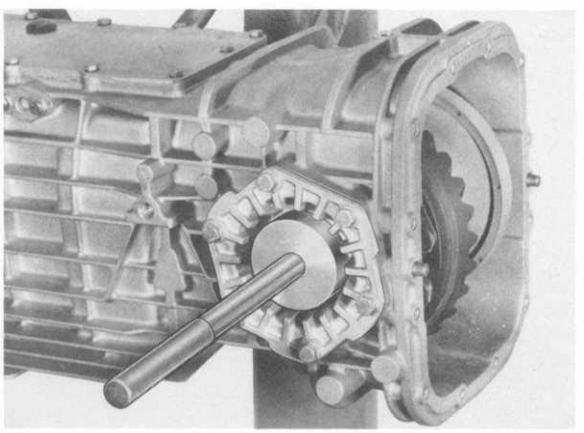
1. Drain transmission oil.

2. Unscrew joint flange bolt and remove joint flange.



Installing

Drive in joint flange seal with Special Tool 9147.



Note

Preload of the taper roller bearings could cause tension on the case when tightening bolts for the side case covers, which later could impair installation of the rear case cover. Consequently the rear case cover should be installed before tightening the bolts.

Measuring the plate wear on the proportional-slip differential

Note

The wear dimension can be determined only by means of the measuring cylinder - special tool 9514.

1. Remove output cylinder.

Note

In order to avoid venting of the differential system, the pressure line at the output cylinder must not be disconnected when the gearbox is installed. In this case, unflange the output cylinder with pressure line from the housing.

2. Back off the adjusting screw of the measuring cylinder as far as possible (facilitates assembly of the cylinder).

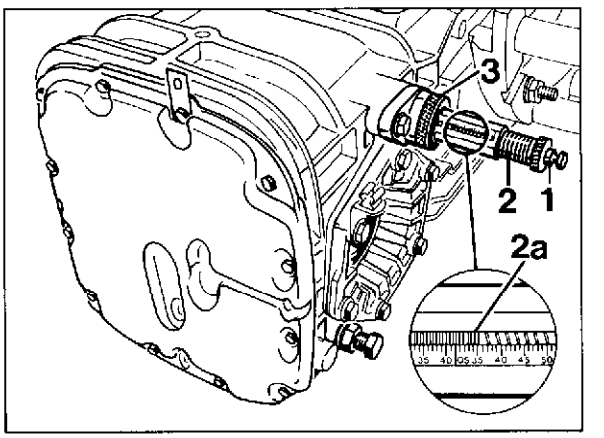
3. Mount the measuring cylinder on the gearbox and tighten the knurled nut.

Note

If the gearbox is installed, it is recommended to use two studs M 8 x 45 with continuous thread to secure the measuring cylinder.

4. Screw in the adjusting screw at the measuring cylinder until there is no longer any axial play at the spacer tappet. Read off the wear dimension in this position.

   New dimension = 34.5 mm
   Wear dimension = 45.0 mm



357-39

LS = Measuring range for longitudinal lock 911 Carrera 4

QS = Measuring range for transverse lock 928 S 4, 928 GT and 911 Carrera 4

1 - Spacer tappet
2 - Adjusting screw
2a - Measuring groove on adjusting screw
3 - Knurled nut

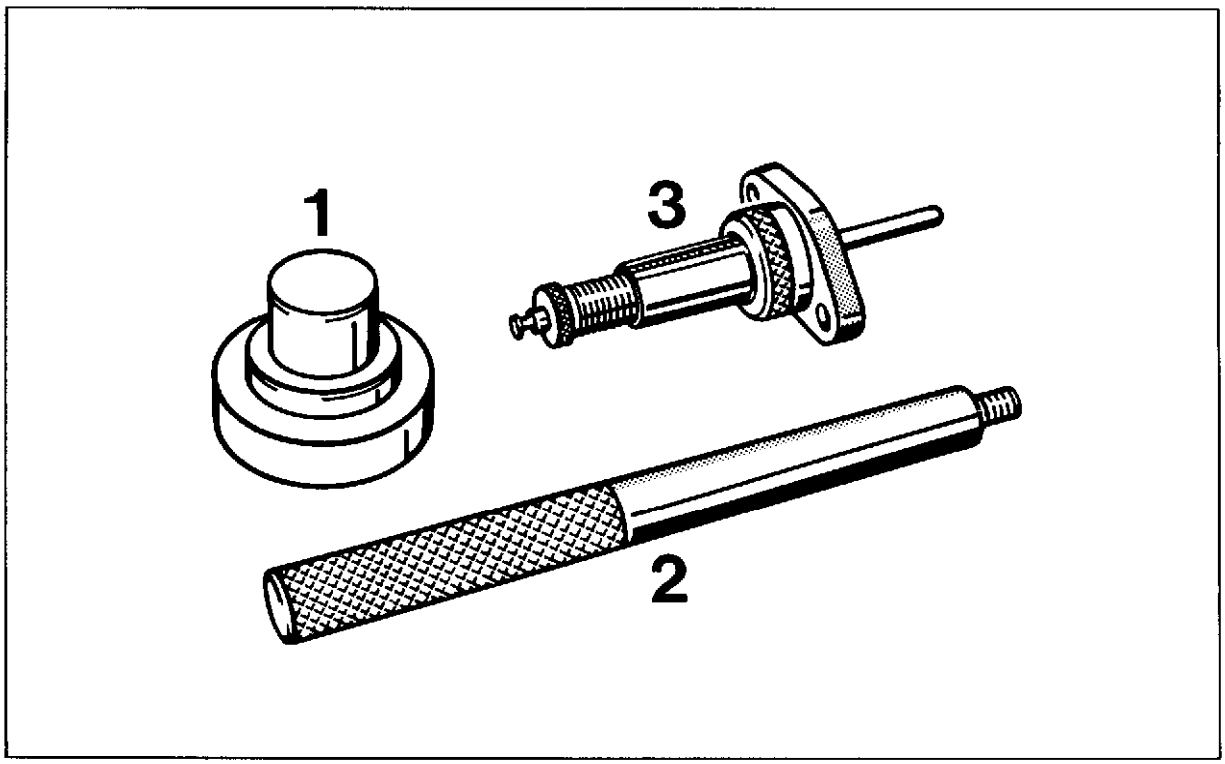
Note

When the wear dimension has been reached, the plates of the lock must be replaced. Do not correct the wear dimension at the thrust bearing under any circumstances.

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Removing and installing the proportional-slip differential

Tool

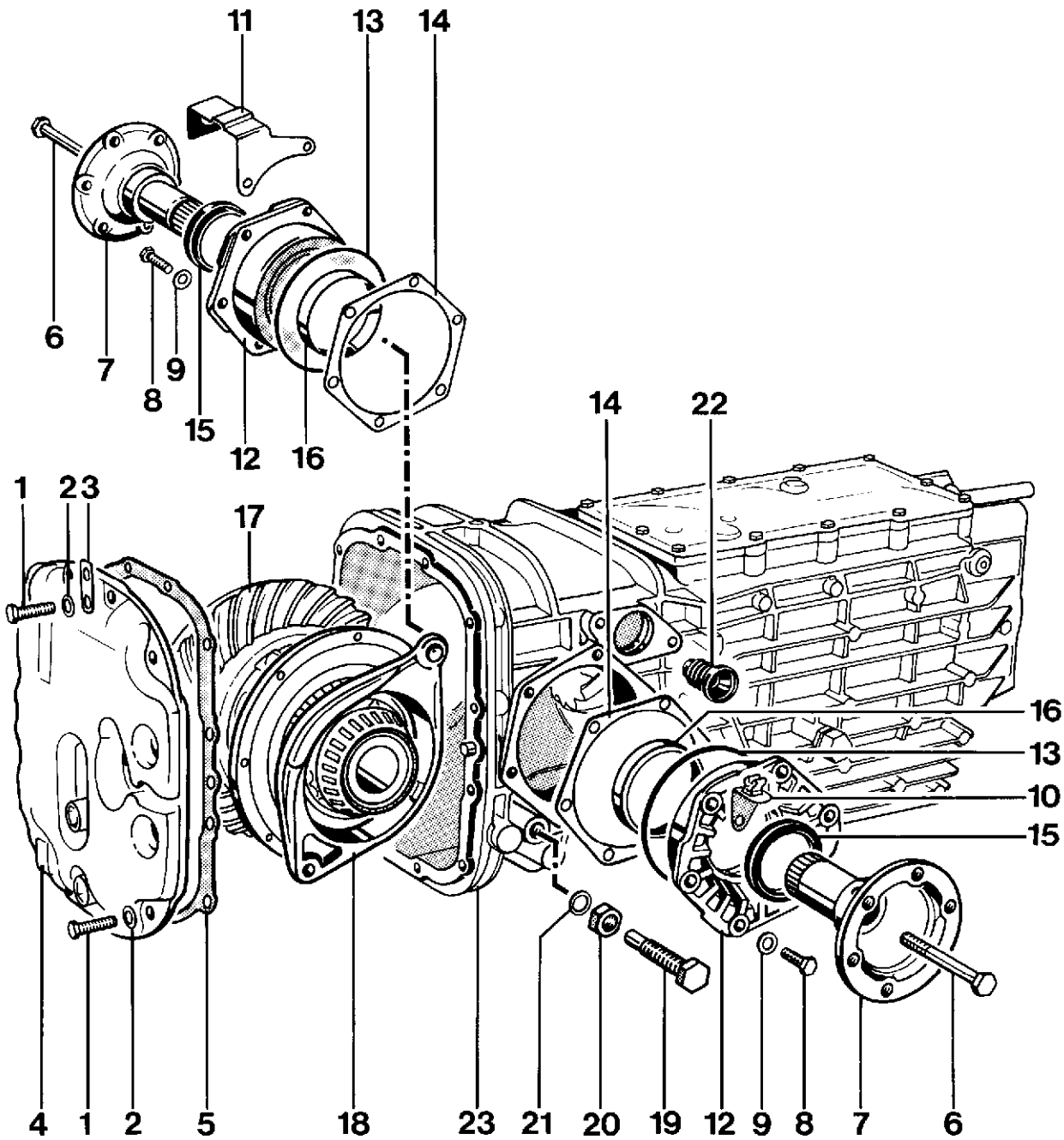


354-39

Nr.	Bezeichnung	Sonderwerkzeug	Bestellnummer	Erläuterung
1	Thrust piece	9147	000.721.914.70	
2	Pin	-	-	from P254
3	Measuring cylinder	9514	000.721.951.40	-

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Removing and installing the proportional-slip differential



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No.	Description	Qty.	Note when Removing	Note when Installing
1	Hexagon screw	12		Tighten with 22 Nm
2	Washer	12		
3	Retaining plate	1		
4	Housing cover	1		
5	Seal	1		Renew
6	Hexagon screw	2	Block flexible flange with suitable mandrel	Tighten with 43 Nm
7	Flexible flange	2		
8	Hexagon screw	12		Tighten with 22 Nm
9	Washer	12		
10	Retaining plate	1		
11	Retaining plate	1		
12	Bearing cap	2	Identify for red-installation	Must be fitted on the same side
13	O-ring	2		Renew, coat with gear oil
14	Shim	X	Note number and thickness for re-installation per side	Determine anew if necessary
15	Sealing ring	2	Drive out with a suitable screwdriver	Drive in with special tool 9147
16	Taper roller bearing outer raceway	2	Mark for re-installation	Install in the same bearing cap, heat bearing cap up to approx. 100 °C and press in with suitable thrust piece.
17	Porsche limited-slip differential	1		Readjust if necessary
18	Engaging lever	1		Fit in the correct position

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No.	Description	Qty.	Note when: Removing	Installing
19	Thrust bearing	1	Only adjust or remove if the plates of the lock are removed or determine installation position for re-installation	Readjust if necessary. Screw in with Loctite 222 and lock with hexagon nut
20	Hexagon nut	1		Tighten with 85 Nm
21	Sealing ring*	1		Renew
22	Bellows	1		Oil slightly and press in home with a suitable pipe piece (e.g VW 418a)
23	Gearbox	1		

* Deleted as of MY '92. Sealing is done with Loctite 222.

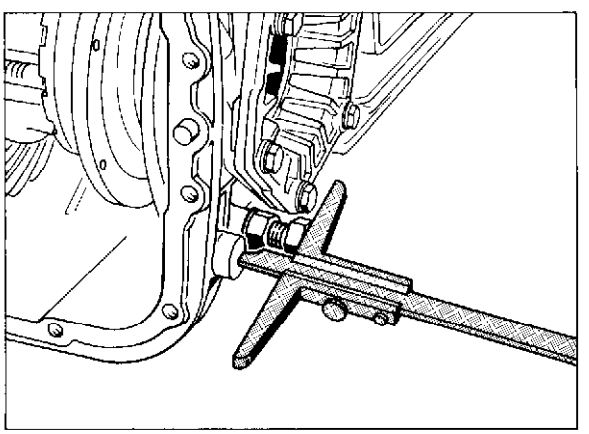
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Assembly instructions for removal and installation

Removal

Note

Before the limited-slip differential is removed, determine the wear condition of the plates under all circumstances (refer to Page 39-206a).
If the worn plates are reused, the thrust bearing (No. 19) must not be adjusted. If adjustment or removal of the thrust bearing should be necesssary (e.g. in the event of leaks), measure the installation position of the thrust bearing for re-installation under all circumstances.



355-39

Installation

Note

Always renew the output cylinder as well if the bellows (No. 22) leaks.

1. Adjusting the thrust bearing: (required only if the plates were renewed)

- The locking torque and drive set must be adjusted.

- The bellows (No. 22) must be installed. Screw in the thrust bearing by only a few turns.
  Pay attention to the installation position of the engaging fork.

- Back off the adjusting screw of the measuring cylinder as far as possible (facilitates assembly of the cylinder).

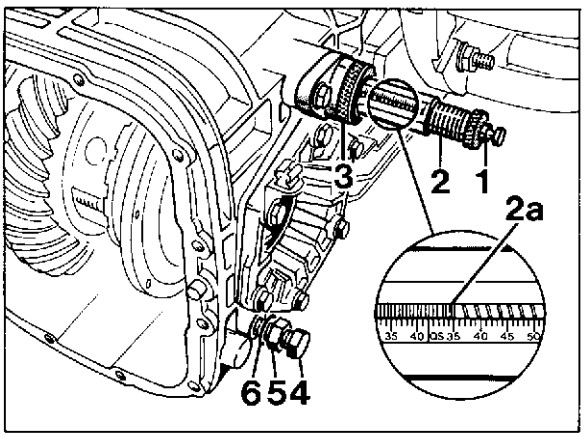
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- Fit the measuring cylinder - special tool 9514 - on the gear and tighten the knurled nut.

- Set a setting dimension of 34.5 mm (in the transverse lock measuring range) with the adjusting screw on the measuring cylinder.

LS = Measuring range for longitudinal lock 911 Carrera 4

QS = Measuring range for tranverse lock 928 S 4, 928 GT and 911 Carrera 4



356-38

1 - Spacer tappet
2 - Adjusting screw
2a - Measuring groove on adjusting screw
3 - Knurled nut
4 - Thurst bearing
5 - Hexagon nut
6 - Sealing ring

- Screw in the thrust bearing until there is no longer any axial play at the spacer tappet of the measuring cylinder. Lock the thrust bearing with the hexagon nut in this position (tightening torque 85 Nm)

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Bleeding hydraulics of Porsche controlled slip differential (PSD)

Preparatory work:

- Remove rear left inner fender
- Connect bleeding device to PSD hydraulic reservoir
- Disconnect vent line
- Build up bleed pressure (approx. 1.5 - 2.0 bar)

1. Bleeding the pressure reservoir

To charge the pressure reservoir, the **ignition must be switched on.**
When the pressure reservoir has been charged, the pump cuts out; reservoir pressure is then approx. 180 bar.

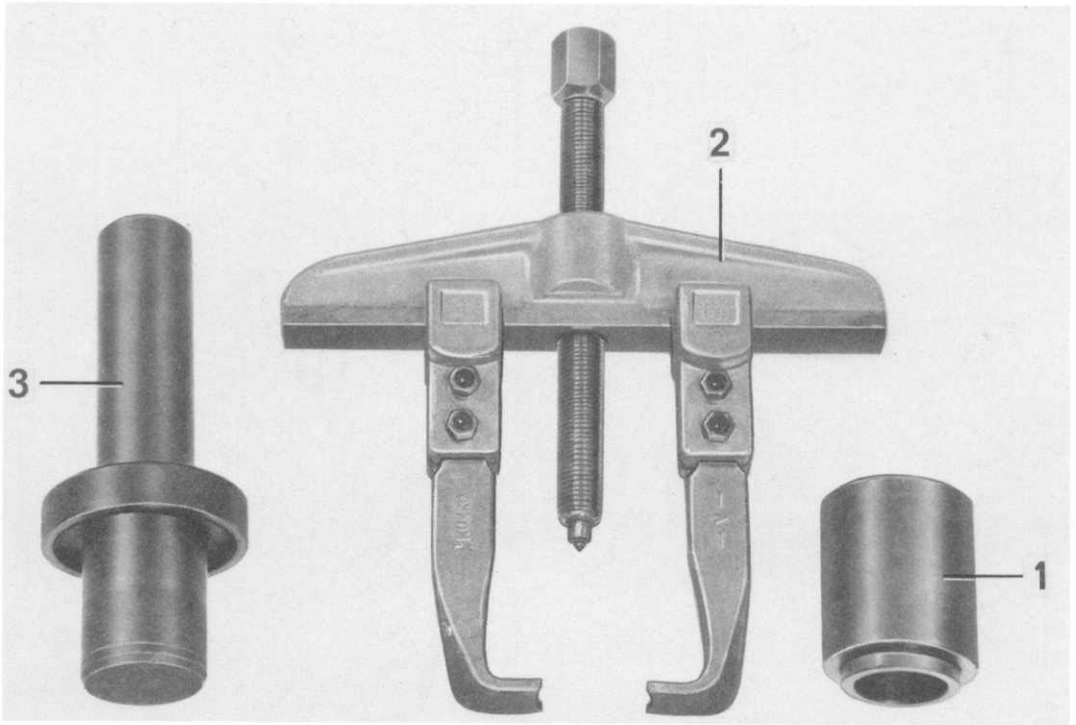
- Connecting the bleed cylinder.
- Switch off the ignition.
- Carefully open the bleed connection and allow the pressure level to drop gradually.
  While this is being done, the **ignition must remain switched off**, to ensure that pressure is completely reduced and air expelled from the reservoir.
- Repeat this procedure several times, making sure that the **ignition is switched on or off at the appropriate stages in the procedure.**

2. Bleeding the valve block and the locking line to the lock slave cylinder

- Connect the 9288 system tester
- Switch the ignition "ON"
- Connect the bleed cylinder to the bleed screw on the slave cylinder
- Open the bleed screw on the slave cylinder
- Select "Start PSD Bleeding" and actuate repeatedly until no further air emerges
- The bleeding device must remain switched on, because the reservoir volume is used up rapidly.
- After this, close the bleed screw on the slave cylinder
- Select "Stop Bleeding" and "Start Pressure Reduction" at the system tester
- Switch off the bleeding device and disconnect it
- Screw on the reservoir cover
- Open the vent line at the reservoir again
- Check level in reservoir. The liquid must be approx. 1 cm above the step in the reservoir body (with the pressure reservoir charged)

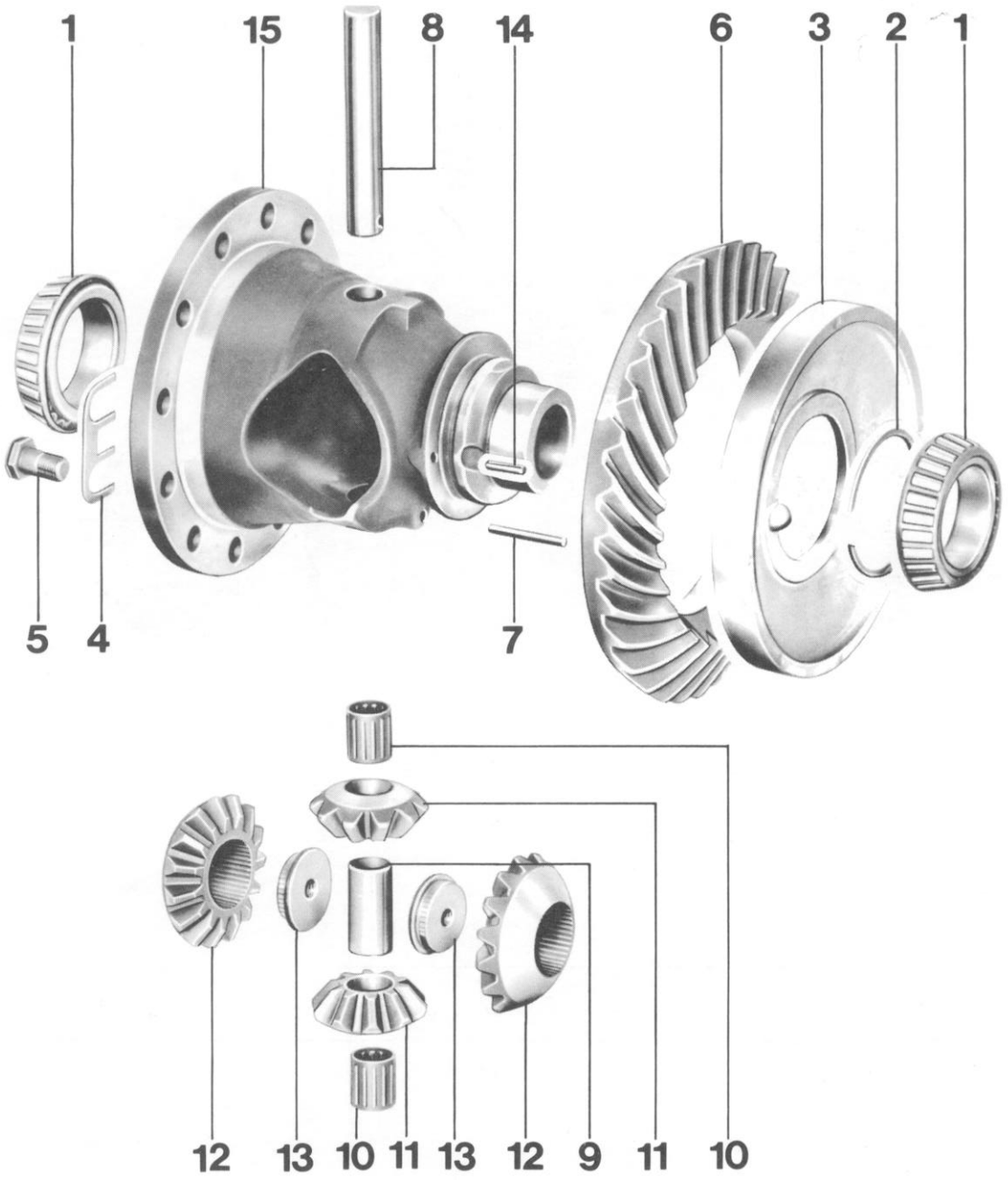
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TOOLS



No.	Description	Special Tool	Remarks
1	Pressure pad	P 263	
2	Extractor	-	Standard
3	Pressure pad	P 264 b	

DISASSEMBLING AND ASSEMBLING DIFFERENTIAL



No.	Designation	Qty.	Note When: Removing	Installing
1	Tapered roller bearing - inner race	2	use suitable extractor and P 261 to remove	drive on with P 264 b
2	Retaining ring	1		
3	Rotor	1		
4	Locking plate	6		fit replacement
5	Hex bolt	12		threads must be dry and free of grease. Torque setting 165 Nm (120.4 ftlb)
6	Ring gear	1		Threaded holes for ring gear bolts must be dry and free of grease. Check alignment and adjust if necessary
7	Lock dowel	1		
8	Differential pin	1		
9	Spacer *	1		
10	Needle roller *	2		
11	Small bevel gear	2		Apply MoS_2 paste to convex surface. Always replace as a pair.

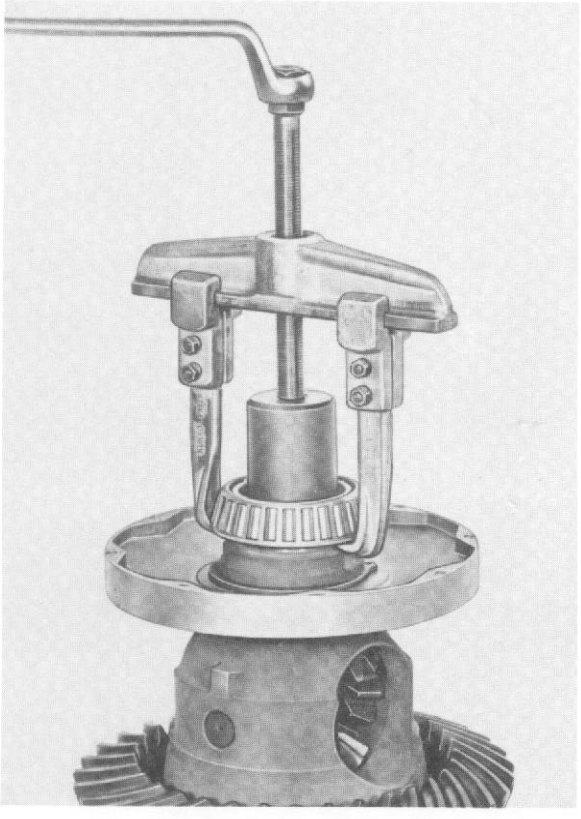
No.	Designation	Qty.	Note when: Removing	Installing
12	Large bevel gear	2		Apply MoS_2 to convex surface. Only replace as a pair.
13	Threaded rod	2		
14	Dowel pin	1		
15	Differential housing	1		

*Needle bearing changed from 86 models onward. The new needle bearings mean that the spacer need no longer be fitted.
The new needle bearings are not interchangeable with the earlier version.

DIASSEMBLING AND ASSEMBLING DIFFERENTIAL

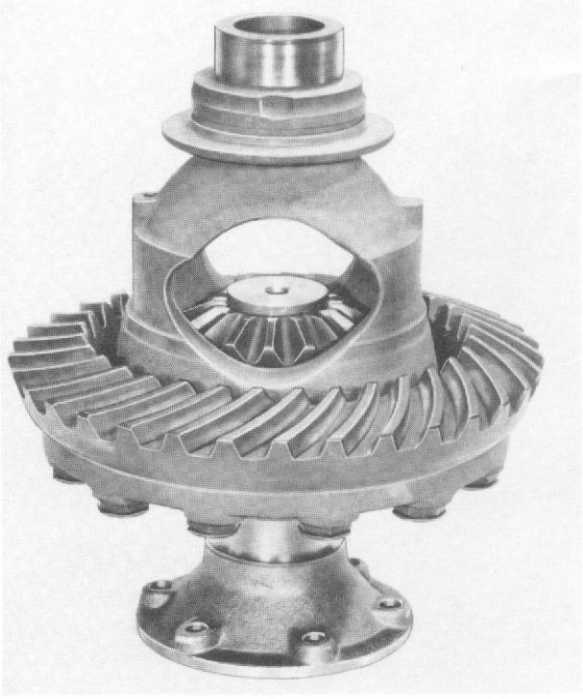
Diassembling

1. Pull off taper roller bearing inner race with a suitable extractor and Special Tool P 263.



2. Coat oval surface of differential gears with MoS_2 paste.

3. Install large differential gears with press-fit threaded plates through large opening in differential case and hold with joint flanges.



Assembling

1. Place ring gear on case and tighten ring gear bolts to torque of 165 Nm (119 ftlb). Slide lockplate into groove of bolts, squeeze together at front with a pliers (to unite lockplate with bolt) and bend down over a hexagon surface to lock.

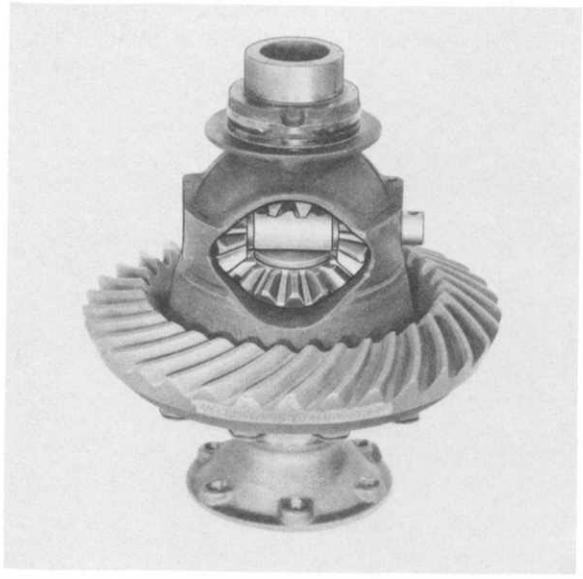
4. Install small differential gears between large differential gears and turn, until bores of gears are aligned with bores in case.



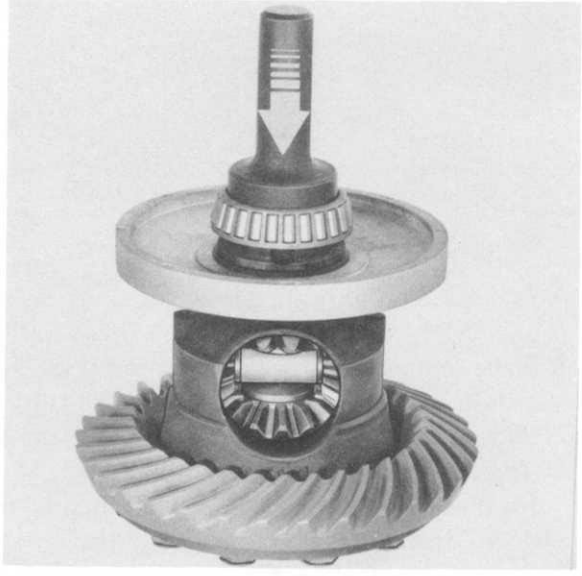
5. Install needle cages and spacer.



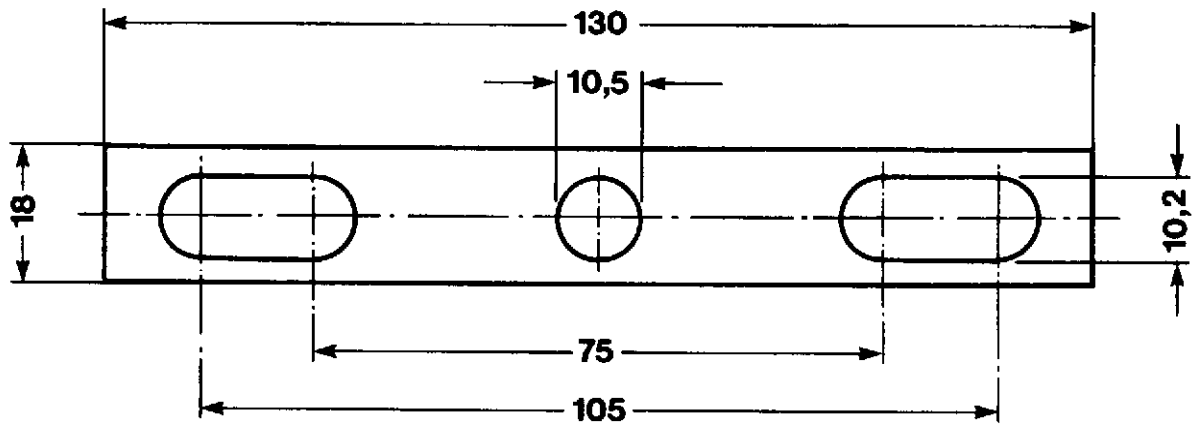
6. Drive in differential shaft in correct position and lock with pin.



7. Drive on taper roller bearing inner race with P 254 b.

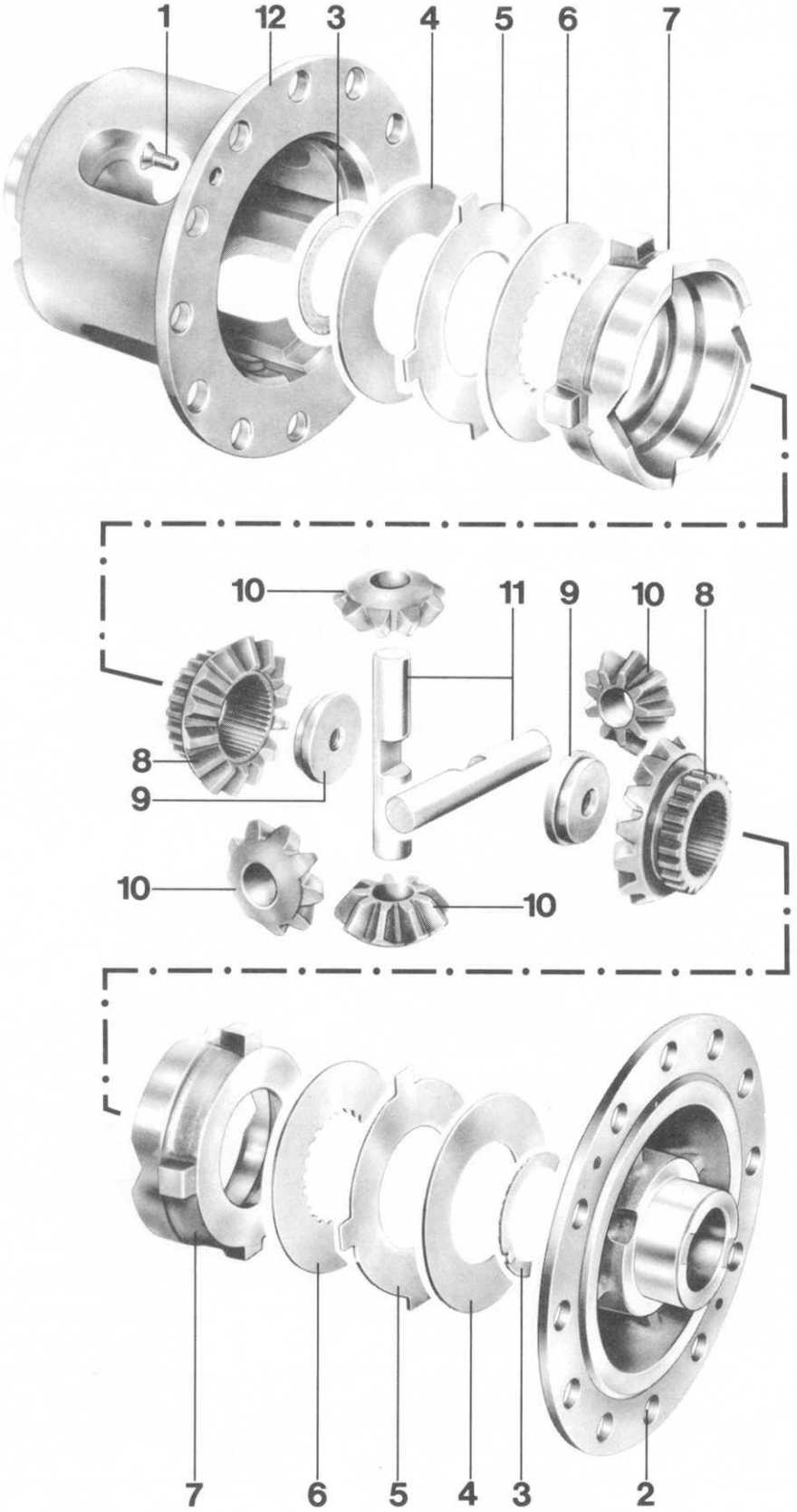


TOOL



No.	Designation	Special tool	Remarks
1	Connector	---	Improvised tool The connector for the flexible flange may be fabricated from a 6 x 18 piece of flat steel.

DISASSEMBLING AND REASSEMBLING LIMITED-SLIP DIFFERENTIAL

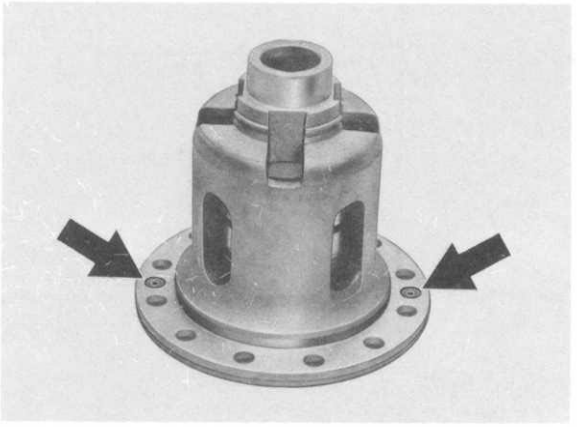


No.	Designation	Qty.	Note when: Removing	Installing
1	Flat-head screw	2		torque down to 10 Nm (7.3 ftlb)
2	Housing cover	1		
3	Take-up disk	2		install in correct position
4	Disk spring	2		install right way round
5	Outer plate	2		
6	Inner plate (molybedenum coating)	2		
7	Pressure ring	2		
8	Axial bevel gear	2		
9	Screw disk	2	push out of axial bevel gear	install in cor-corect position
10	Bevel pinion	4		
11	Differential axle	2		
12	Differential housing	1		

DISASSEMBLING AND REASSEMBLING LIMITED-SLIP DIFFERENTIAL (40% LOCK-UP)

D i s a s s e m b l i n g

1. Unscrew flat-head screw from housing cover and remove cover.



2. Remove all internals.

R e a s s e m b l y

1. Check all parts for wear or damage and replace as necessary.

a) Differential housing:
Check guide grooves for outer plates and pressure rings for wear.

b) Pressure rings:
Check for signs of heavy wear or ridging on the guide dogs and contact surfaces. The rings must move easily in the differential housing.

c) Axle bevel gears:
The contact surfaces for the take-up plates should not be worn and the inner plates must move easily on the splines.

d) Plates:
Check inner and outer plates for wear. There should be no signs of excessive wear on the guide dogs of the outer plates or the teeth of the inner plates.

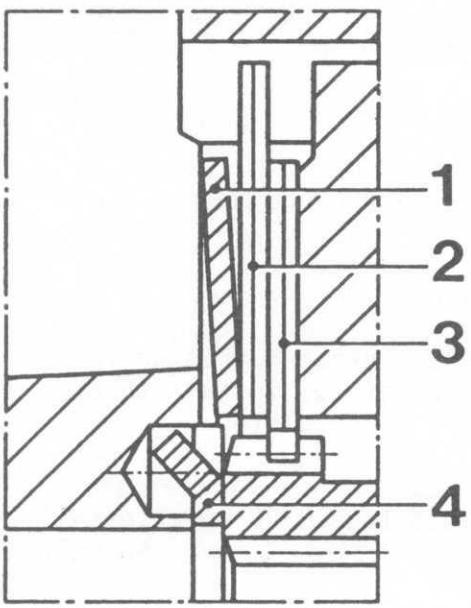
2. Apply transmission oil to all slide faces of plates, pressure rings and differential axles prior to reassembly.

3. Insert take-up disks so that the dog engages the hole in the housing or cover. As an aid to assembly, apply enough grease to the disks to hold them in place.

4.Install remaining components as shown in the exploded drawing.

N o t e

The disk springs must be installed with the convex side pointing in toward the plate package.



1 - Disk spring

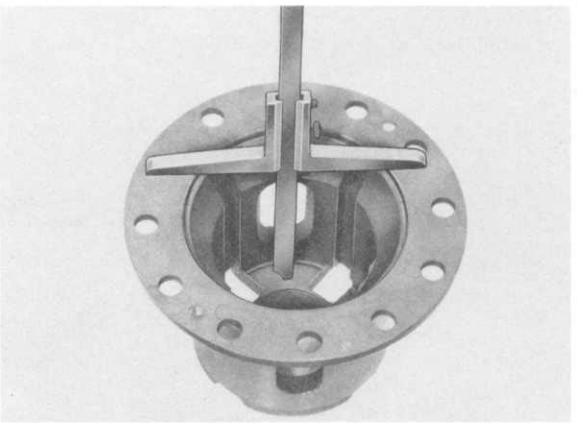
2 - Outer plate

3 - Inner plate

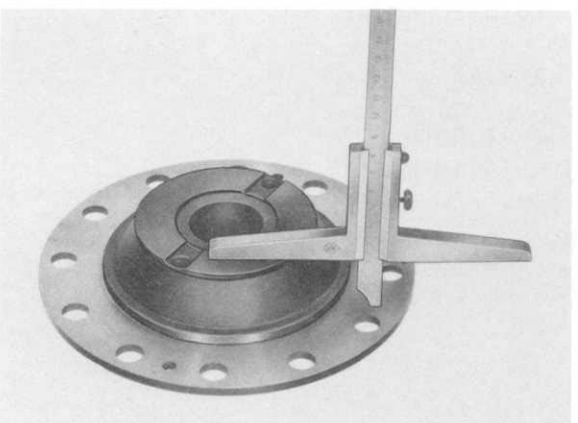
4 - Take-up disk

Reestablishing the thickness of the plate package; if new parts have been installed, the thickness of the plate package must be reestablished.

1.Use a depth gage to measure depth of housing "a".
Example: a = 110.80 mm



2.Measure the cover at "b".
Example: b = 29.20 mm



3.Calculate clearance "c" inside housing. c = a - b

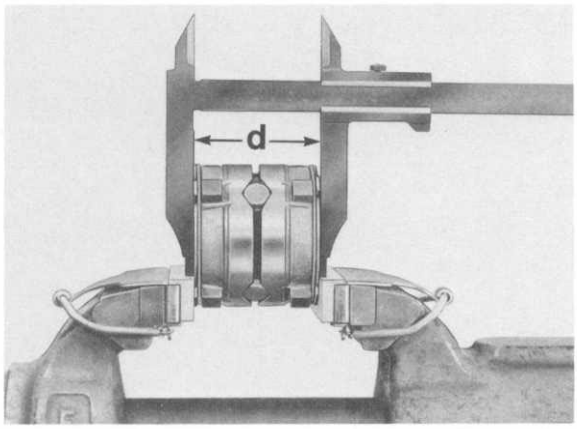
Example:

a = 110.80 mm
b = 29.20 mm

c = 81.60 mm

4.To measure the thickness "d" of the plate package (with 2.0 mm thick outer plates, but without disk springs), hold the plate package lightly in a vise and measure "d" with a micrometer.

Example: d = 76.40 mm.

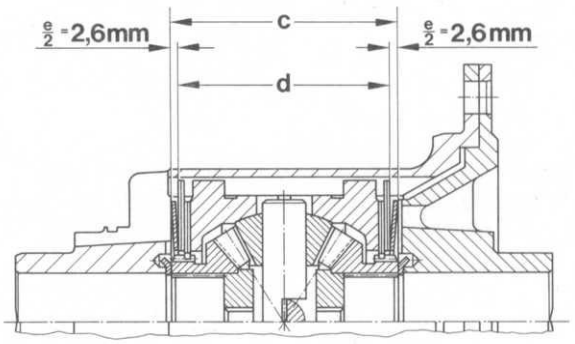


5.To determine "e" (must be equal to 5.20 mm) e = c - d

Example:

c = 81.60 mm
d = 76.40 mm

e = 5.20 mm
========



$e_2 + e_2 = e = 5.2$ mm

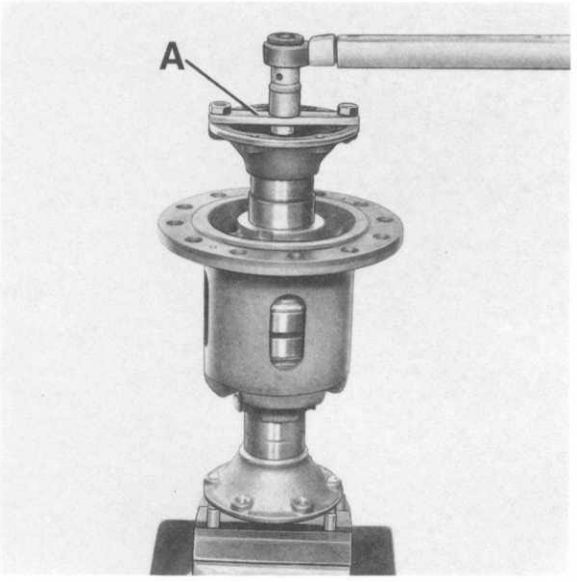
N o t e

If "e" is greater than or less than specified, install thicker or thinner outer plates.

"e" less than 5.20 mm - install thinner plates
"e" greater than 5.20 mm - install thicker plates

Outer plates of thicknesses 1.9 mm, 2.0 mm and 2.1 mm are available.

6.After assembly, measure the slip torque with drive applied to one axial bevel gear and the other fixed. Clamp a flange with two screws in the vise and place differential in position. Locate second flange with improvised connector and turn differential with a torque wrench. A torque of 10...35 Nm (7.3...25 ftlb) must be attained.



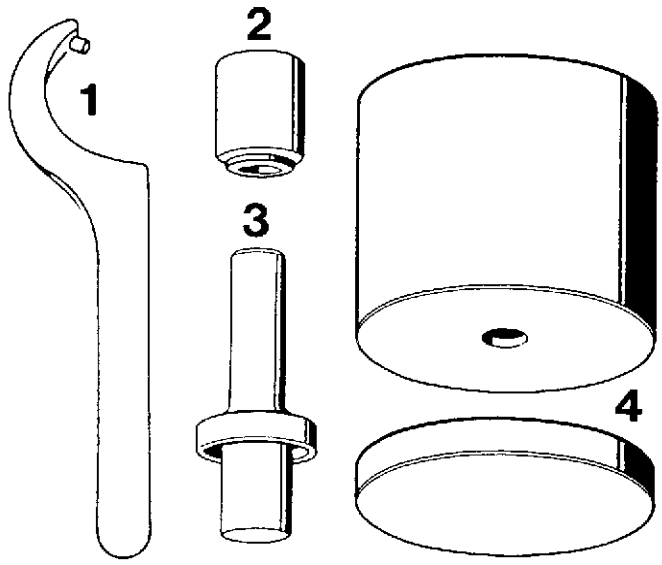
A = Connector (improvised)

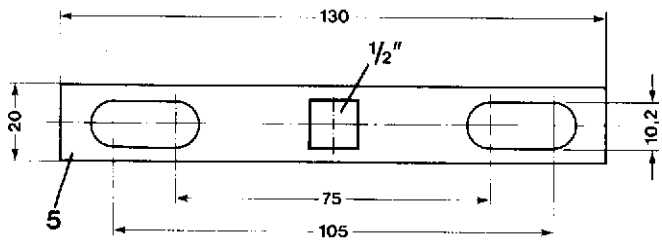
N o t e

If the specified torque is not attained with the thickest outer plates, all the plates are worn and require replacement.

Dismantling and assembling the proportional-slip differential

Tool

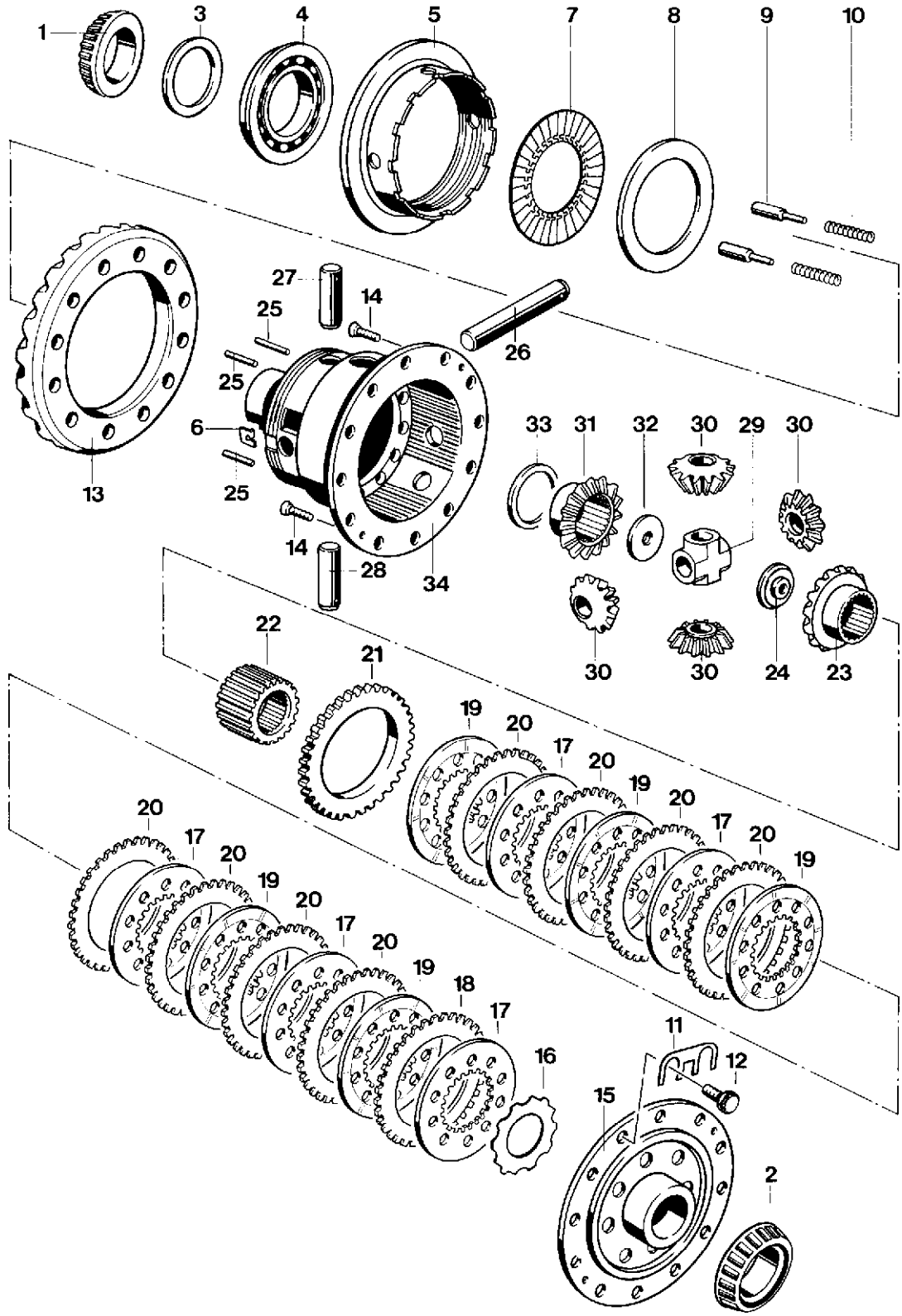




No.	Description	Special Tools	Order Number	Remarks
1	Sickle spanner	–	–	commercially available
2	Thrust piece	P 263	000.721.263.00	
3	Thrust piece	P 264 b	000.721.264.20	
4	Measuring fixture	9508/1	000.721.950.81	2 parts
5	Connection piece	–	–	Self-manufacture (flat steel 10 x 20)

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Dismantling and assembling the proportional-slip differential



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No.	Designation	Qty.	Note when: Removing	Installing
1	Taper roller bearing - Outer raceway	1	Pull off with suitable puller	Press on home with special tool P 264 b
2	Taper roller bearing - Outer raceway	1	Pull off with suitable puller	Press on home with suitable pipe piece
3	Stop disk	1		
4	Engaging bearing	1		
5	Adjusting nut	1	Bend up tab washer, back off nut by several turns and attach adhesive tape to lever disk	Set basic locking torque and secure with tab washer
6	Tab washer	1		Renew
7	Lever disk	1	Degrease surface and fix position of the lever segments with adhesive tape	Install in correct position, Pull off fixing tape
8	Thrust ring	1		Flat side to the thrust pins
9	Thrust pin	4		Replace in sets only
10	Pressure spring	4		
11	Tab washer	6		Replace. Push into the groove of the hexagon screws, pull together at the front with plyers (so that the tab washer is firmly attached to the hexagon screw) and secure downwards over a hexagon face.
12	Hexagon screw	12		The thread must be dry and free of grease. Tighten with 165 Nm

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No.	Designation	Qty.	Note when: Removing	Installing
13	Ring gear	1		Heat up to approx. 120 °C, threads for ring gear screws must be dry and free of grease. Pay attention to pair number. Readjust if necessary.
14	Countersunk screw	2		Tighten with 10 Nm
15	Cover	1		
16	Friction washer	X	Note thickness for re-installation	Redetermine thickness if necessary
17	Inner plate (sintered coating)	5		Oil with gear oil. The oil bores in the support plate must be positioned exactly flush over each other
18	Outer adjusting plate	X	Note thickness for re-installation	Redetermine thickness if necessary
19	Inner plate (Gylon)	5		Pay attention to installation position. The color point must be visible during assembly. Oil with gear oil
20	Outer plate (1.5 mm thick)	8		
21	Thrust ring	1		Large, flat side faces the plate assembly
22	Plate support	1		
23	Axle bevel gear	1		Replace only in sets with taper pinion
24	Threaded piece	1		
25	Clamping pin	3		Drive in so that position is correct
26	Pin	1		
27	Pin	1		

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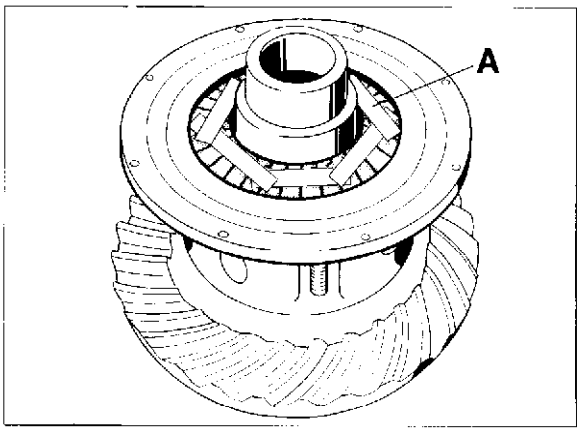
No.	Designation	Qty.	Note when: Removing	Installing
28	Pin	1		
29	Cross-piece	1		
30	Taper pinion	4		Replace only in sets with axle bevel gears
31	Axle bevel gear	1		Replace only in sets with taper pinion
32	Threaded piece	1		
33	Friction washer	X	Note thickness for re-installation	Redetermine thickness if necessary
34	Housing	1		

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Assembly and dismantling instructions

Dismantling

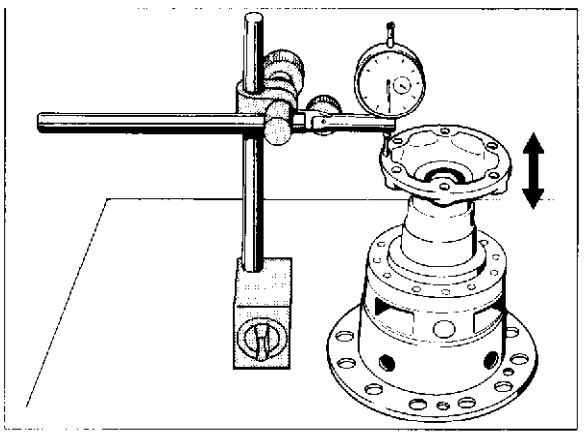
Relieve the lever disk (No. 7) by undoing the adjusting nut (No. 5). Degrease the lever disk and fix the segments for re-installation with adhesive tape.



A = Adhesive tape 296-39

Assembly

1. Determine the axial play of the axle bevel gears and adjust to 0.05...0.15 mm by inserting the corresponding friction washers (No. 16/33).

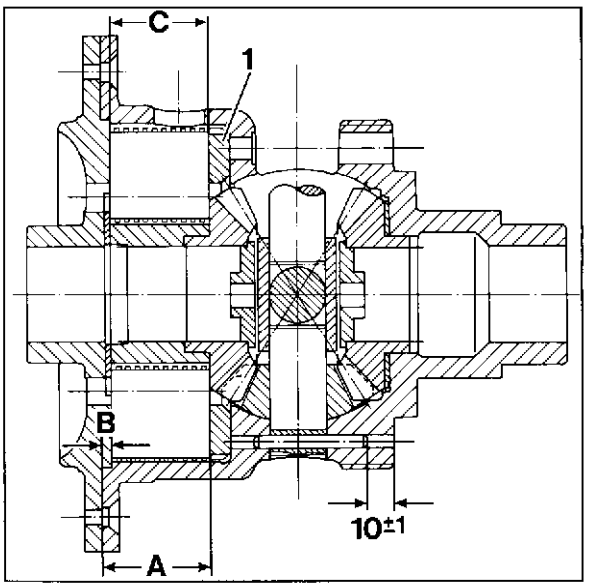


197-39

Note

If parts (e.g. differential housing or bevel gears) are replaced, the finished friction washers must be installed for measurement.

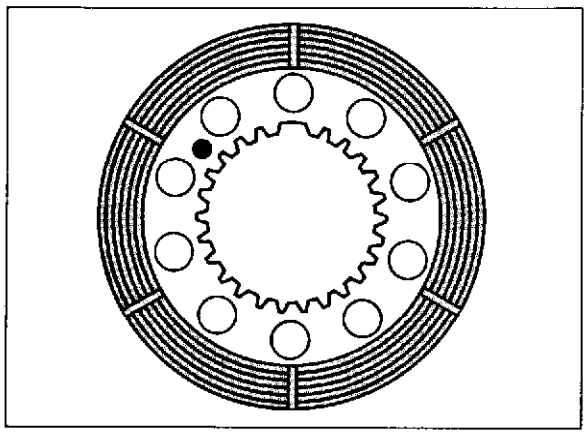
2. Drive in the clamping pins for the taper pinion shafts in the correct position.



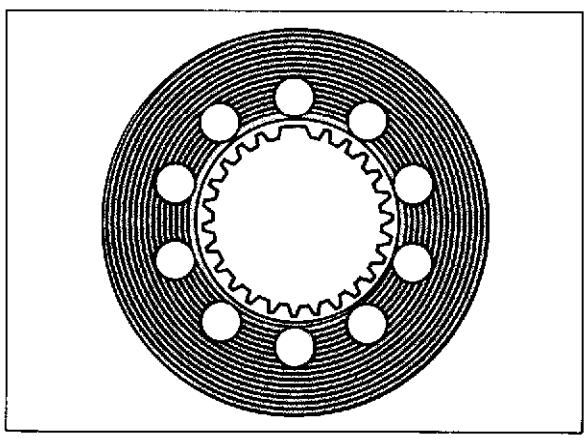
297 - 39

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3. Distinguishing features of the inner plates:

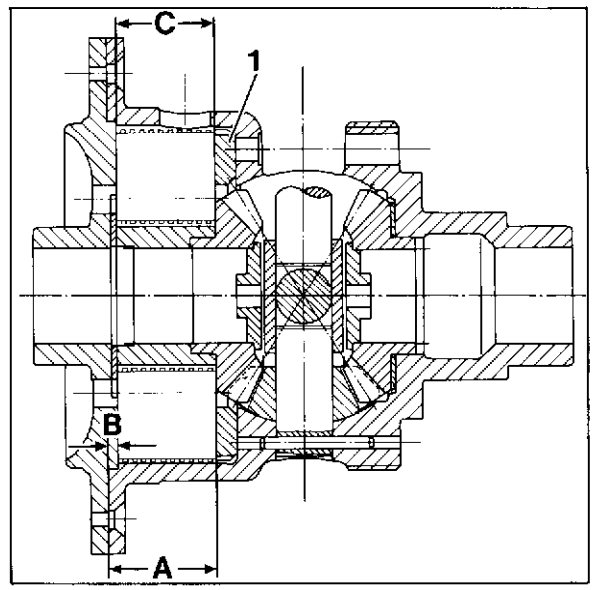


Inner plate (Gylon) 288-39



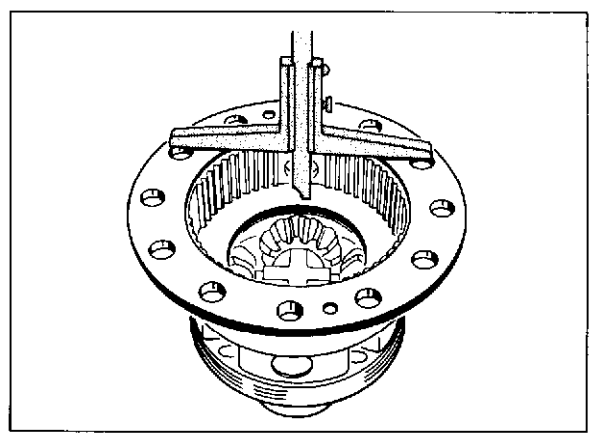
Inner plate (Sintered coating) 289-39

4. Determine the thickness of plate assembly "C":



1 = Thrust ring
C = Assembly thickness 297-39

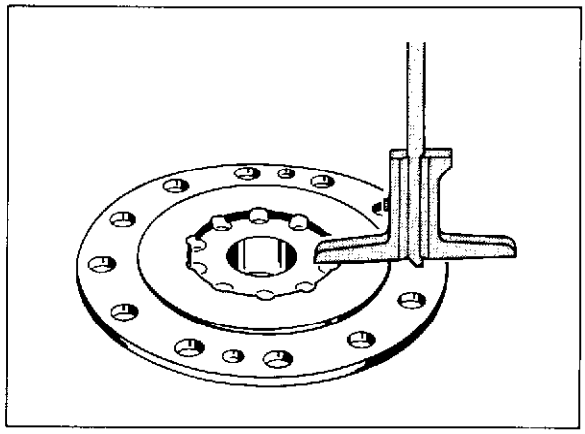
- Fit the thrust ring and determine the dimension "A":



299-39

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- Determine the dimension "B"



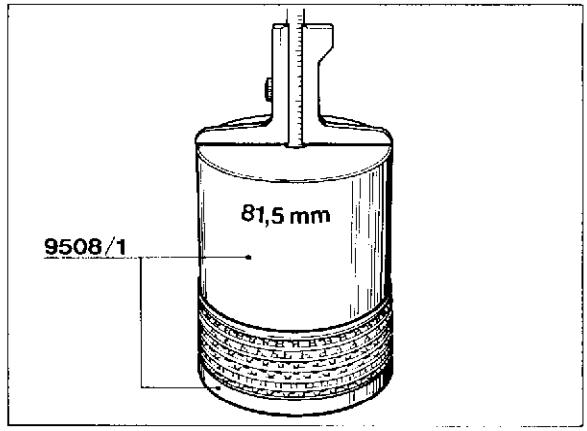
300-39

- Determine the clear distance "C" (assembly thickness) in the housing.
  "C" = "A" - "B"

Example:

A =		38.90 mm
B =	–	3.60 mm
C =		35.30 mm

Assemble the complete plate assembly in accordance with the exploded drawing and measure with special tool 9508/1.



184-39

Example

Measurement result:		115.30 mm
Height of the special tool*	–	81.50 mm
Package thickness		33.80 mm

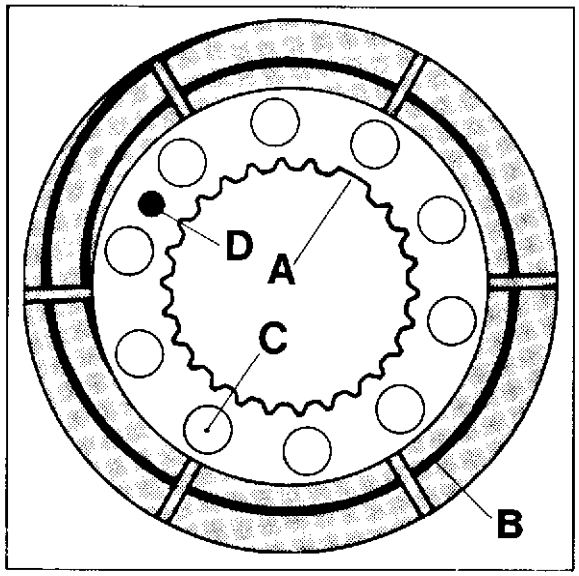
* marked on tool

- Adjust the thickness of the plate assembly to the calculated value "C" ± 0.1 mm by means of the outer adjusting plate (No. 18).

5. Installation position of Gylon inner plates:
   Fit Gylon inner plates so that the color point is visible during assembly and so that the spiral groove for the oil supply runs from inside to outside in clockwise direction when looking at the plate assembly (assembly direction) (refer to simplified diagram).

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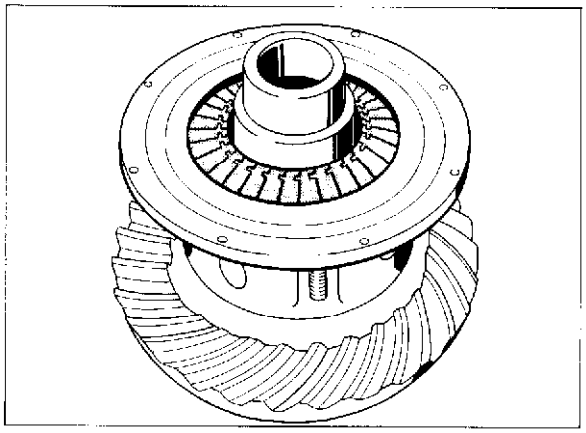
In addition, the oil bores in the supply plate of the inner plates must lie exactly flush over each other. A missing tooth on the support plate facilitates assembly.



207-39

A = Missing tooth
B = Spiral groove
C = Oil bore
D = Color point

6. Installation position of the lever disk.

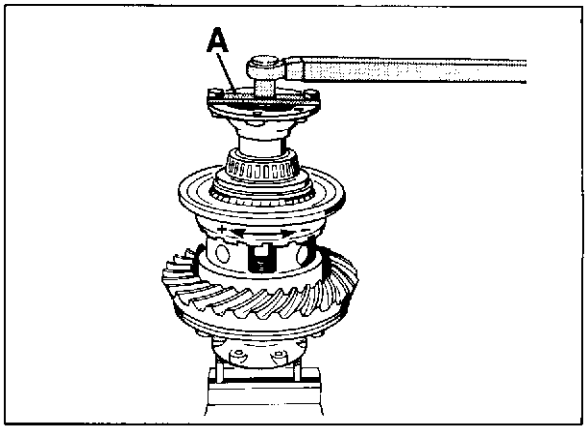


295-39

7. Setting the basic locking torque

- Limited-slip differential completely assembled (with engaging bearing and taper roller bearing inner raceways)

- Measure the cranking torque with one fixed and one driven axle bevel gear. For this purpose, clamp one flange in the vice with two screws and measure the torque at the other flange.



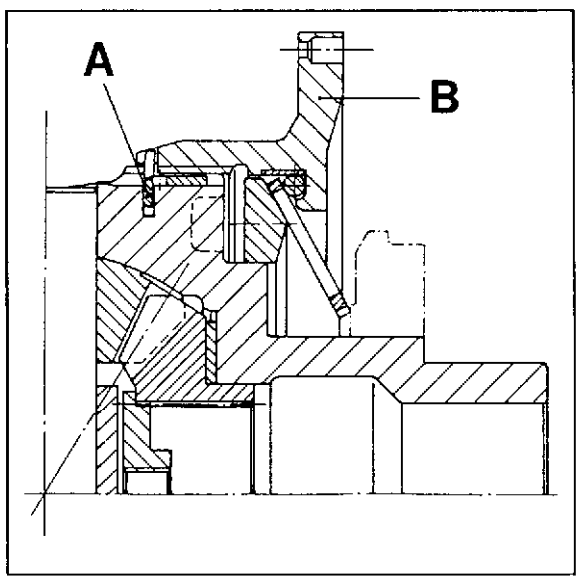
A = Connection piece

301-39

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- Adjust the cranking torque to 100 Nm by turning the adjusting nut with the sickle spanner. Then back off the adjusting nut to the locking groove at which the torque is just below the cranking torque of 20 Nm.

- Secure the adjusting nut with a tab washer.

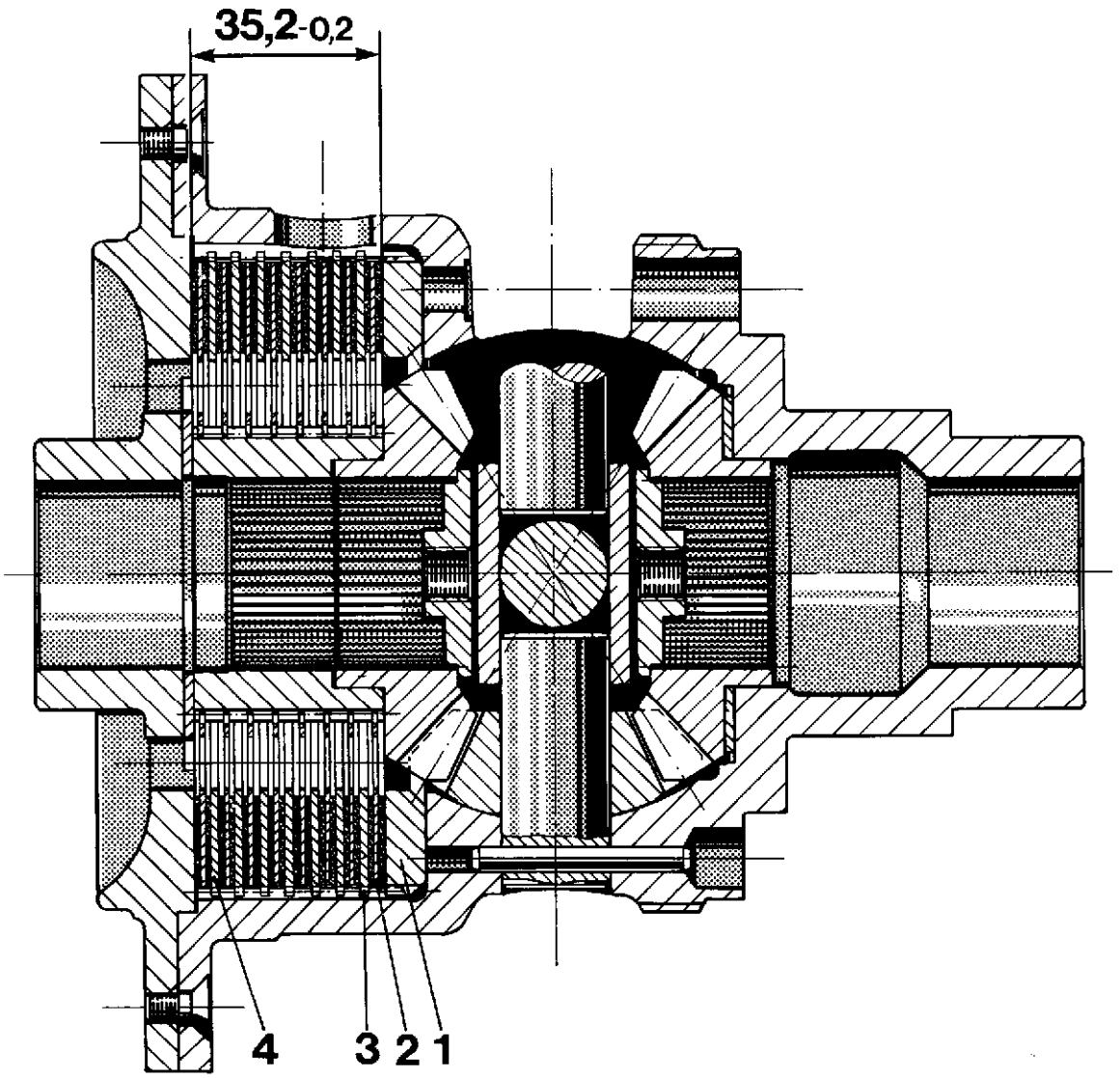


287-39

A = Tab washer
B = Adjusting nut

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Dismantling and ass. controlled lim. slip differential with Valeo friction discs



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No.	Designation	Qty.	Note: Removal	Note: Installation
1	Thrust ring	1		Large, flat side faces disc pack
2	Inner disc (Valeo)	8		
3	Outer disc (1.5 mm)	6		
4	Outer disc (Adjusting disc)	1		

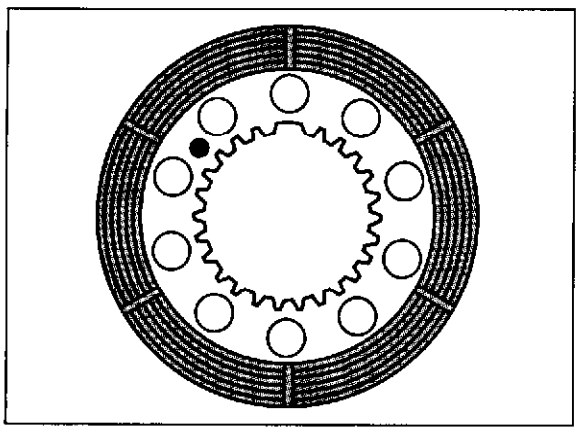
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Dismantling and assembly notes

Note

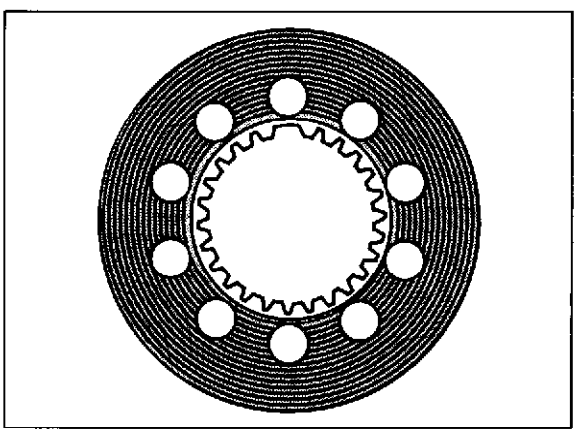
Following fitting of the Valeo friction discs, stacking and adjustment of the disc pack have been modified.

1. Differences between the types of inner discs used:



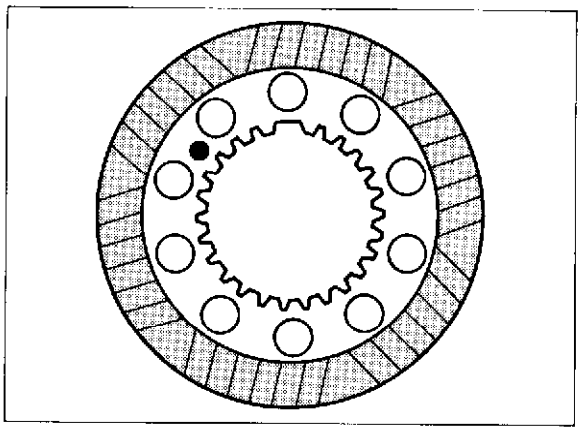
288-39

Inner disc (Gylon)



289-39

Inner disc (sintered bellows)



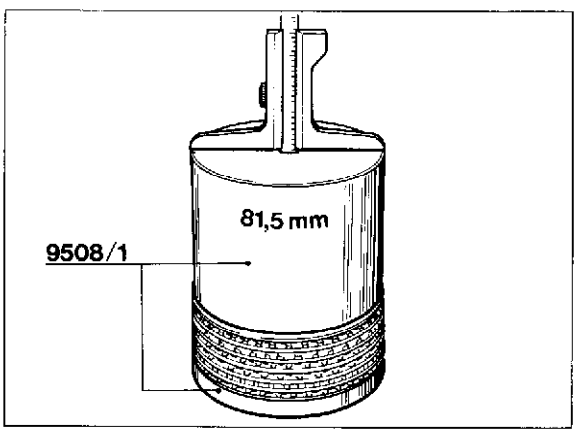
1311-39

New Valeo inner disc

2. Determine thickness of disc pack

Pack thickness (new) = 35.2 – 0.2 mm
Wear limit = 33.8 mm

Measure complete disc pack without thrust ring using Special Tool 9508/1.



184-39

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Example

Measurement result	115.20 mm
Special tool height*	– 81.50 mm
Pack thickness	33.70 mm

* Engraved on Special Tool

Note

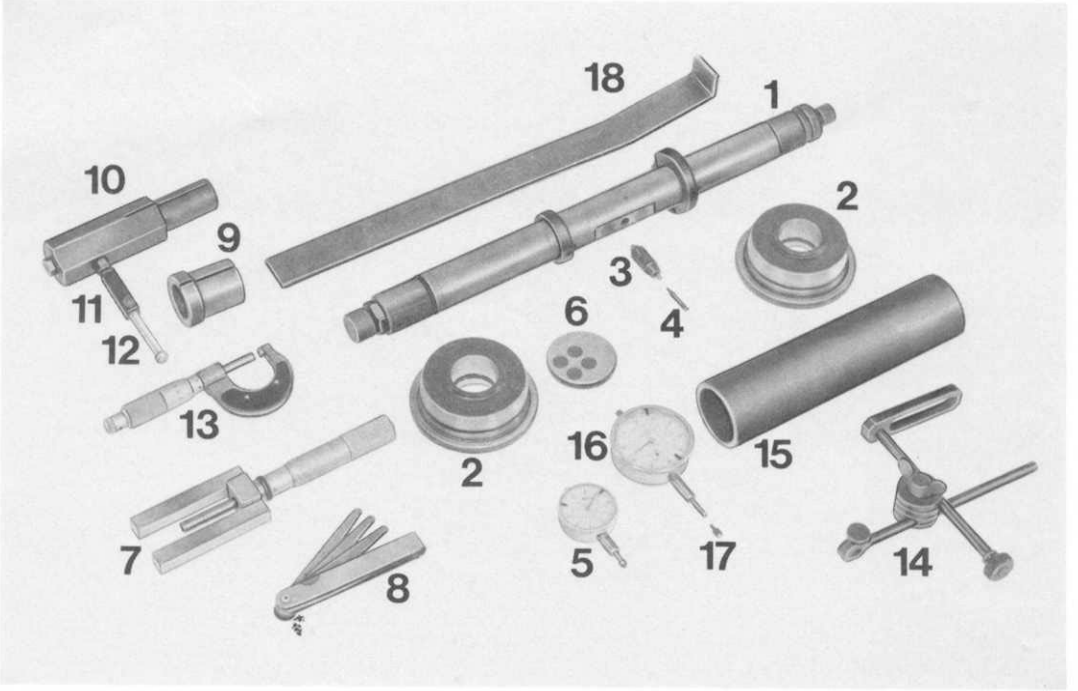
If the wear dimension has been reached, all inner discs must be replaced. To adjust the discs to the specified pack thickness, use the outer adjusting disc (No. 4).

3. Oil discs with transmission oil before fitting.

4. The oil bores in the carrier plate of the inner disc must line up exactly.

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TOOLS

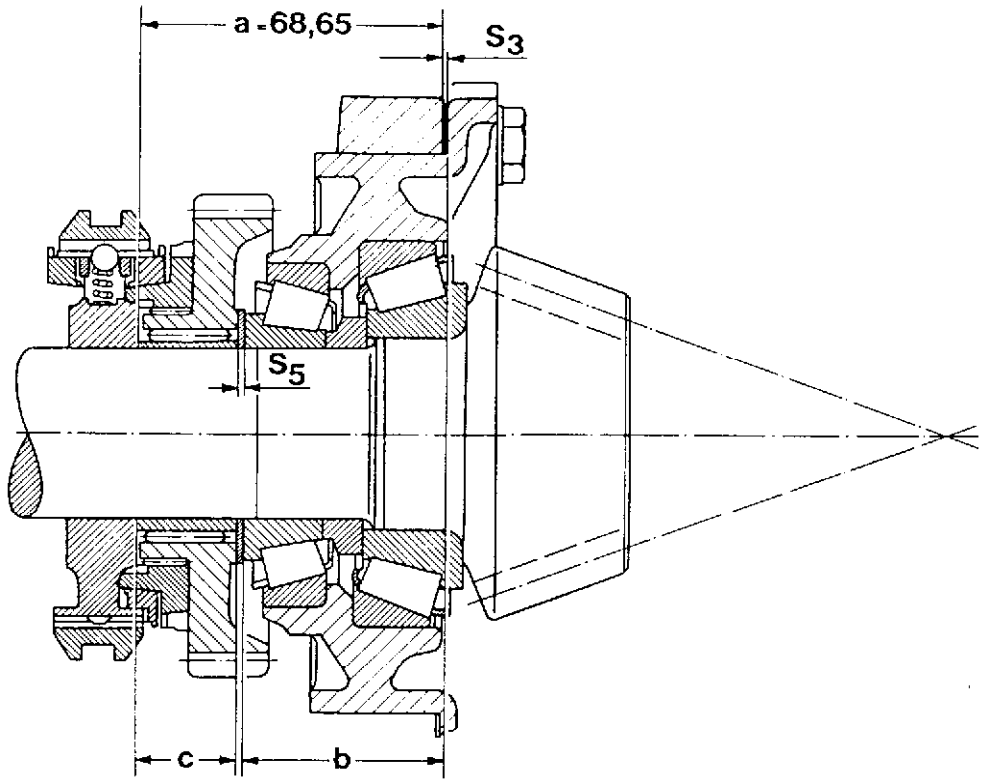


No.	Description	Special Tool	Remarks
1	Universal gage	VW 385/1	
2	Centering discs	VW 385/4	
3	Gage plunger	VW 385/14	
4	Dial gage extension	9150	
5	Dial gage	-	Standard, 3 mm range
6	Gage plate	VW 385/17	
7	Master gage	VW 385/30	
8	Feeler gage	-	Standard, 0.05 to 1 mm
9	Bushing	9145	
10	Locking sleeve	VW 521/4	
11	Adjustable lever	VW 388	
12	Gage plunger	9196	
13	Gage bolt	-	Standard
14	Dial gage holder	VW 387	
15	Pipe	9238	
16	Dial gage	-	Standard
17	Dial gage extension	VW 382/10	
18	Lever	-	Local manufacture

DETERMINING THICKNESS OF SHIM S_5 ON DRIVE SHAFT

N o t e

The thickness of the shim determines the position of the idlers and reverse gear relevant to the housing and to the selector rods/selector forks.



Size "a" = Specified size determined by design factors (68.65 mm)
Size "b" = Flange area bearing cover to end of drive-fit tapered roller bearing
Size "c" = Length of needle bearing - inner race
S_3 = Shim S_3

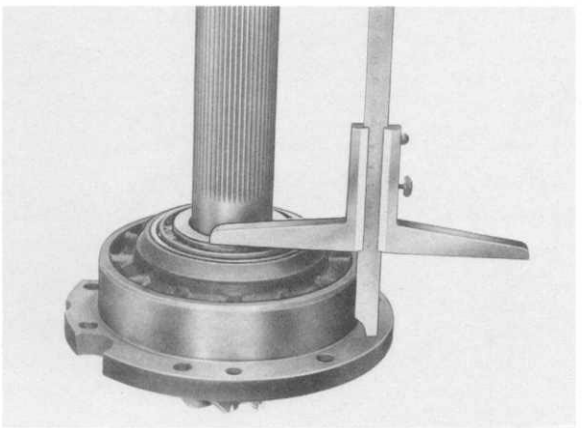
To calculate the thickness of the shim

$$S_5 = 68.65 - b - c + S_3$$

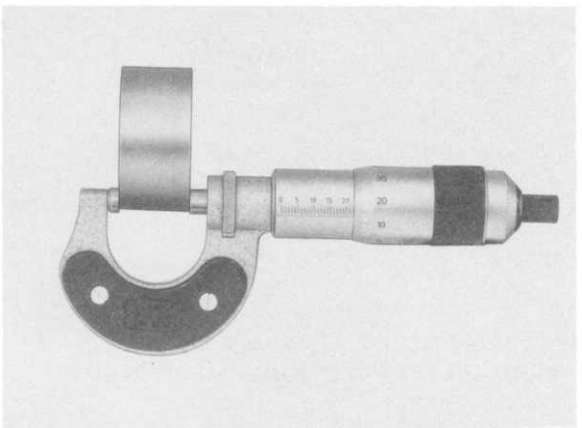
b, c and S_3 are measured values

Measuring Procedure:

1. Determine thickness of shim S3 (see page 39 - 221).
2. Apply 20 kN (2t) to the bearing assembly, pressing it on to drive shaft.
3. Measure "b" (e.g. 44.20 mm).



4. Measure "c" (e.g. 22.18 mm).



5. Calculate S_5

$S_5 = 68.65 - b - c + S_3$

$S_5 = 68.65 - 44.20 - 22.18 + 0.45$

$S_5 = 2.72$

Note

Shims from 2.20 mm to 3.30 mm are available in 0.1 mm graduations.

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Note

For manufacturing reasons at the beginning of standard production transmissions of

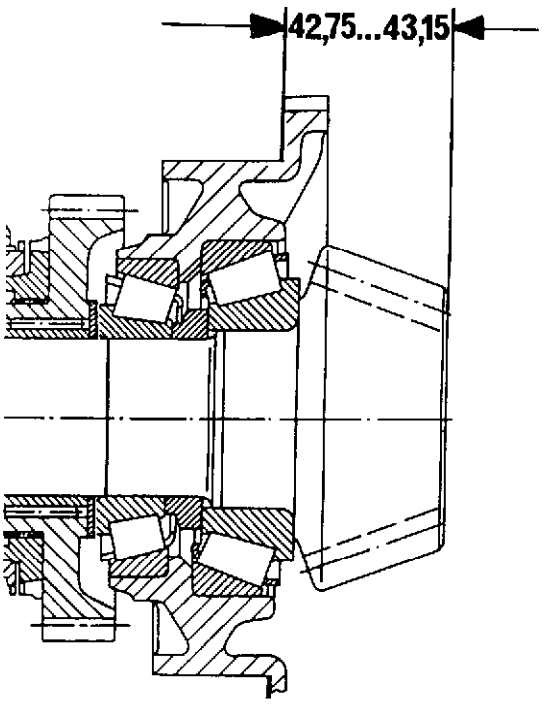
Type G 28.10 from Transm. No. 11 F 00070 to 11 F 00451
and
Type G 28.11 from Transm. No. 11 F 05069 to 11 F 05322

had been assembled with bearing assemblies, for which the following adjustment has to be made to determine the thickness of shim S_5.

$$S_5 = 112.00 - b - c + S_3 - 0.5$$

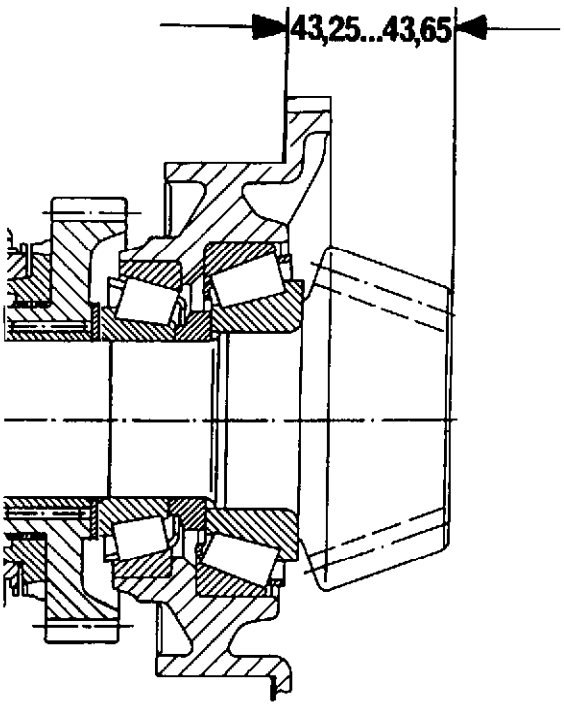
Old and new bearing assemblies differ as shown below.

Old Version



$S_5 = 112.00 - b - c + S_3 - 0.5$

New Version



$S_5 = 112.00 - b - c + S_3$

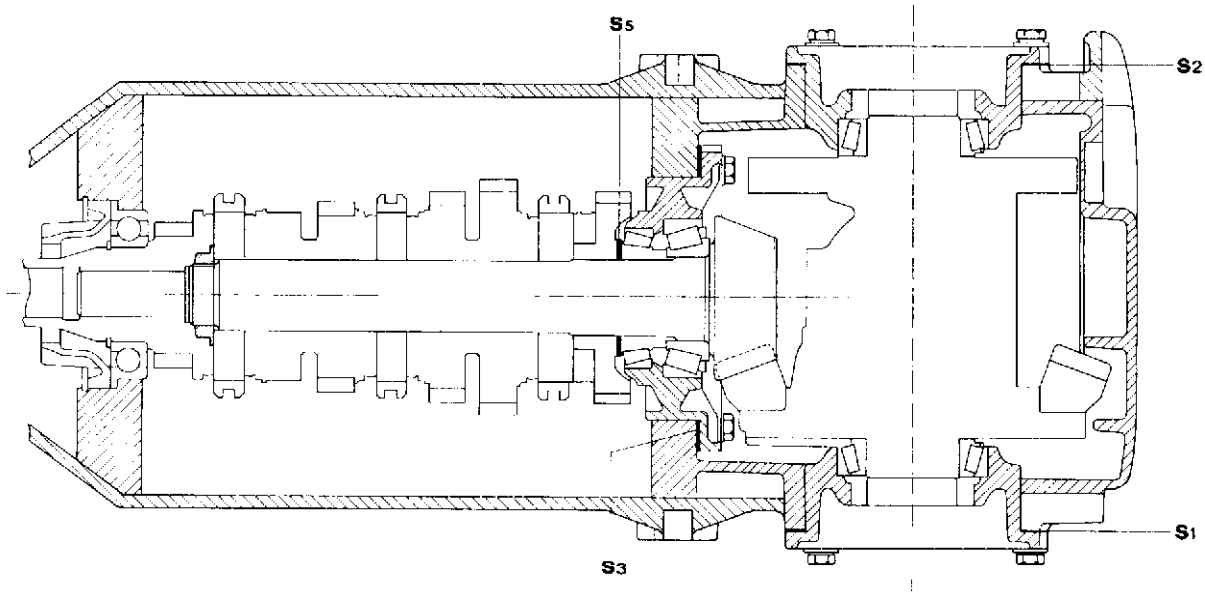
Recommended Sequence of Adjusting Drive Pinion and Ring Gear

When it becomes necessary to adjust the drive pinion and ring gear, it would be in the interest of economical procedures to keep to the following sequence.

1. Determine the total shim thickness "Stot" (S_1 plus S_2) for the specified pre-load of the taper roller bearing/differential.
2. Determine shim thickness "S_3".
3. Determine shim thickness "S_5".
4. Divide total shim thickness "Stot" in S_1 and S_2 so that there is the specified amount of backlash between the ring gear and drive pinion.

The goal of adjustments is to relocate the point of optimal quiet running as was determined in the special testing machine during production.

Perfect results require absolute care and cleanliness during all assembly measuring operations.



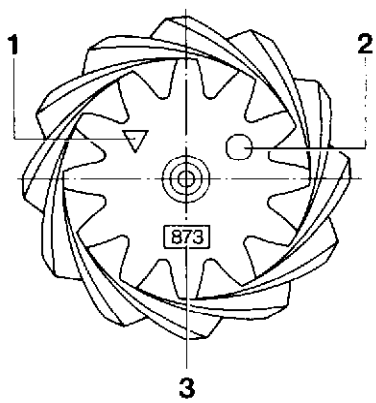
Location of Shims

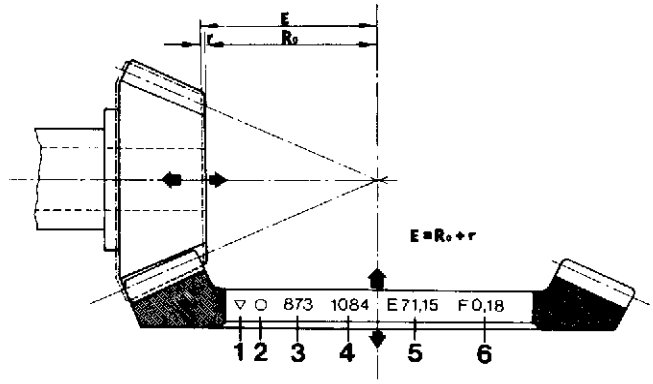
S_1 = Shim for ring gear
S_2 = Shim for ring gear
S_3 = Shim for ring gear
S_5 = Shim for pinion/ring gear

ADJUSTING DRIVE PINION AND RING GEAR

General

Careful adjustment of the pinion and ring gear is important to guarantee a long service life and quiet running for the final drive. This is why pinions and ring gears are matched during production and checked on special testing machines for the most favorable surface appearance and low noise levels in both directions of rotation. The position of quietest running is determined by moving the pinion in an axial direction, keeping the ring gear within specified backlash tolerances. The devitation "r" from the design distance "R_o" is measured, added to design distance "R_o" and inscribed on the ring gear as adjusting distance "E".





1 = Porsche trademark
2 = Manufacturing code
3 = Serial pair number from 001 to 999
4 = Manufacturing month and year, four digits (e.g. 1084)
5 = Adjusting distance E (e.g. E 71.15)
6 = Backlash F (e.g. F 0.18)
R_o = Design distance 70.70 mm
E = Adjusting distance (R_o + r)
r = Devitation from R_o

The drive pinion and ring gear only have to be adjusted when jobs on the final drive require the replacement of parts having direct influence on the adjustment. Refer to the following table to avoid unnecessary adjustments!

Adjust / Replaced Part	Ring Gear ($S_1 + S_2$)	Drive Pinion with Adjusting Distance "E" (S_3)
Transmission case	X	X
Side transmission cover	X	X
Bearing bracket with taper roller bearing for drive pinion	X	X
Drive pinion/ring gear	X	X
Differential case	X	
Taper roller bearing for differential	X	

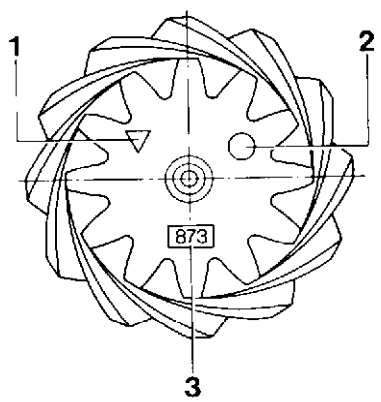
Note

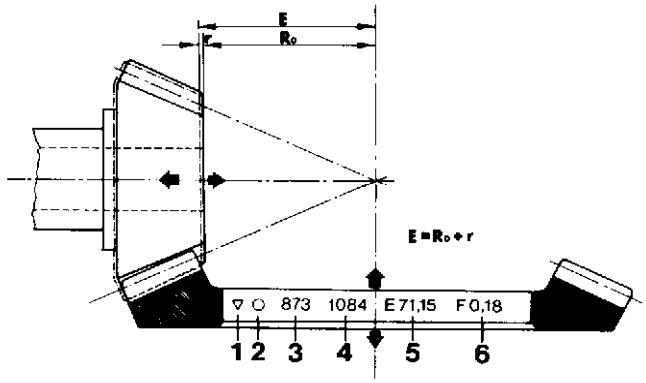
When changing shim thickness S_3 it will always be necessary to redetermine the thickness of shim S_5.

Adjusting Pinion

Note

There are different marks and codes for adjustment of the drive pinion/ring gear from 1985 models on.





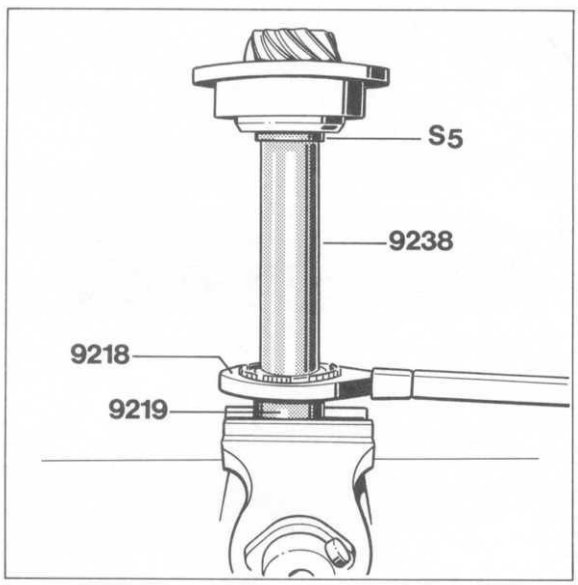
1 = Porsche trademark
2 = Manufacturing code
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4 = Manufacturing month and year, four digits (e.g. 1084)
5 = Adjusting distance E (e.g. E 71.15)
6 = Backlash F (e.g. F 0.18)
R_o = Design distance 70.70 mm
E = Adjusting distance (R_o + r)
r = Deviation from R_o

With the new system (e.g. E 71.15) it is no longer necessary to look for the corresponding design distance R. E, the adjusting distance, can be applied direct on the master gage without calculations.

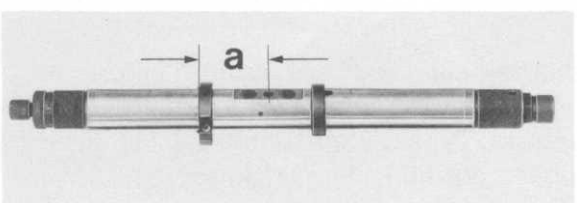
Note

In older model manual transmissions the complete drive pinion had been installed before adjusting the pinion in the case.
This is no longer possible from 1985 models on (Transm. Type G 28/10 and G 28/11), since shim thickness S_5 can only after determining the pinion position (shim thickness S_3).

1. Mount bearing assembly on drive pinion and preload with 20 kN (2 tons).
2. Slide Special Tool 9238 with shim "S_5" on drive pinion in place of gear set, install 4th and 5th gear guiding sleeve and tighten collar nut to torque of 300 Nm (217 ftb). Use Special Tools 9218 and 9219 for this operation.

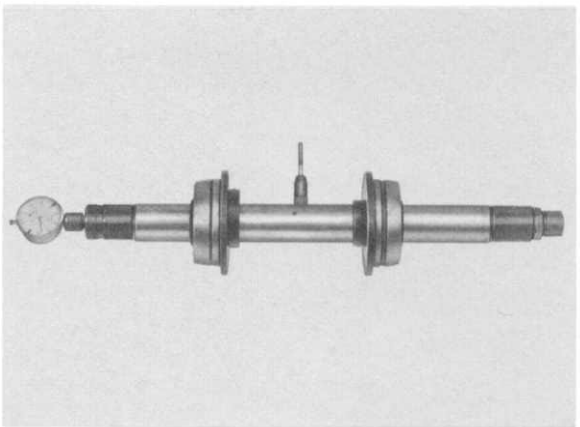


3. Install drive shaft.
4. Install drive pinion without shim S3 and tighten all bearing cap bolts to torque of 30 Nm (22 ftlb).
5. Install one side bearing cap without an O-Ring and bolt down with two hexagon head bolts.
6. Set adjusting ring of universal gage VW 385/1 to distance "a".

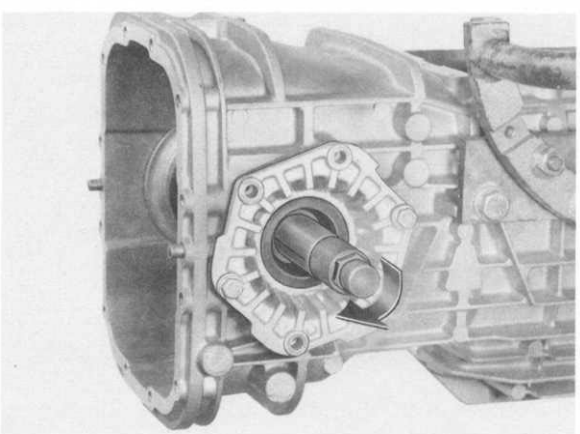


a = approx. 80 mm

7. Slide centering discs VW 385/4 on to universal gage and screw in gage plunger VW 385/14 with a 20 mm dial gage extension 9150.



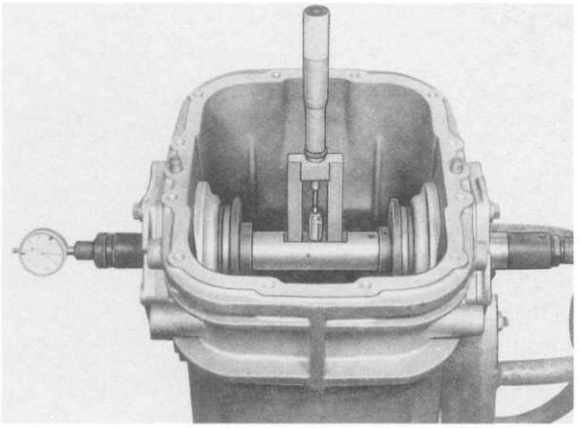
8. Insert universal gage in case.
9. Install second side bearing cap without an O-ring and bolt down with two hexagon head bolts.
10. Pull out centering discs of universal gage with the spindle far enough, that the univer sal page can still be just turned by hand.



11. Set master gage VW 385/30 to adjusting distance E (e.g. 71.15 mm).

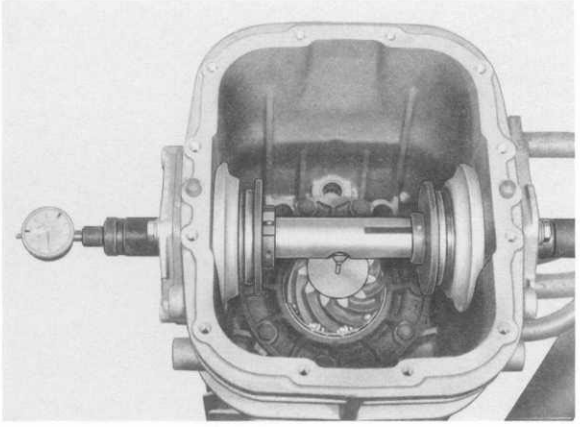
Printed in Germany – XXXI, 1993

12. Apply master gage and set dial gage (3 mm range) to zero with 1 mm preload.



13. Place gage plate VW 385/17 on pinion head.

14. Turn universal gage carefully unitl dial gage extension is perpendicular to face of pinion head. At this moment the dial gage needle reaches its reversing motion point, at which the dial gage must be read.



Note

The measured value will always deviate from the set distance "E" in antilockwise direction (small needle of dial gage will be between 0 and 1), i.e. if the dial gage has a preload of 1 mm the value deviating from 1 must be added to shim thickness S3.

15. The determined amount of deviation is shim thickness S3 and this shim is installed between the bearing cap and transmission case. Round of this value to the nearest 0.05 mm (e.g. 0.22 mm rounded off to 0.25 mm).

16. Determine shim thickness S5 (see page 39 - 215).

17. Recheck adjusting distance "E" after installing the shims of determined thickness. A deviation of ± 0.03 mm is acceptable.

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ADJUSTING RING GEAR (Stotal)

Note

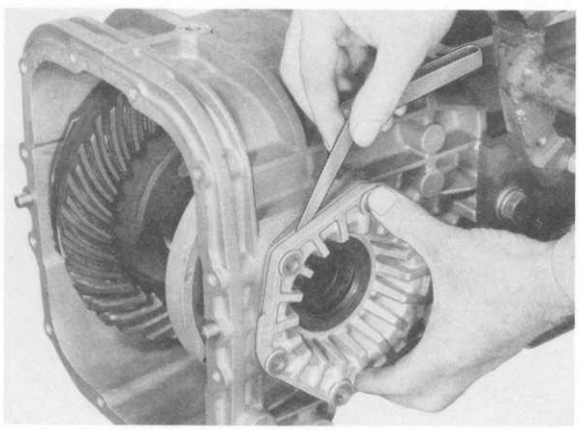
The drive pinion must not be installed for this adjustment.

1. Install differential with ring gear in case.

2. Install side transmission cover (ring gear end) without shims and tighten all bolts to torque of 22 Nm (16 ftlb).

3. Guide in second side transmission cover without shims carefully.

4. Check gap between transmission case and side transmission cover with a feeler gage.



5. Calculate total shim thickness "Stot".

Stot = Gap - 0.03 mm (bearing preload)

Example:

Gap		1.25 mm
Bearing preload	-	0.30 mm
Stot		0.95 mm

ADJUSTING BACKLASH

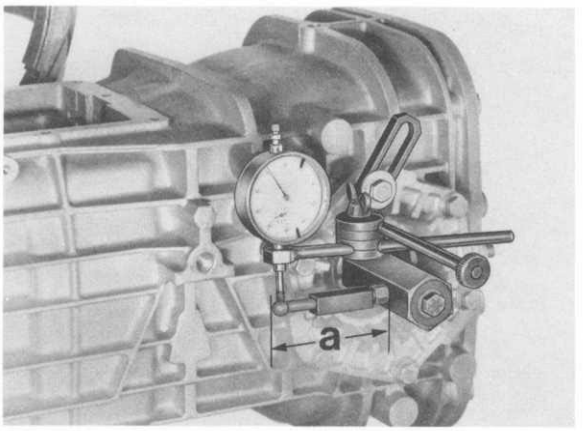
1. Install drive pinion with shims S_3 determined for drive pinion adjustment and tighten all bearing cap bolts to torque of 30 Nm (22 ftlb).

2. Place differential in case.

3. Install side transmission covers, placing determined shim "Stot" on ring gear end and tightening all bolts to torque of 22 Nm (16 ftlb).

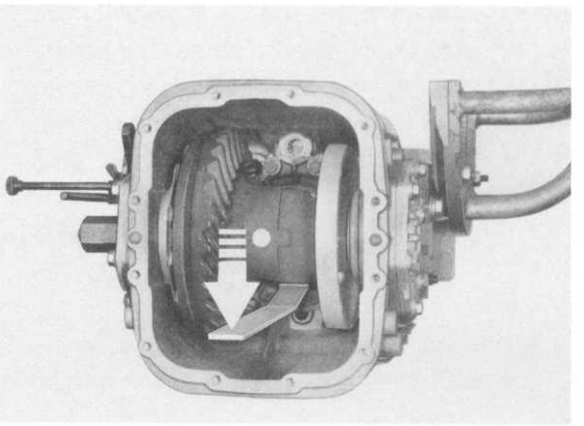
4. Turn differential in both directions several times to settle taper roller bearings.

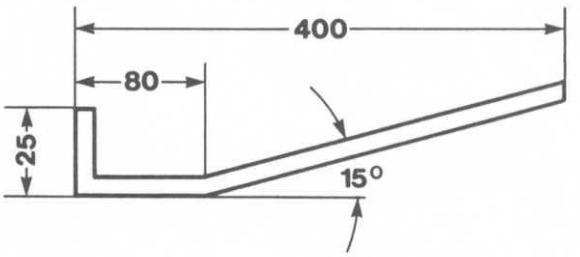
5. Install gages, setting gage plunger VW 388 to distance "a" = 80 mm.



6. Turn ring gear carefully to stop by hand and set dial gage to zero.

7. Hold drive pinion with locally manufactured hooks and turn back rings gear carefully. Read and note amount of backlash.





Hooks manufactured locally of 30 x 5 mm flat steel.

DETERMINING THICKNESS OF SHIMS S_1 AND S_2

The measured backlash must be brought to the value specified by the drive pinion/ring gear manufacturer by way of dividing "Stot".

The specified backlash is inscribed on the ring gear. Deviations of up to - 0.05 mm are acceptable. The specified backlash must never be exceeded.

Determining Shim Thickness S_1 (Ring Gear End)

S_1 = Stot (total shim thickness)
- measured backlash
+ specified backlash (inscribed on ring gear)

Example:

Stot	0.95 mm
- measured backlash	0.88 mm
	0.07 mm
+ specified backlash (e.g. 0.20 mm)	0.20 mm
S_1	0.27 mm

Determining Shim Thickness S_2 (Opposite Ring Gear)

S_2 = Stot - S_1

Example:

Stot	0.95 mm
S_1	- 0.27 mm
S_2	0.68 mm

Note

Experience with these drive pinions/ring gears has shown that shims S_2 (opposite ring gear) can be selected approx. 10 to 15 % thinner in favour of shims S_1 (ring gear end).

1. Remove side transmission covers and divide shims "Stot" to give the shim thickness determined for S_1 and S_2.

Note

Make sure of a certain amount of backlash when tightening nuts for the side transmission covers. The drive pinion and and ring gear must never be brought to seize.

2. Check backlash and, if necessary, change shims S_1 and S_2 again until specified backlash is reached.

3. Check backlash on periphery four times by turning ring gear 90° each time. The four measurements must not deviate from each other by more than 0.05 mm.

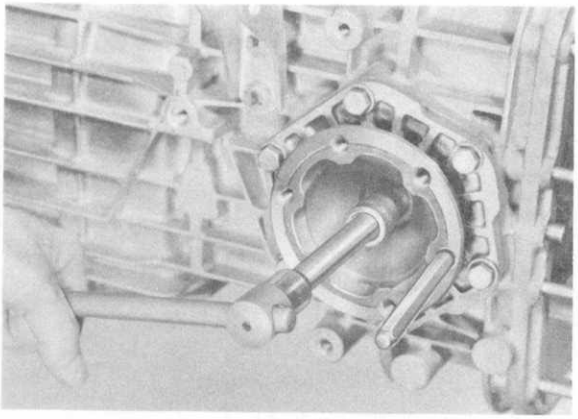
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Nut	12		Tighten to specified torque	
2	Washer	12		Replace if necessary	
3	Holder	1			
4	Rear cover	1			
5	Gasket	1		Replace	
6	Bolt	2		Tighten to specified torque	
7	Axle flange	2			
8	Bolt	12		Tighten to specified torque	
9	Washer	12		Replace if necessary	
10	Side cover	2	Mark for reassembly	Must be installed on same side	
11	Shim	X	Note number and thickness for reassembly on each side	Determine again, if necessary	
12	O-Ring	2		Replace, coat slightly with transmission oil	
13	Oil seal	2	Press out with suitable screwdriver	Drive in with US 8050/10	
14	Tapered roller bearing outer race	2	Mark for reassembly	Install in same side cover, heat side cover to approx. 100° C/212° F and drive in with a suitable mandrel	
15	Differential	1		Adjust, if necessary	
16	Case	1			

REMOVING AND INSTALLING DIFFERENTIAL

Removing

1. Drain transmission oil.

2. Unscrew axle flange bolt and remove axle flange.

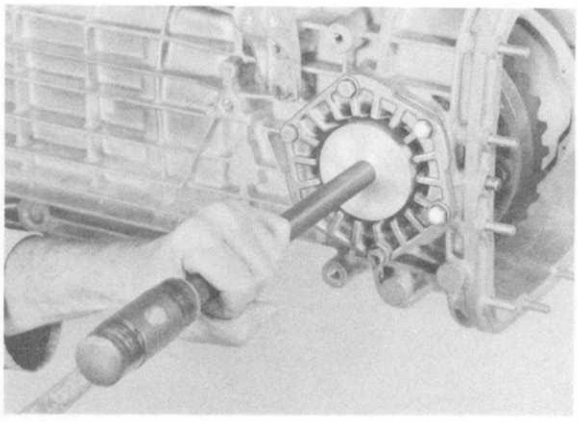


Note

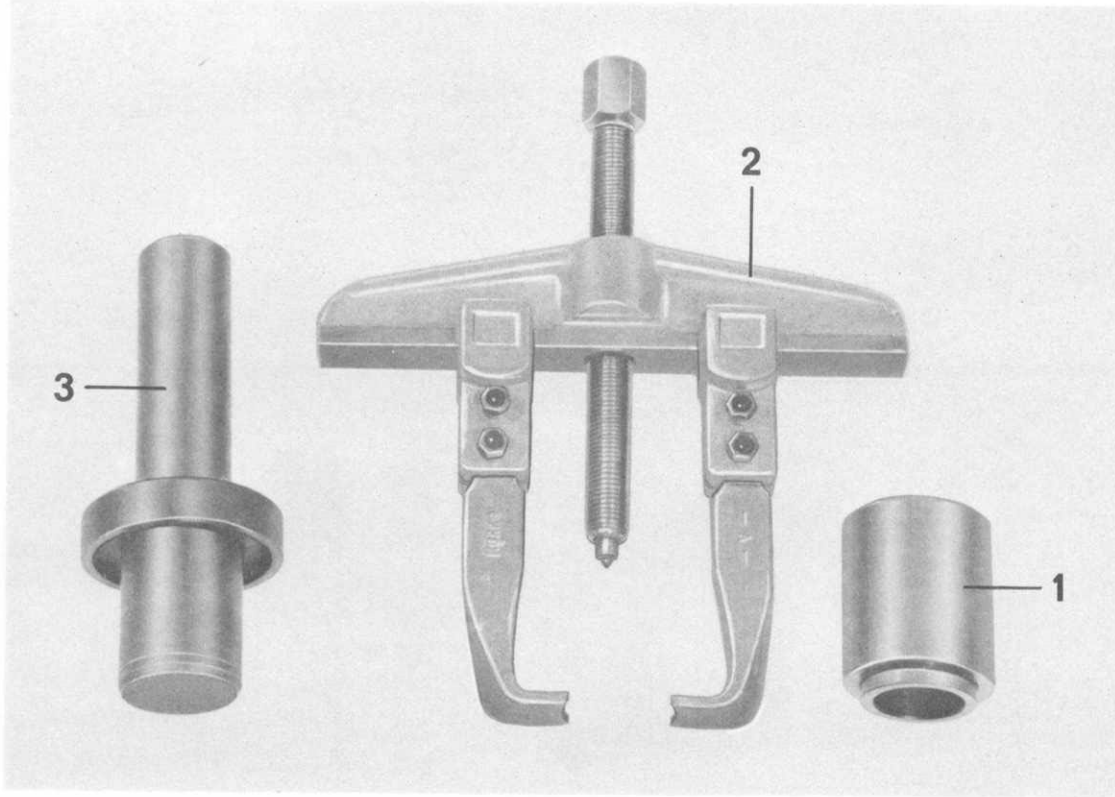
Preload of the tapered roller bearings could cause tension on the case when tightening bolts for the side covers, which later could impair installation of the rear cover. Consequently the rear cover should be installed before tightening the bolts.

Installing

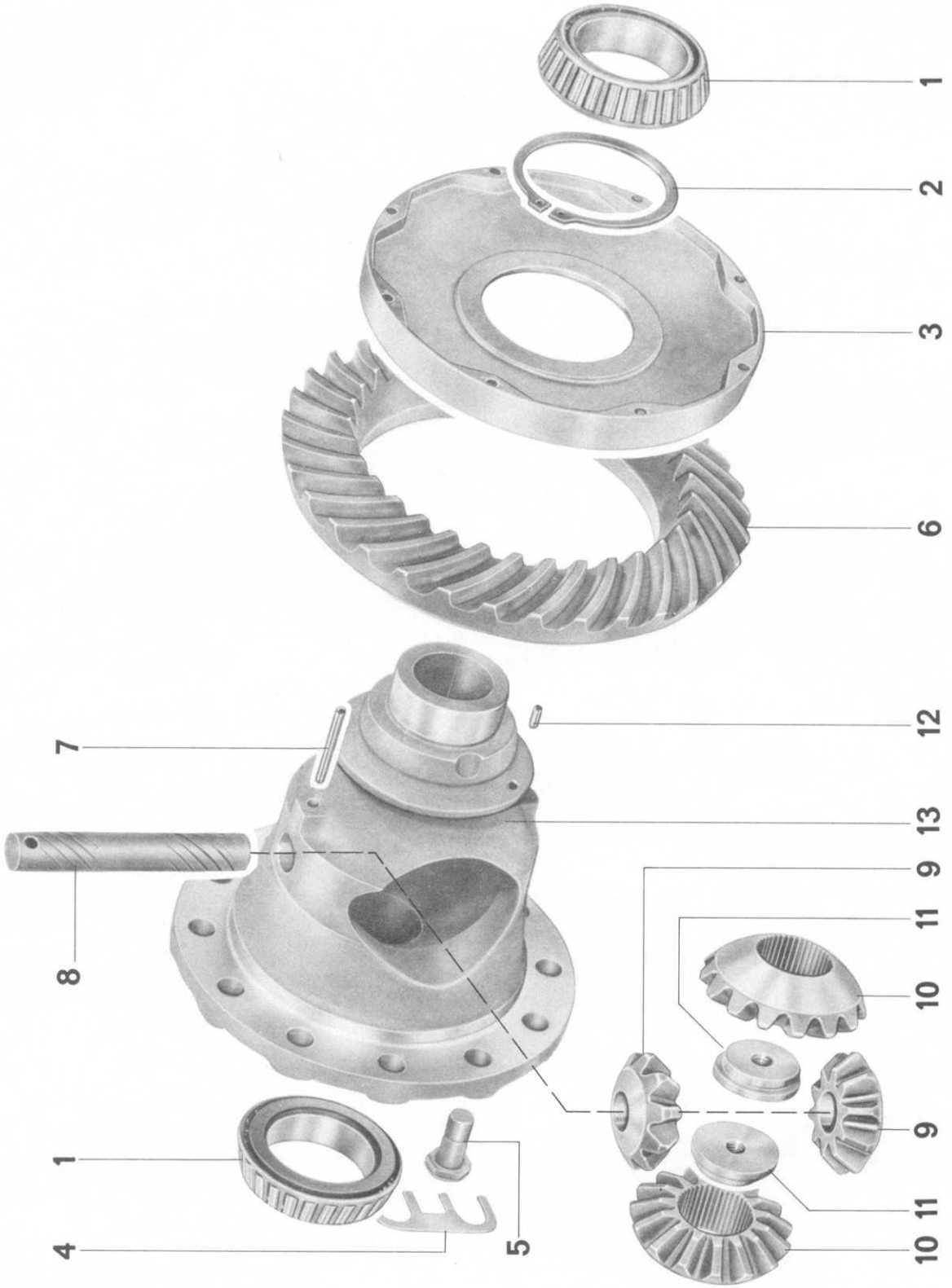
Drive in axle flange seal with US 8050/10.



TOOLS



No.	Description	Special Tool	Remarks
1	Mandrel	P 263	
2	Extractor	US 1078	
3	Drift	P 264 b	

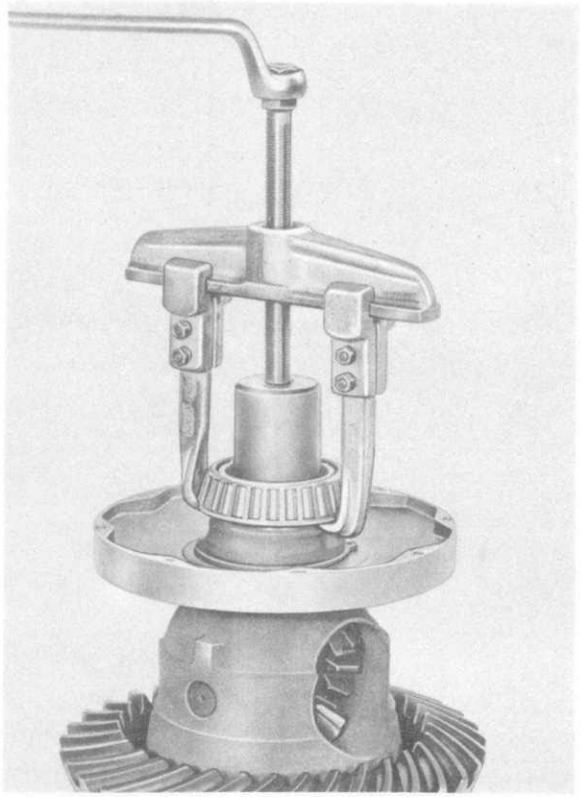

1
2
3
6
12
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13
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11
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1
9
4
5
11
10

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Tapered roller bearing inner race	2	Pull off with US 1078 and P 263	Drive on with P 264 b	
2	Circlip	1			
3	Magnet carrier plate	1			
4	Lockplate	6		Replace	
5	Bolt	12		Threads must be dry and greaseless. Tighten to specified torque	
6	Ring gear	1		Heat to approx. 100° C/212° F. Tapped holes for ring gear bolts must be dry and greaseless. Note pair number. Adjust if necessary	
7	Roll pin	1			
8	Differential gear shaft	1			
9	Small differential gear	2		Coat thrust surface with MoS_2 paste. Replace only in pairs	
10	Large differential gear	2		Coat thrust surface with MoS_2 paste. Replace only in pairs	
11	Axle flange nut	2			
12	Split pin	1			
13	Differential housing	1			

DISASSEMBLING AND ASSEMBLING DIFFERENTIAL

Disassembling

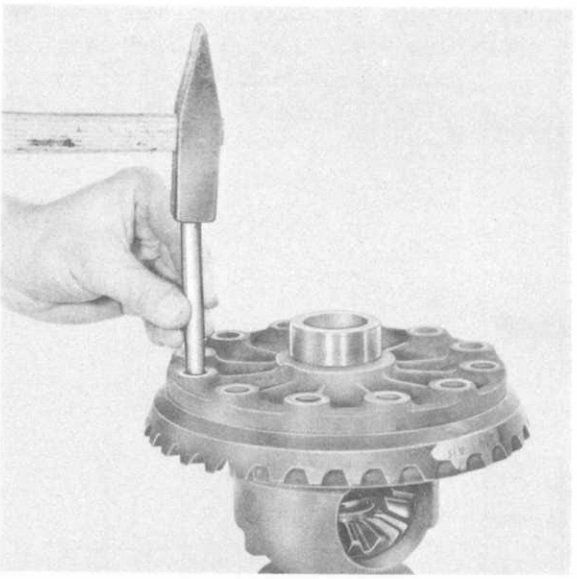
1. Pull off tapered roller bearing inner race with an extractor US 1078 and Special Tool P 263.



Note

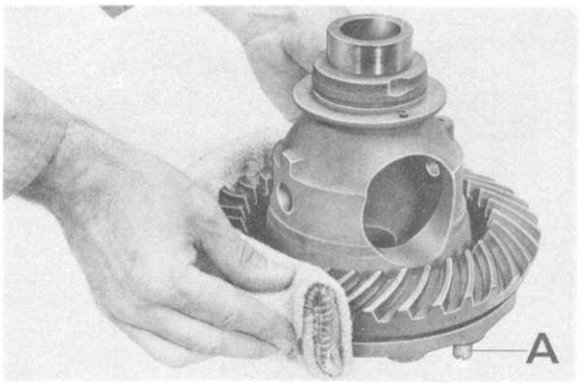
Claws of both legs might have to be machined.

2. Drive ring gear from housing with a suitable mandrel.



Assembling

1. Heat ring gear to approx. 100° C/212° F and install. Use local manufactured centering pins as guides.

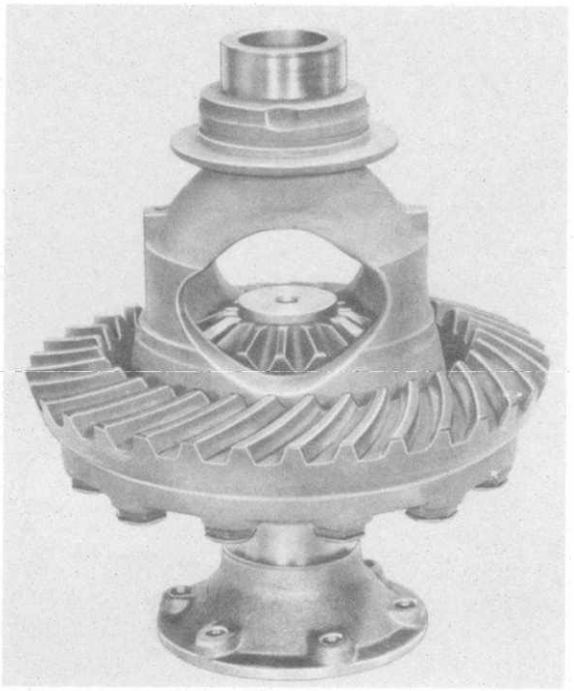


A - Centering pins (local manufacture)

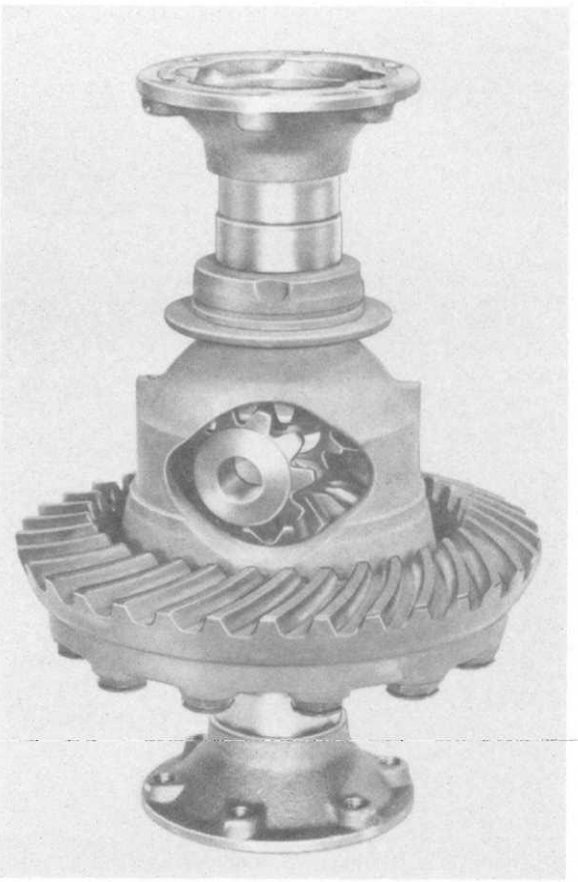
2. Tighten ring gear bolts to specified torque. Slide lockplate into bolt head groove. Squeeze lockplate ends together with pliers. Bend lockplate ends down over side of bolt head.

3. Coat oval surface of differential gears with MoS_2 paste.

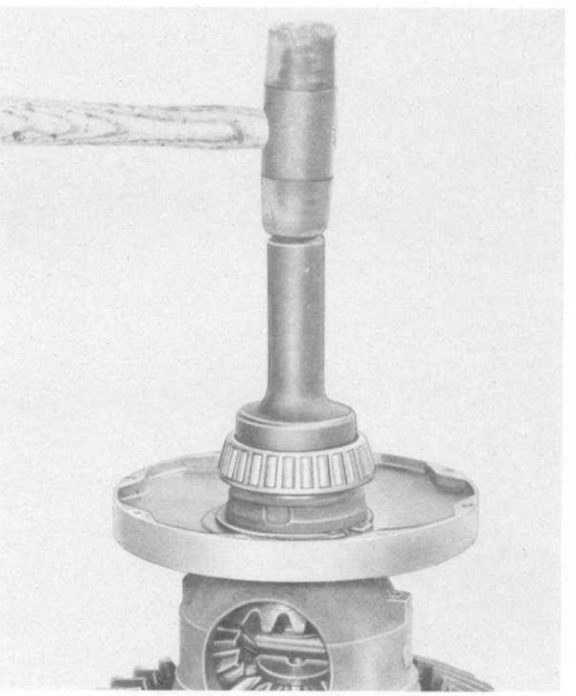
4. Install large differential gears with press-fit threaded plates through opening in differential case and hold with joint flanges.



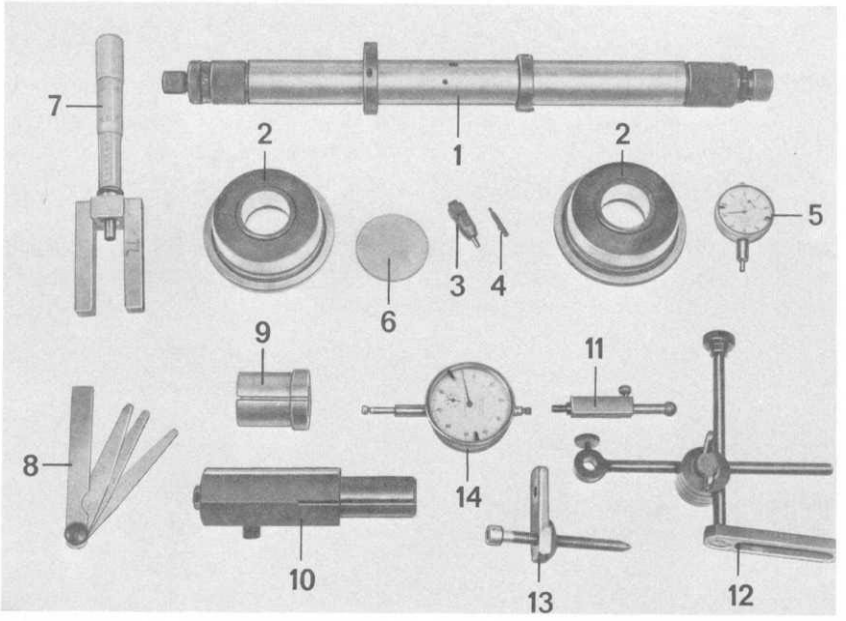
5. Install small differential gears between large differential gears and turn, until bores of gears are aligned with bores in case.



6. Drive on taper roller bearing inner race with P 264 b.



TOOLS

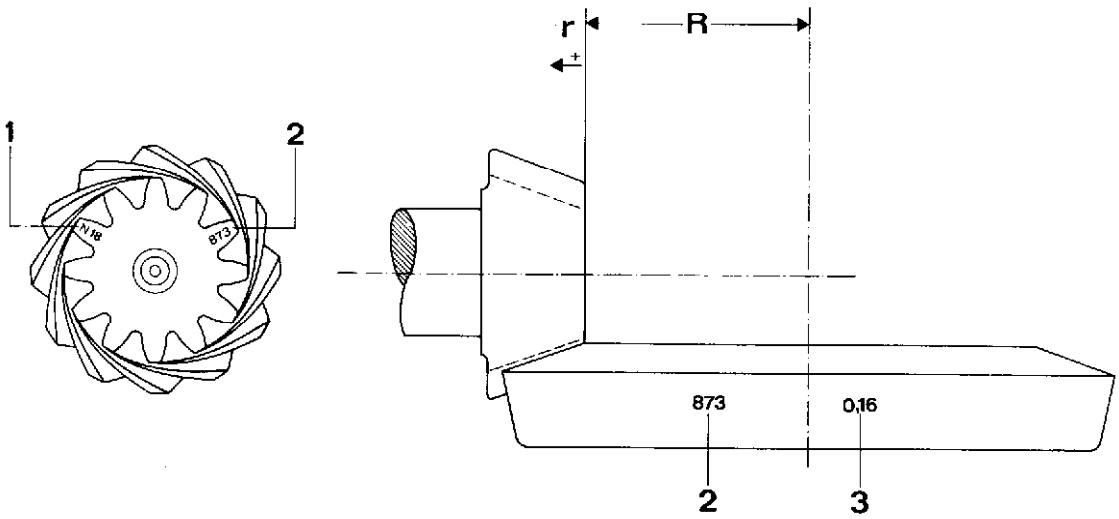


No.	Description	Special Tool	Remarks
1	Universal gauge	VW 385/1	
2	Centering discs	VW 385/4	
3	Gauge plunger	VW 385/14	
4	Dial gauge extension (20 mm)	9150	
5	Dial gauge	-	Standard, 3 mm range
6	Gauge plate	VW 385/17	
7	Master gauge	VW 385/30	
8	Feeler gauge	-	Standard, 0,05 - 1,0 mm
9	Clamping sleeve	9145	
10	Adjusting device	VW 521/4	
11	Adjustable lever	VW 388	
12	Universal dial gauge holder	VW 387	
13	Holder	-	Local manufacture
14	Dial gauge	-	Standard

ADJUSTING DRIVE PINION AND RING GEAR

Note

Careful adjustment of the drive pinion and ring gear is important to guarantee a long service life and quiet running for the final drive. This is why drive pinions and ring gears are matched during production and checked on special testing machines for the most favorable surface appearance and low noise levels in both directions of rotation. The position of quietest running is determined by moving the drive pinion in an axial direction, keeping the ring gear within specified backlash tolerances. The deviation "r" from the design distance "R" is measured and inscribed on the face of the drive pinion. Ring gears and drive pinions are designed in such a manner that deviation "r" is always added to design distance "R"; is always given with a + sign.



R = Design distance (G 28.03 = 72.70 mm/G 28.05 = 70.70 mm)
r = Deviation from R given in 1/100 mm
1 = Deviation r
2 = Pair code
3 = Backlash

Recommended Sequence of Adjusting Drive Pinion and Ring Gear

When it becomes necessary to adjust the drive pinion and ring gear, it would be in the interest of economical procedures to keep to the following sequence.

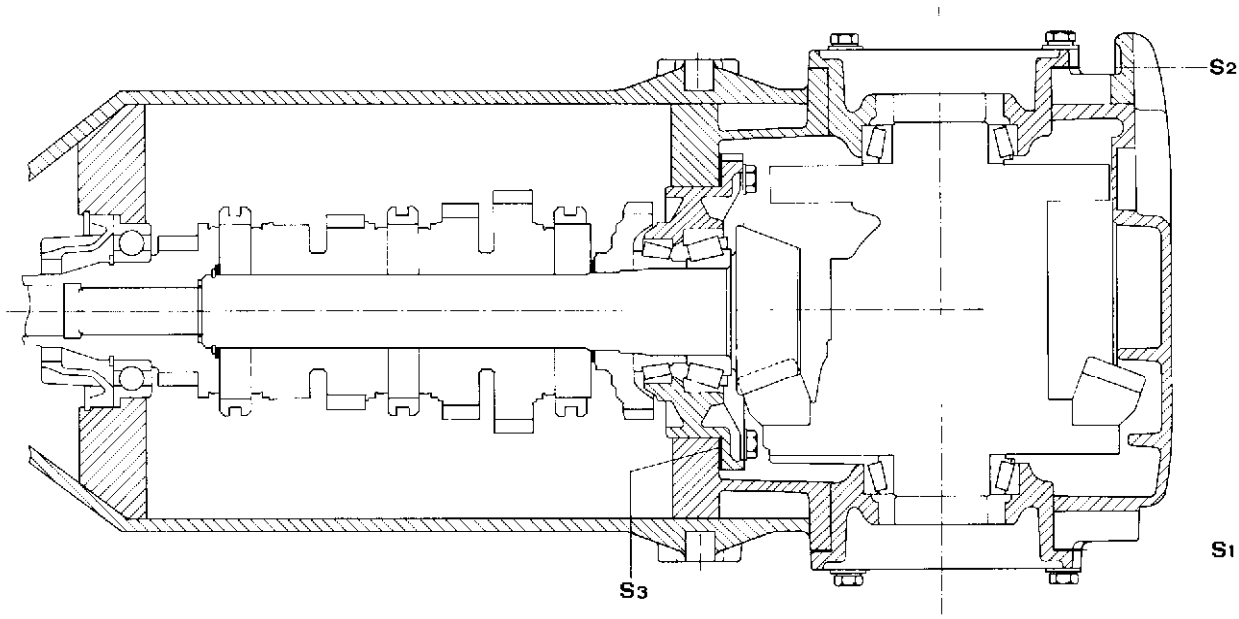
1. Determine the total shim thickness "Stot." (S_1 plus S_2) for the specified pre-load of the taper roller bearing/differential.

2. Determine shim thickness "S_3".

3. Divide total shim thickness "S tot." in S_1 and S_2 so that there is the specified amount of backlash between the ring gear and drive pinion.

The goal of adjustments is to relocate the point of optimal quiet running as was determined in the special testing machine during production.

Perfect results require absolute care and cleanliness during all assembly and measuring operations.



Location of Shims

S_1 = Shim for ring gear
S_2 = Shim for ring gear
S_3 = Shim for drive pinion

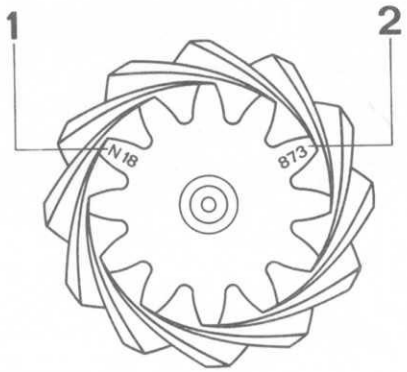
The drive pinion and ring gear only have to be adjusted when jobs on the final drive require the replacement of parts having direct influence on the adjustment. Refer to the following table to avoid unnecessary adjustments!

Adjust: / Replaced Part	Ring Gear ($S_1 + S_2$)	Drive Pinion Deviation "r" (S_3)
Transmission case	X	X
Side transmission cover	X	
Bearing bracket with taper roller bearing for drive pinion	X	X
Drive pinion/ring gear	X	X
Differential case	X	
Taper roller bearing for differential	X	

ADJUSTING PINION

Distance "E" must be calculated from the given design distance "R" + deviation "r" inscribed on face of pinion.

"R" for Type G 28.03 = 72.70 mm
"R" for Type G 28.05 = 70.70 mm



1 = Deviation "r" in 1/100 mm
2 = Pair code

Example:

Deviation "r" on face of pinion is N 18.

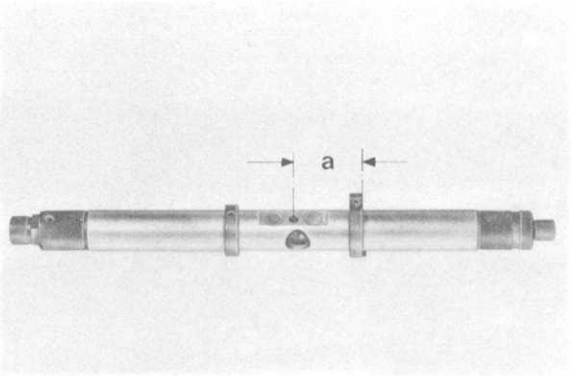
R = Design distance		72.70 mm
r = Deviation	+	0.18 mm
E = Adjusting distance		72.88 mm

1. Install input shaft, without circlip.

2. Install pinion without shims S3 and tighten all bearing retaining plate bolts to specified torque.

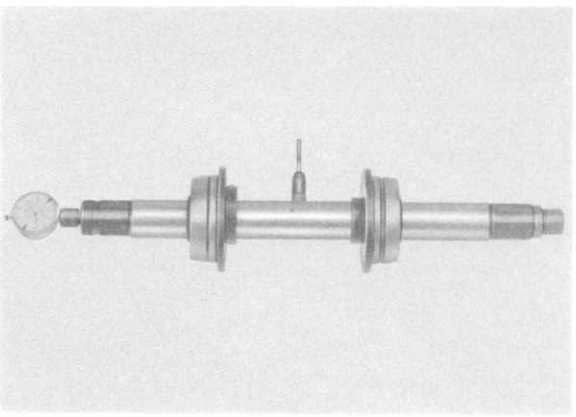
3. Install one side cover without O-ring and secure with two bolts.

4. Set adjusting ring of universal master gauge VW 385/1 at distance "a".



a = 60 mm

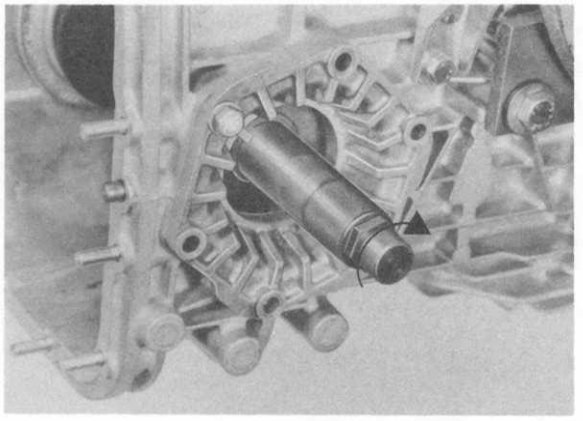
5. Install centering discs VW 385/4 on universal master gauge and attach gauge plunger VW 385/14 with dial gauge extension 9150 (20 mm).



6. Insert universal gauge in case.

7. Install second side cover without O-ring and secure with two bolts.

8. Use spindle to move centering disc of universal gauge out so that the universal gauge can just barely be turned by hand.

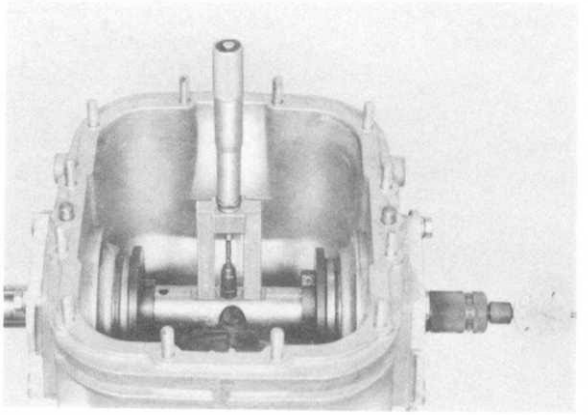


9. Set master gauge VW 385/30 at adjusting distance E (E = R + r)

Example:

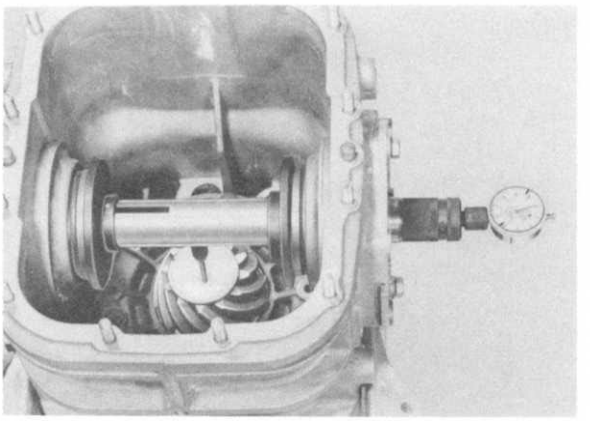
R = 72.70 mm
r = + 0.18 mm
E = 72.88 mm (adjustment of master gauge)

10. Install master gauge and set dial gauge (3 mm range) at zero with 1 mm pre-load.



11. Install gauge plate VW 385/17 on pinion head.

12. Turn universal gauge carefully until dial gauge extension is perpendicular to face of pinion head. At this moment dial gauge needle will reach its point of reversal and dial gauge should be read.



Note

The measured value will always deviate from the set distance "E" counterclockwise (small dial gauge) needle positioned between 0 and 1), i.e. when dial gauge is set with 1 mm pre-load the value deviating from 1 must be used as shim thickness S_3.

For this measurement the dial gauge must be read anticlockwise (red range).

13. Insert a shim with thickness S_3 equalling the determined deviation between the bearing cap and transmission case. Round off to the nearest 0.05 mm (e.g. 0.22 mm becomes 0.25 mm).

14. After installation of shims with the determined thickness,recheck adjusting distance "E".

Note

In the interest of economical procedures the countershaft should be installed in the case before assembly of the drive pinion with determined shims S_3.

ADJUSTING RING GEAR (Stot.)

Note

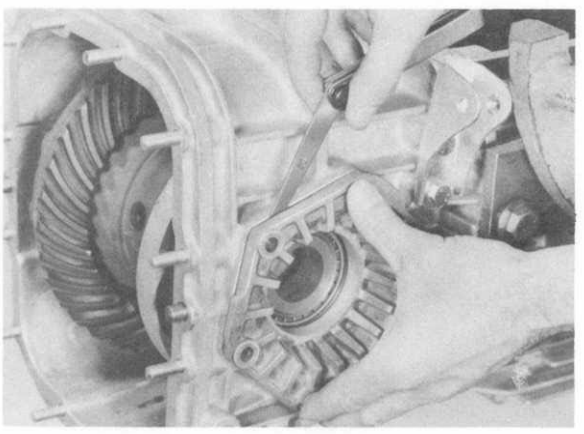
The drive pinion must not be installed for this adjustment.

1. Install differential with ring gear in case.

2. Install side transmission cover (ring gear end) without shims and tighten all bolts to specified torque.

3. Guide in second side transmission cover without shims carefully.

4. Check gap between transmission case and side transmission cover with a feeler gauge.



5. Calculate shim thickness "Stot.".

Stot. = gap - 0.30 mm (bearing pre-load)

Example:	
Gap	1.25 mm
Bearing pre-load	- 0.30 mm
Stot.	0.95 mm

ADJUSTING BACKLASH

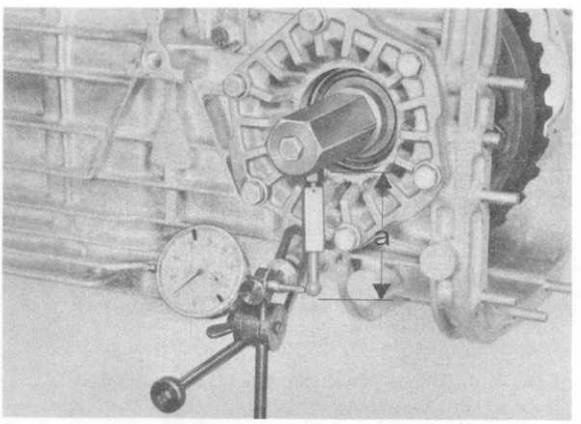
1. Install pinion with shims S_3 determined for pinion adjustment and tighten bearing retaining plate bolts to specified torque.

2. Place differential in case.

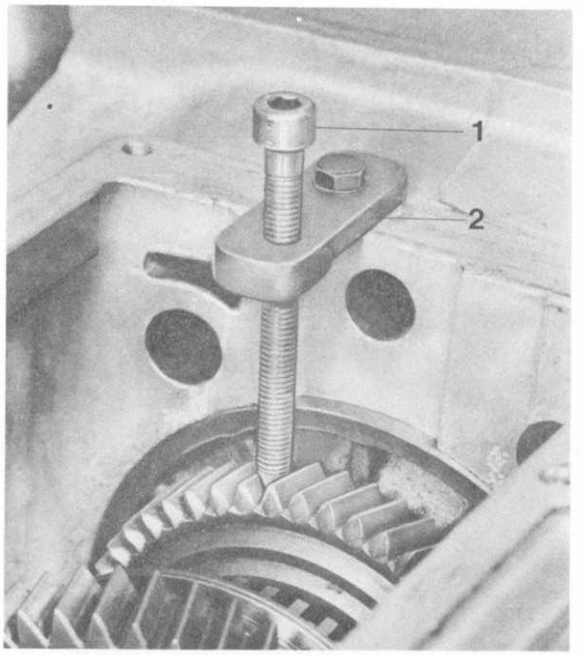
3. Install side cover, placing determined shim "Stotal" on ring gear end, and tighten all bolts to specified torque.

4. Turn differential in both directions several times to settle tapered roller bearings.

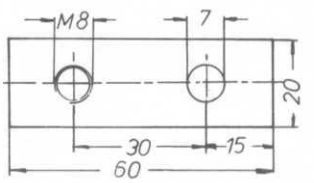
5. Install gauges, setting adjustable lever VW 388 to distance "a" = 80 mm.



6. Engine 5th and reverse gears, and hold pinion with local manufactured tool on reverse gear. This is done by tightening a screw with a ground point between two teeth.



1 - Screw M 8 x 80 (ground point)
2 - Flat iron 60 x 20 x 6 mm



Note

When shift rods are installed the engagement of two gears will require removal of detent plunger for 1st and reverse gear shift rod.

7. Turn ring gear to stop by hand and set dial gauge at zero.

8. Turn back ring gear and read amount of backlash (e.g. 0.88 mm).

DETERMINING THICKNESS OF SHIMS S_1 AND S_2

Note

The measured backlash must be brought to the value specified by the pinion/ring gear manufacturer by dividing "Stotal".

Specifications:
Getrag pinion/ring gear = 0.15 to 0.20 mm
Hurth pinion/ring gear = 0.20 to 0.25 mm

The specified backlash is inscribed on the ring gear.

S_1 = Stotal
- measured backlash
+ specified backlash (inscribed on ring gear)
X 0.66 (lift constant)

Example:

Stotal	0.95 mm
- measured backlash	0.88 mm
	0.07 mm
+ specified backlash (e.g. 0.20 mm)	0.20 mm
	0.27 mm
X (lift constant)	0.66
S_1 =	0.18 mm

S_2 = Stotal - S_1

Example:

Stotal	0.95 mm
S_1	- 0.18 mm
S_2 =	0.77 mm

1. Remove side cover and divide shims "Stotal" to give the shim thicknesses determined for S_1 and S_2.

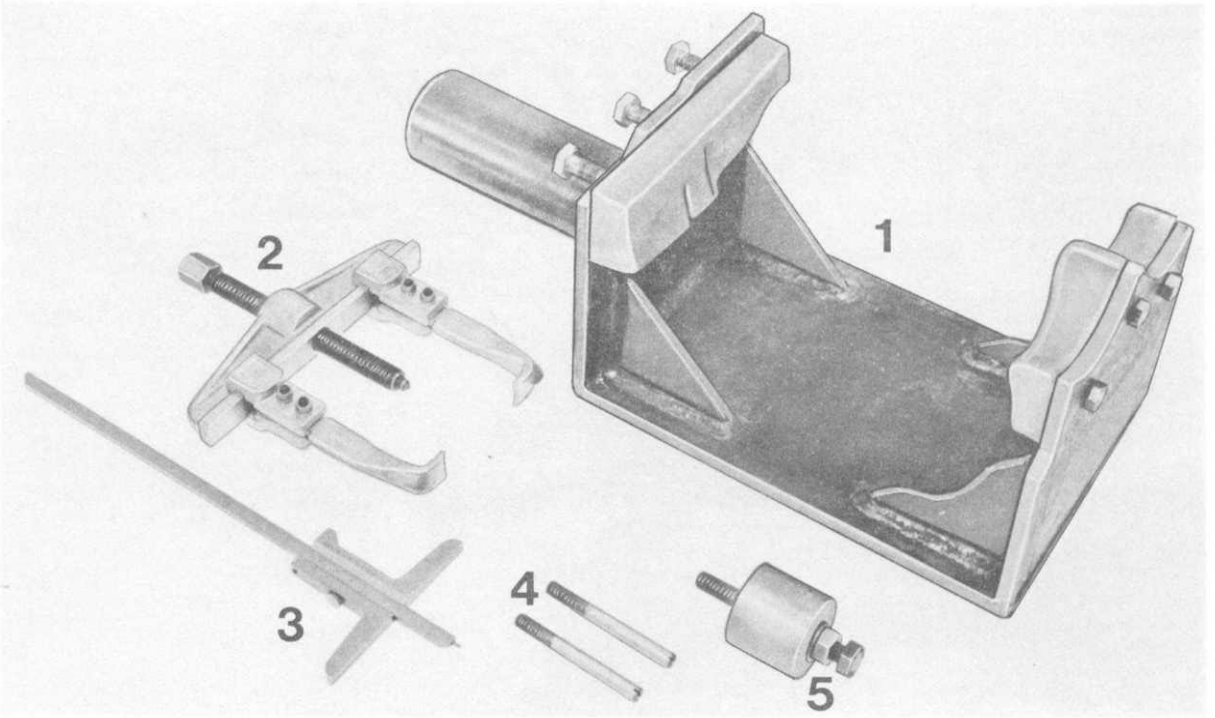
Note

In the interest of economical procedures the shift rods and shift forks should be installed prior to the assembly of the differential with determined shims S_1 and S_2.

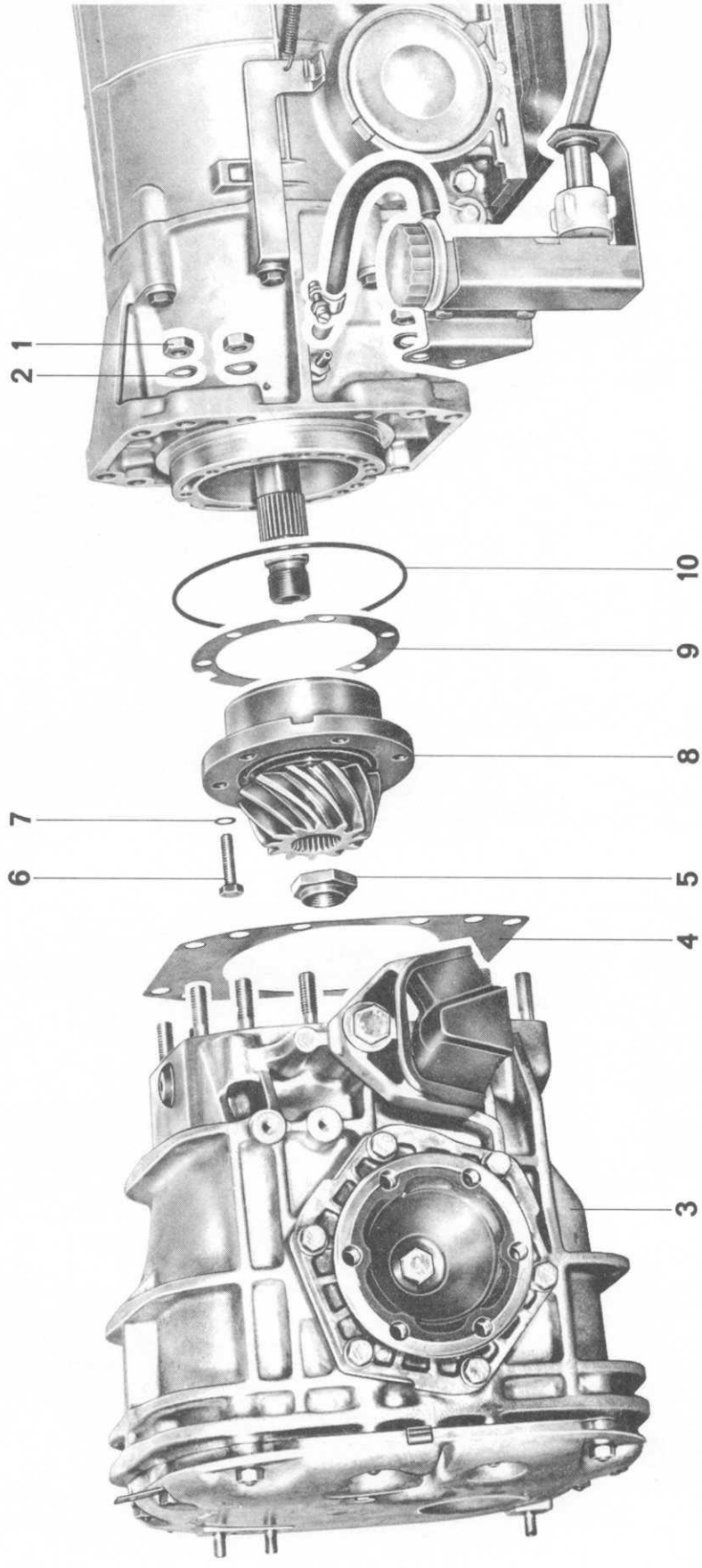
2. Measure backlash and, if necessary, change shims S_1 and S_2 again until specified backlash is reached.

3. Check backlash at four places by turning ring gear 90° each time. The four measurements must not deviate from each other by more than 0.05 mm.

TOOLS



No.	Description	Special Tool	Remarks
1	Transmission holder	9162	
2	Puller	US 1078	
3	Depth gauge	---	Standard
4	Centering pins	---	Made locally
5	Installer	---	Made locally (steel pipe 45 x 5 x 40 mm with welded cover and 11 mm dia. bore)


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No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Nut	12		Torque: 39 . . . 46 Nm (28 . . . 33 ftlb)	
2	Washer	12			
3	Final drive	1			
4	Shim S_3	X	Note quantity and thickness of shims for installation later	Redetermine thickness if necessary	
5	Nut	1	Engage parking lock	Engage parking lock and tighten to specified torque. Lock collar of nut	See page 39 - 24a
6	Bolt	6		Torque: 27 . . . 32 Nm (20 . . . 23 ftlb)	
7	Circlip	6		Position correctly. Hollow side faces flange	
8	Bearing assembly with drive pinion	1	Pull out with a suitable puller	Press in with locally made tool	
9	Shim	X	Note quantity and thickness of shims for installation later	Redetermine thickness if necessary	
10	O-ring	1		Replace, coat with ATF. Make sure that fit is correct when installing final drive	

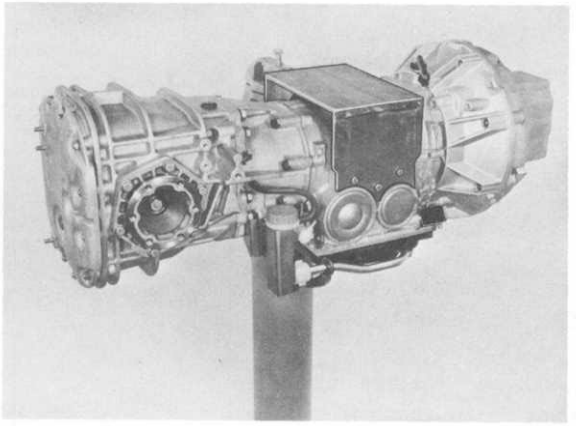
REMOVING AND INSTALLING FINAL DRIVE FOR AUTOMATIC TRANSMISSION

Removing

1. Remove transmission and take off control pressure lever.

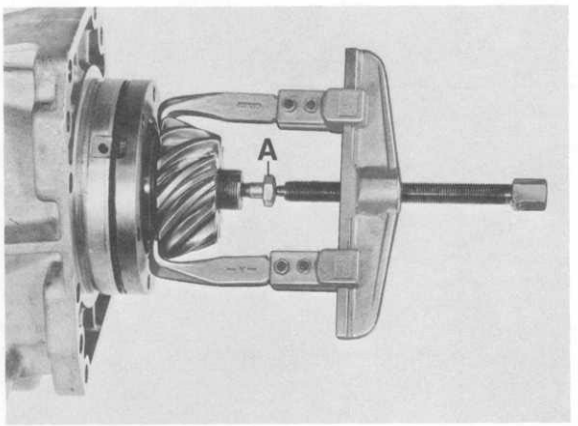
Note
Be careful not to place any force on lever shaft when loosening or tightening the mounting screw, to prevent damage to shaft in transmission. Always counterhold with a wrench when loosening or tightening (see page 37 - 14).

2. Mount transmission on assembly stand with Special Tool 9162 and drain oil from final drive.



3. Engage parking lock and remove collared nut.

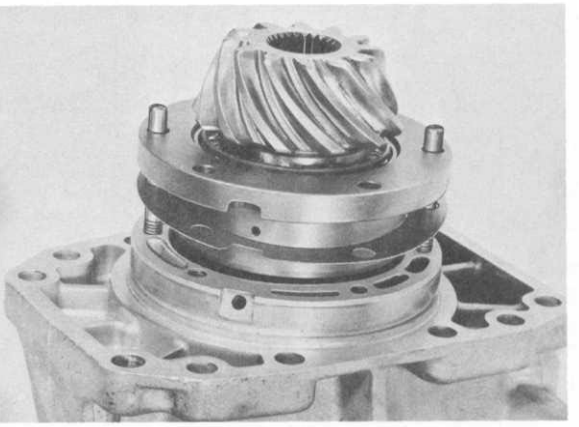
4. Pull out bearing assembly with a suitable puller (e. g. US 1078).



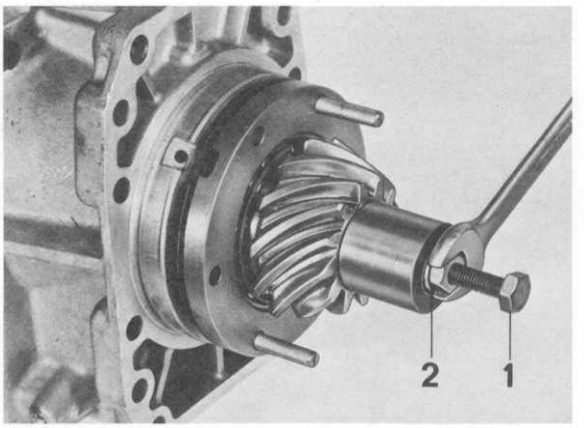
A – M 10 x 30 bolt with centering hole

Installing

1. Install the shims noted before removal or shims of newly determined thickness on output shaft together with bearing assembly.



2. Press in bearing assembly with locally made tool.



1 – Bolt from Special Tool 9148
2 – Washer

Note

Use locally made centering pins to facilitate installation.

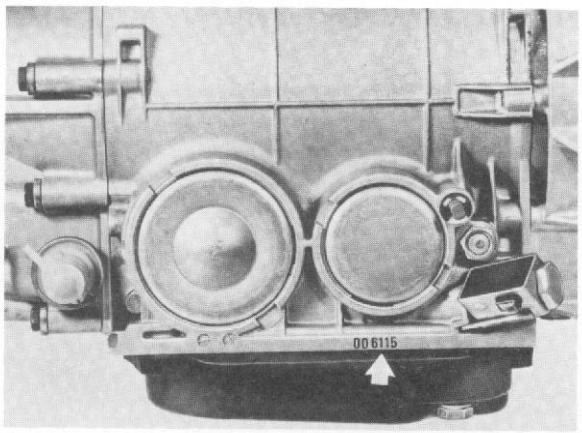
3. Engage parking lock and tighten collar nut as follows:
   Transmission Type A 22.02
   (without fixed governor)
   200 . . . 240 Nm (145 . . . 175 ftlb)

   Transmission Type A 22.01
   up to DB Mfg. No. 5797
   (without fixed governor)
   200 . . . 240 Nm (145 . . . 175 ftlb)

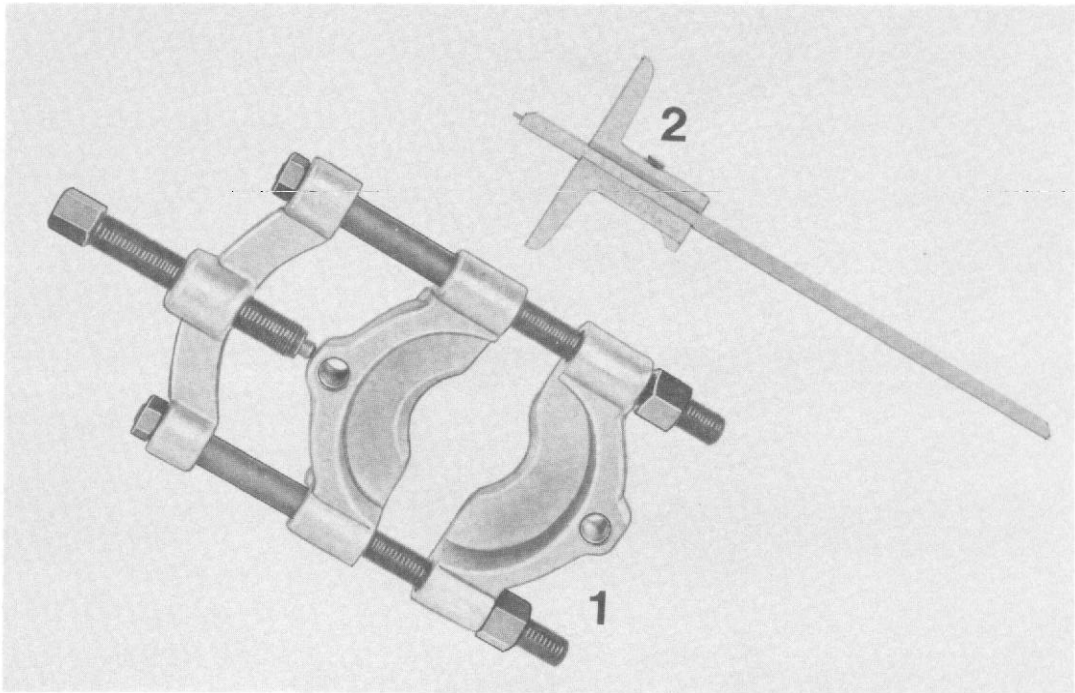
   Transmission Type A 22.01
   from DB Mfg. No. 5798
   (with fixed governor)
   280 Nm (200 ftlb)

Note:

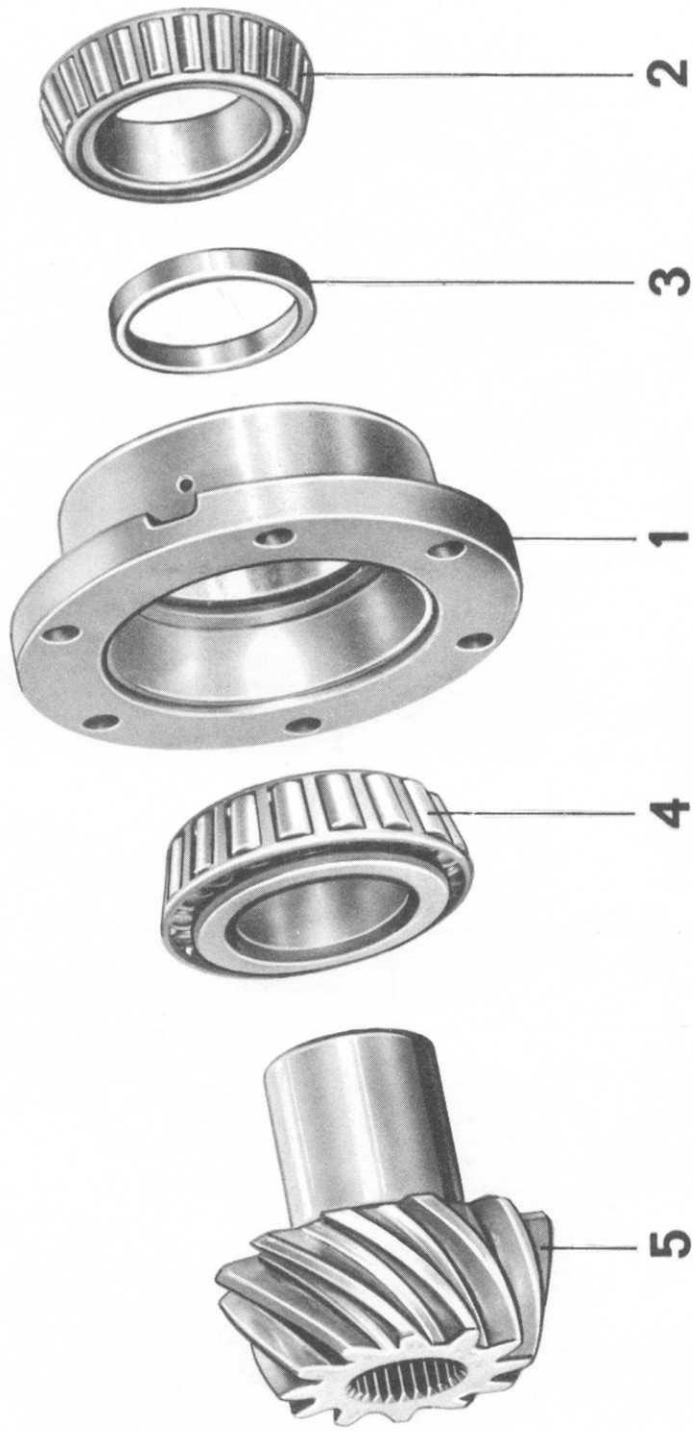
The DB manufacturing number is stamped on the right side of the transmission case, above the ATF sump.



TOOLS



No.	Description	Special Tool	Remarks
1	Separator	US 1103	
2	Depth gauge	---	Standard

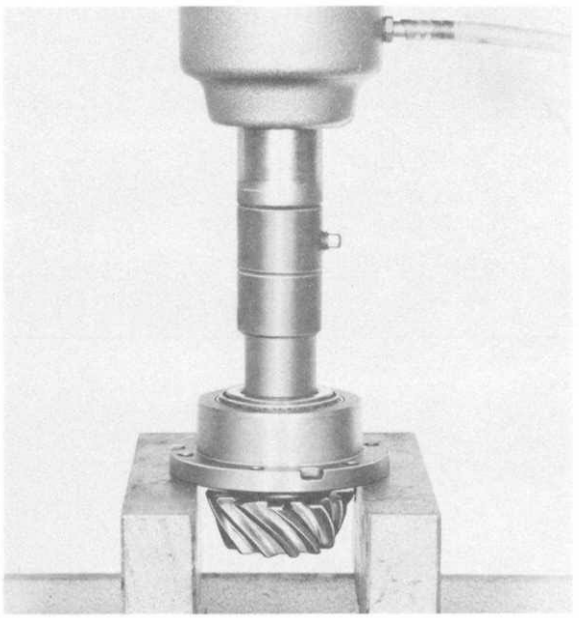

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bearing flange	1		For replacements only available as complete part (positions 1...4)	
2	Bearing inner race	1		Heat to approx. 120° C/248° F and drive on	
3	Adjusting ring	X			
4	Bearing inner race	1		Heat to approx. 100° C/212° F and drive on	
5	Pinion	1	Press out with VW 516	Note pair number	

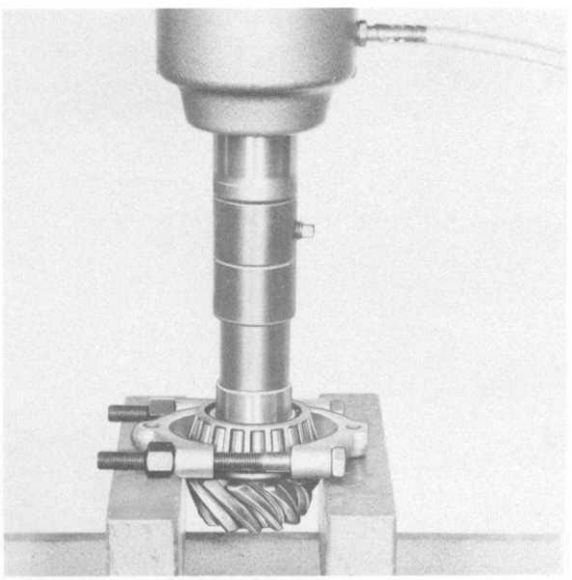
DISASSEMBLING AND ASSEMBLING BEARING ASSEMBLY FOR AUTOMATIC TRANSMISSION

Disassembling

1. Press out pinion with VW 516.



2. Press off tapered roller bearing inner race with a special tool separator US 1103.



Assembling

Note

Bearing flange is only available as a complete unit (with tapered roller bearings and adjusting ring) for replacements.

1. Heat tapered roller bearing inner race to approx. 100° C/212° F and drive on.

2. Press on assembled bearing with VW 415 a, approx. 5 tons force.

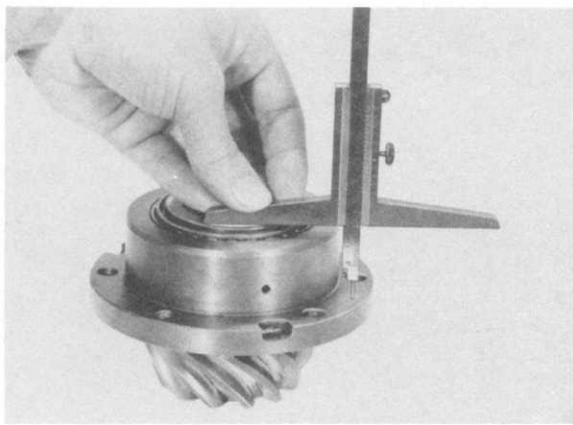
3. If necessary, determine thickness of shims for bearing assembly.

Determining Thickness of Shims for Bearing Assembly

Note

The adjustment of bearing assembly is important for axial play of automatic transmission. Consequently the thickness of shims has to be determined again after repairing or replacing a bearing assembly.

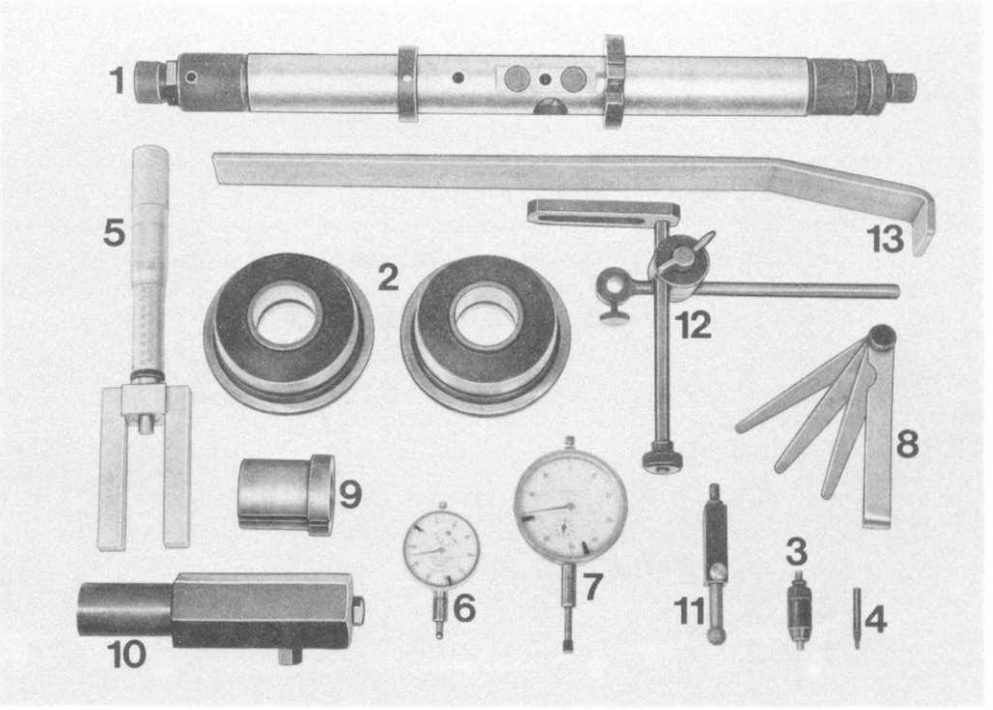
Use a depth gauge to measure distance from taper roller bearing surface to bearing flange surface (e.g. 34.55 mm). Since the design calls for a distance of only 34 $\pm$ 0.05 mm, a shim 0.55 mm thick has to be used.



Example

34.55 mm actual distance (measured on bearing assembly)
- 34.00 mm nominal distance (designed distance)
0.55 mm thickness of shims

TOOLS

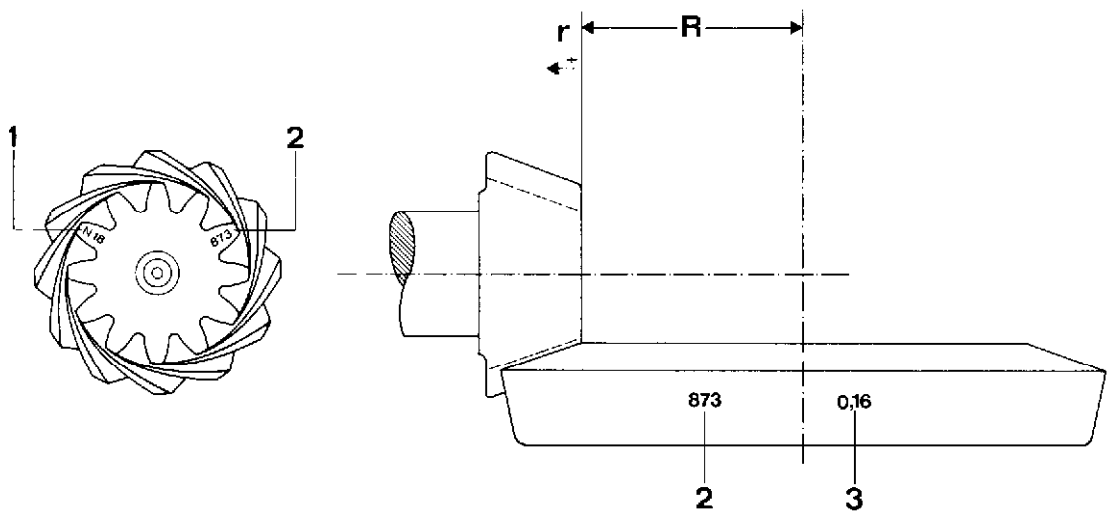


No.	Description	Special Tool	Remarks
1	Measuring bar	VW 385/1	
2	Centering rings	VW 385/4	
3	Plunger	VW 385/14	
4	Dial gauge extension (25 mm)	9168	
5	Master micrometer	VW 385/30	
6	Dial gauge		Standard, 3 mm range
7	Dial gauge		Standard, 10 mm range
8	Feeler gauge		Standard, 0.05 to 1.0 mm
9	Sleeve	9145	
10	Clamping arbor	VW 521/4	
11	Adjustable lever	VW 388	
12	Dial gauge holder	VW 387	
13	Lever		Made locally

ADJUSTING PINION AND RING GEAR

General Information

Accurate adjustments of the pinion and ring gear are immensely important for the service life and smooth running of the final drive. This is why pinions and ring gears are paired during manufacture and checked in special machines for tooth pattern and quietness in both directions of rotation. The position of smoothest running is determined by moving the pinion in an axial direction, whereby the ring gear is lifted out of the no-play meshing position far enough so that the backlash will be kept within specified tolerances. Deviation "r" from the designed distance "R" is measured and recorded on face of pinion. Ring gears and pinions are designed so that deviation "r" is always added to "R", i.e. is preceded by a + sign.



R = Design distance 72.70 mm
r = Deviation from R in 1/100 mm
1 = Deviation r
2 = Pair number
3 = Backlash

Recommended Sequence for Adjustment of Pinion/Ring Gear

If drive pinion and ring gear have to be adjusted, the following sequence of procedures would be most economical.

1. Determine total shim thickness "Sges" (S_1 plus S_2) for specified preload of taper roller bearing/differential.
2. Determine shim thickness "S_3".
3. Divide total shim thickness "Sges" into S_1 and S_2, so that specified backlash is between ring gear and drive pinion.

Objective of adjustments must be to regain the maximum degree of quiet running, as had been determined by the special testing machine in manufacturing.

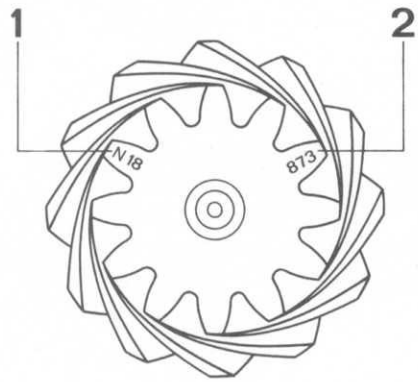
Absolute cleanliness is essential for all assembly jobs and testing procedures to guarantee perfect results.

After working on the final drive it will only be necessary to adjust the pinion and ring gear, if parts had been replaced which have direct influence on said adjustment. The following chart will help in avoiding unnecessary adjustments!

Adjust: / Part Replaced	Ring Gear (S_1 + S_2)	Drive Pinion deviation "r" (S_3)
Transm. case (automatic) or rear transmission case	X	X
Bearing assembly for pinion	X	X
Final drive case	X	X
Side transmission cover	X	
Pinion/ring gear	X	X
Differential case	X	
Taper roller bearing for differential	X	

ADJUSTING PINION

Adjusting distance "E" is calculated from known design distance "R" = 72.70 mm + deviation "r", which is located on face of drive pinion.



1 = Deviation "r" in 1/100 mm
2 = Pair number

Note

The design of the drive pinion will not allow use of the 5 mm thick Special Tool VW 385/17, normally applied for adjustments.

Since Special Tool VW 385/30 includes this 5 mm distance, it is important to add 5 mm to adjusting distance "E".

Example:

N 18 is the deviation "r" on face of pinion.

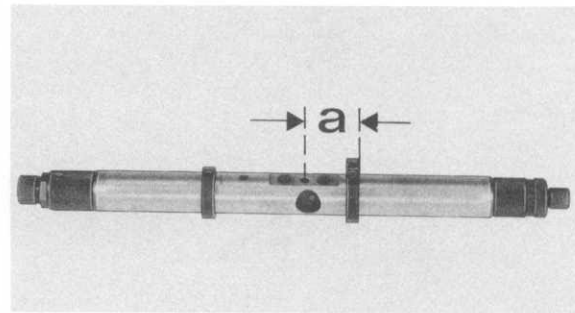
R = design distance		72.70 mm
r = deviation	+	0.18 mm
E = adjusting distance		72.88 mm
Missing special tool	+	5.00 mm
Adjustment of master gauge		77.88 mm

1. Install bearing assembly with shims and tighten collared nut to specified torque.

2. Install final drive case (without shims) and tighten all hexagon nuts to specified torque.

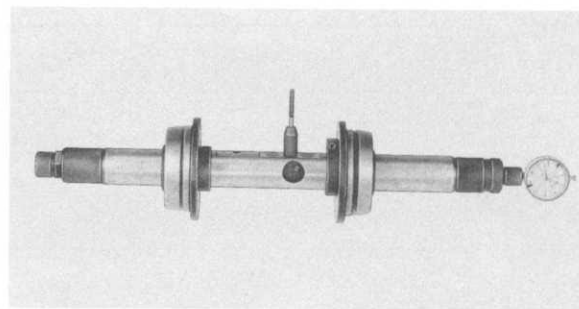
3. Install one side bearing cover without O-ring and secure with two bolts.

4. Adjust setring of Special Tool VW 385/1 to distance "a".



a = 41 mm

5. Slide Special Tools VW 385/4 on to 385/1. Install Special Tool VW 385/14 with (25 mm) dial gauge extension 9168.



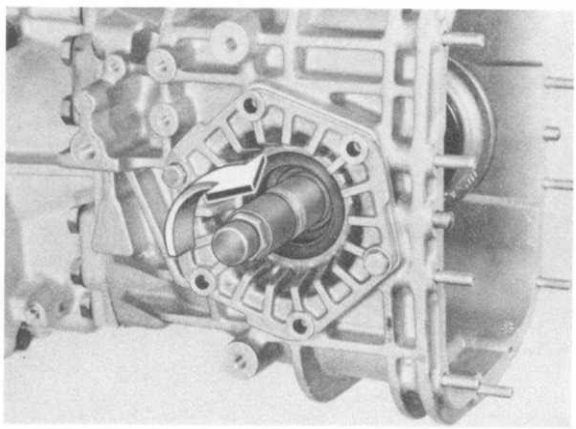
Printed in Germany

6. Turn pinion so that surface of pinion nut is vertical.

7. Insert measuring bar into case.

8. Install second side cover without O-ring and secure with two bolts.

9. Pull out centering ring of measuring bar with the spindle so that measuring bar can still just be turned by hand.

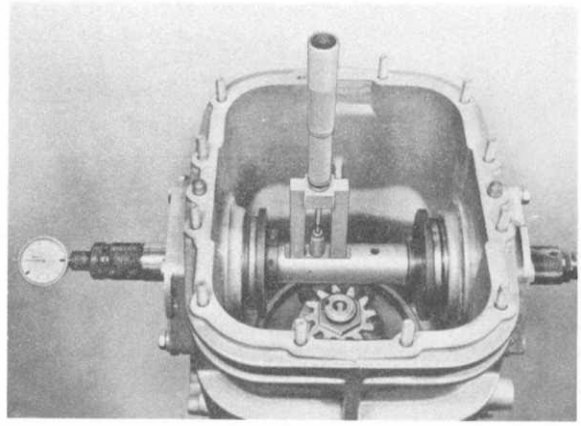


10. Set Special Tool VW 385/30 to adjusting distance "E" + 5 mm (for missing Special Tool VW 385/17).

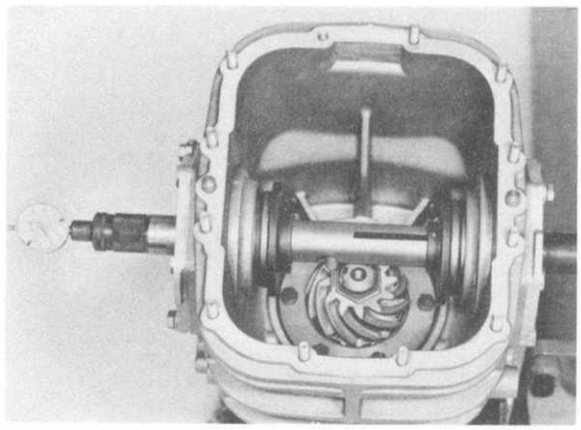
Example:

R	=	72.70 mm	
r	=	+ 0.18 mm	
E	=	72.88 mm	
		+ 5.00 mm	
		77.88 mm	adjustment of measuring bar

11. Install measuring bar and set (3 mm range) dial gauge at zero with 1 mm preload.



12. Turn measuring bar carefully until dial gauge extension is vertical to face of pinion head. At this moment dial gauge needle will reach its point of reverse direction, when dial gauge must be read.



Note

The measured value will always deviate from the set distance in clockwise direction (small needle of dial gauge will be between 1 and 2), i.e. when adjusting the dial gauge with 1 mm preload the value deviating from 1 is added as shim thickness S_3.

Example:

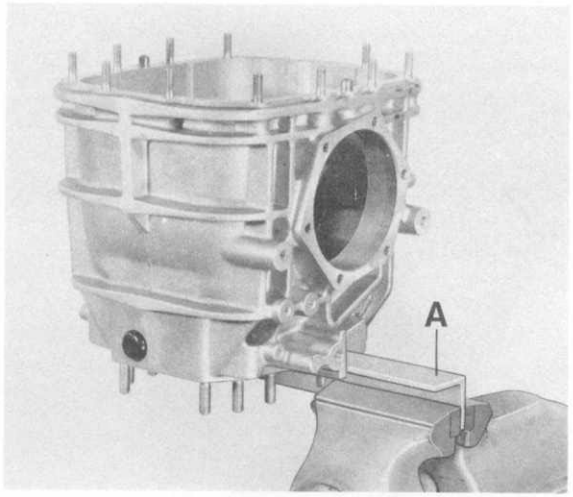
If small needle of dial gauge is between 1 and 2, and large needle points to 0.40 mm, use 0.40 mm as shim thickness S_3 (with 1 mm dial gauge preload).

13. Install the determined shim thickness S_3 between transmission case and final drive housing.

14. Recheck distance after installation of shims with determined thickness. A deviation of $\pm$ 0.03 mm is permissible.

ADJUSTING RING GEAR (S_{total})

1. Clamp final drive housing in a vise, using a suitable fixture.



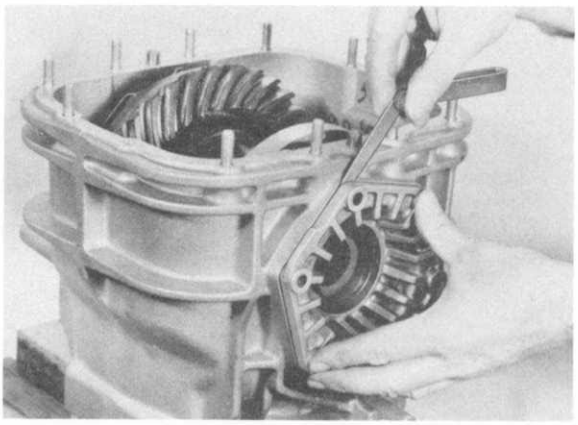
A - angle iron bar

2. Install differential with ring gear in housing.

3. Install side cover (ring gear end) without shims and tighten all bolts to specified torque.

4. Guide in second side cover without shims carefully.

5. Check gap between transmission case and side cover with a feeler gauge.



6. Calculate shim thickness S_{total}

S_{total} = gap - 0.30 mm (bearing preload)

Example:

Gap		1.25 mm
Bearing preload	-	0.30 mm
		0.95 mm

ADJUSTING BACKLASH

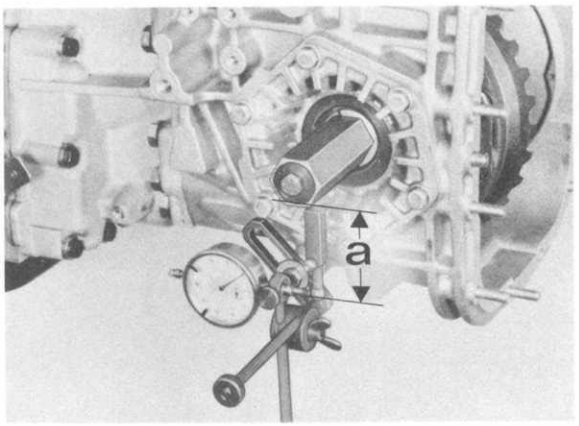
1. Place shims determined for pinion adjustment between transmission case and final drive housing. Install final drive housing and tighten all mounting bolts to specified torque.

2. Install differential in housing.

3. Install side cover, using total shim thickness "S_{total}" as determined on ring gear end and tighten all bolts to specified torque.

4. Turn differential in both directions several times, to settle tapered roller bearings.

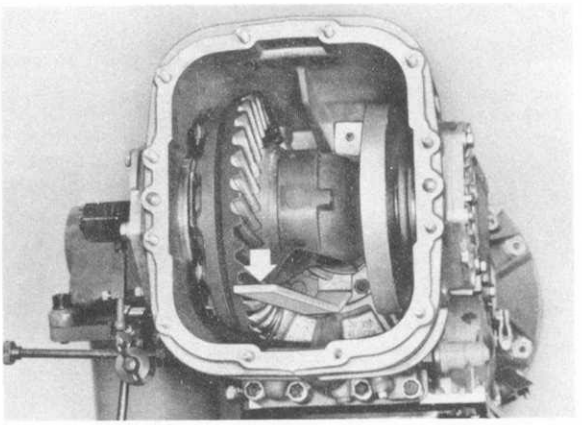
5. Install measuring tools. Set Special Tool VW 388 to distance "a" = 80 mm.

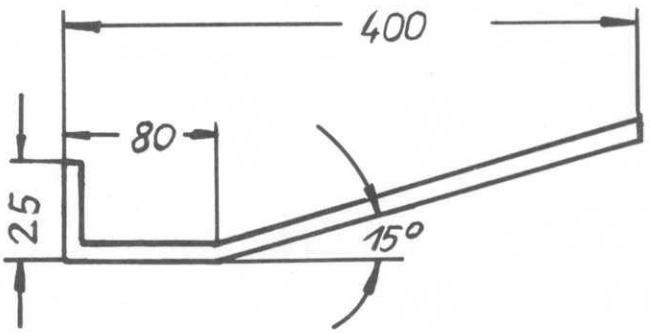


6. Engange parking lock.

7. Turn ring gear carefully by hand against stop and set dial gauge to zero.

8. Hold pinion with locally made lever and turn back ring gear carefully. Read and note amount of backlash.





Lever made locally from flat iron 30 x 5 mm

Printed in Germany

DETERMINATION OF SHIMS S_1 AND S_2

Measured backlash must be brought to value specified by manufacturer of pinion/ring gear by splitting total shim thickness Sges.

Specified Value:
Getrag pinion/ring gear = 0.15 to 0.20 mm
Hurth pinion/ring gear = 0.20 to 0.25 mm

Backlash is stamped on ring gear.

Determining Shim Thickness S_1 (Ring Gear End)

S_1 = Sges (total shim thickness)
- measured backlash
+ backlash inscribed on ring gear

Example:

Sges	0.95 mm
- measured backlash	0.88 mm
	0.07 mm
+ inscribed backlash (e.g. 0.20 mm)	0.20 mm
S_1	0.27 mm

Determining Shim Thickness S_2 (Opposite Ring Gear)

S_2 = Sges - S_1

Example:

Sges	0.95 mm
S_1	- 0.27 mm
	0.68 mm

Note

The change in backlash by splitting shims S_1 and S_2 is only an example and does not have to be made strict according to procedures.

1. Remove side transmission cover and split total shim thickness Sges, that it gives the determined shim thicknesses S_1 and S_2.

Note

When tightening nuts for side transmission covers, always remember that there is a certain amount of backlash. Never let the drive pinion and ring gear clamp.

2. Measure backlash and, if necessary, change shims S_1 and S_2 again until specified play is reached.

3. Check backlash at four places on periphery, turning ring gear by 90° each time. Measurements must not deviate from each other by more than 0.05 mm.

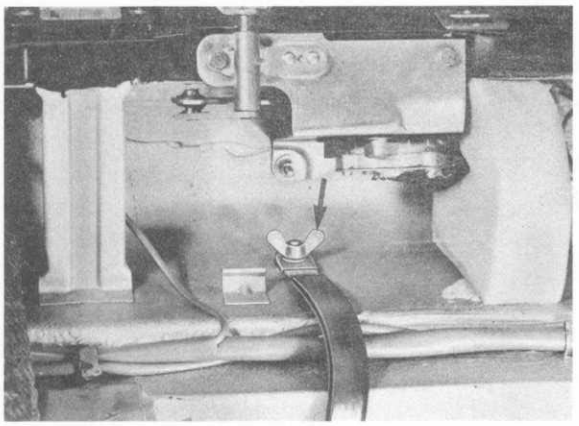


1 = Automatic transmission
2 = Central tube
3 = Drive plate housing

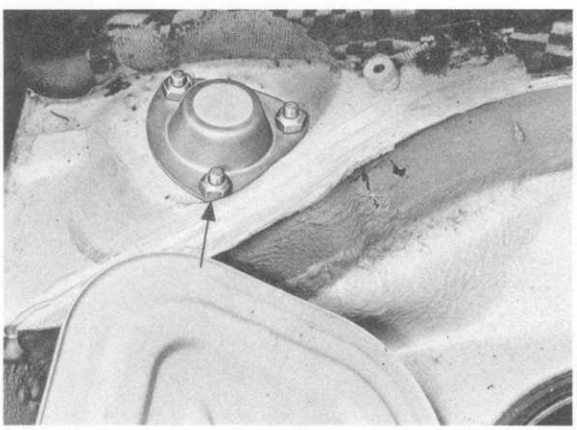
REMOVING AND INSTALLING CENTRAL TUBE (AUTOMATIC TRANSMISSION)

Removing

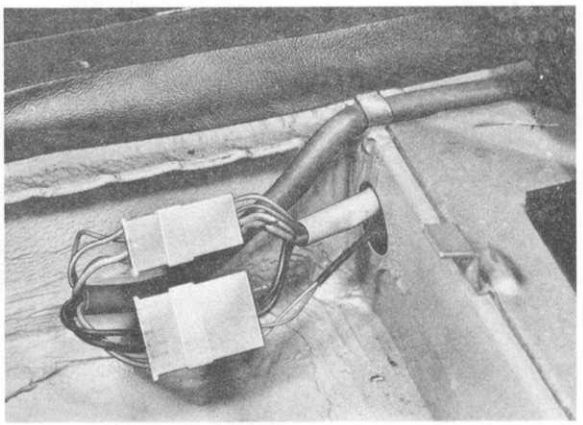
1. Remove battery ground strap.



2. Remove self-locking nuts from spring struts in trunk.



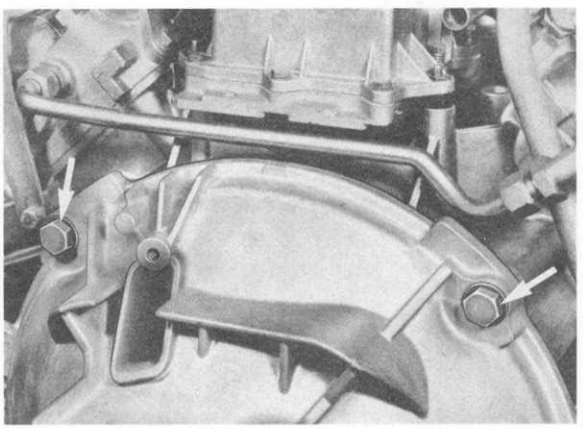
3. Disconnect multiple plugs in spare wheel well and pull out downward.



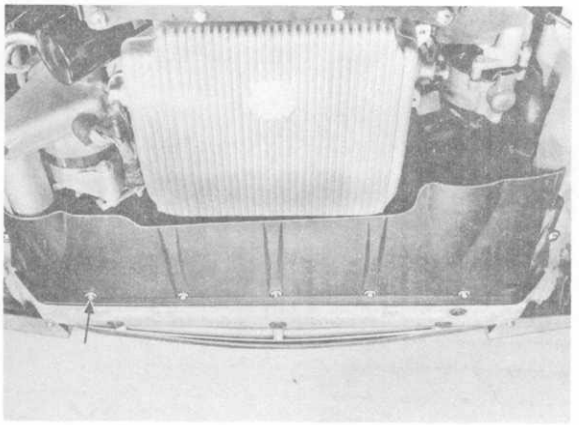
4. Detach parking brake cable at fastener.

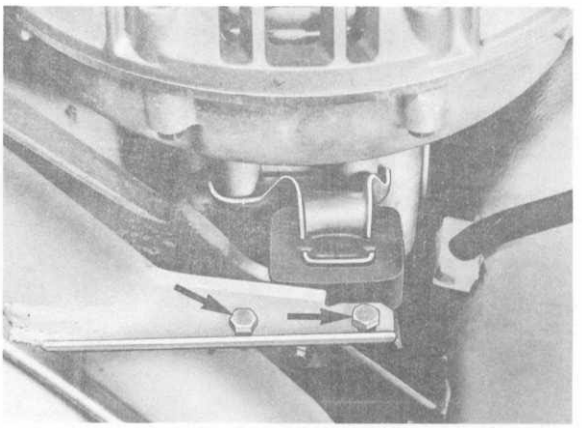
5. Remove air cleaner.

6. Remove upper mounting screws of drive plate housing.



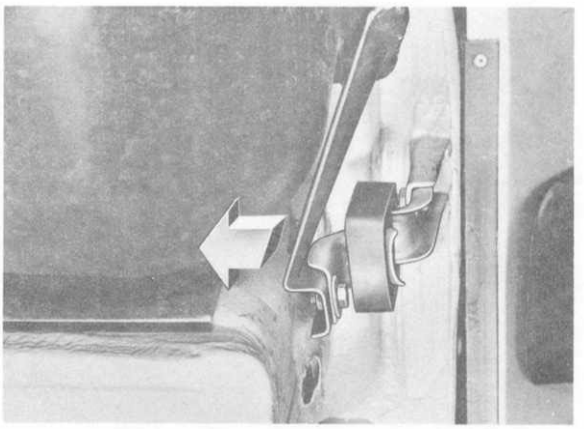
7. Remove splash shield.

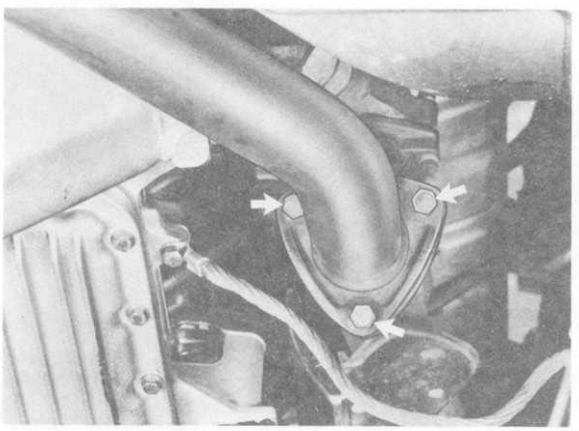


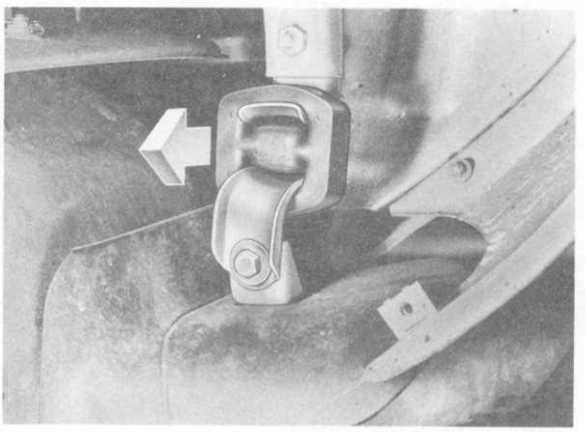


8. Remove lower body brace.

9. Remove entire exhaust system, by removing bolts on exhaust manifold and holder, and then pulling exhaust system out of rubber holder.





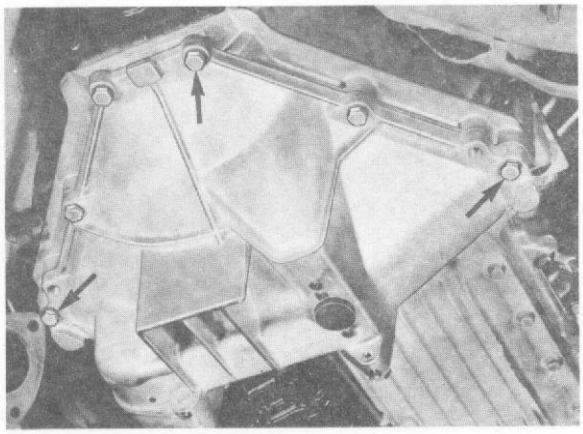


Note

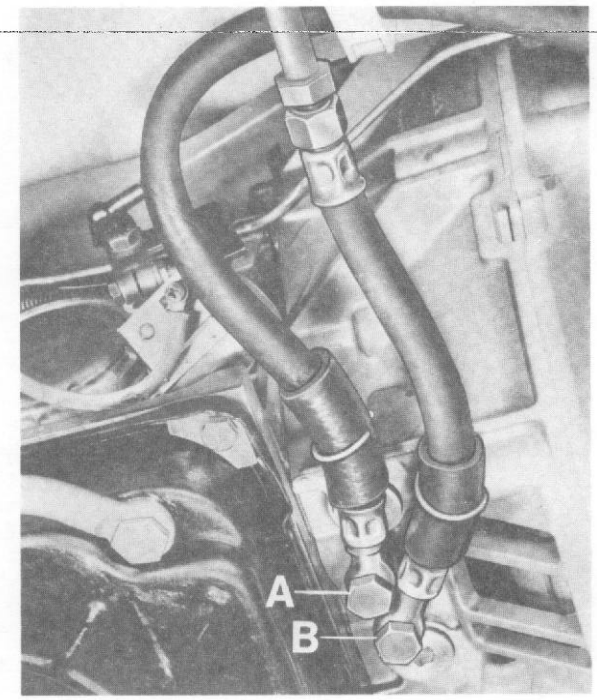
Two people will be required to remove and install a complete exhaust system.

10. Remove exhaust system heat shields.

11. Remove cover for drive plate housing together with starter and detach stabilizer bar.

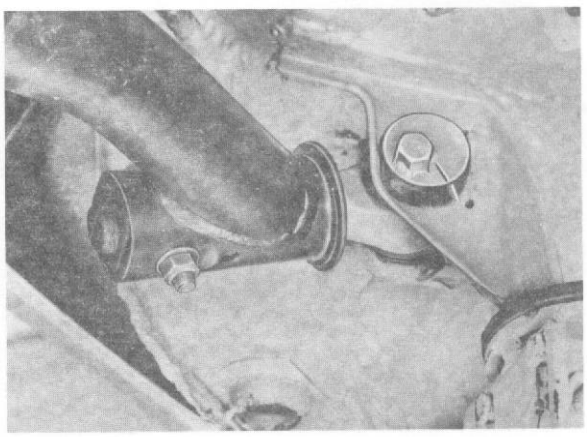


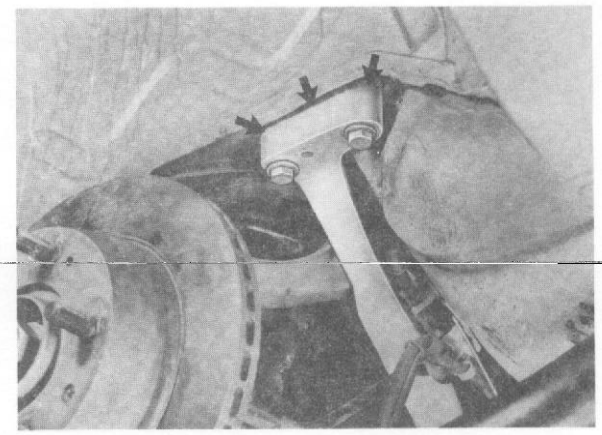
12. Detach feed and return lines for ATF cooler and plug bores in converter housing.



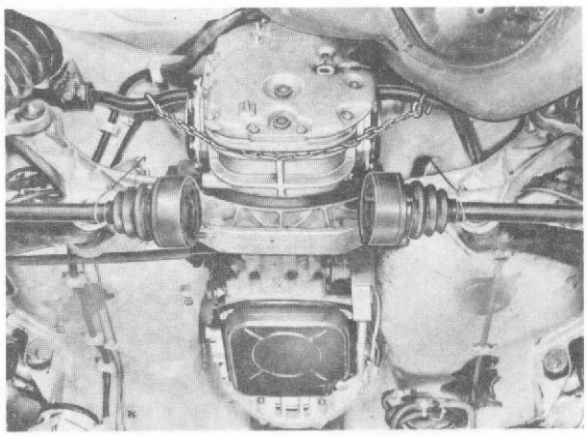
A - To cooler inlet (bottom connection)
B - From cooler outlet (top connection)

13. Mark location of toe eccentric bolts and rear axle cross member for reinstallation.



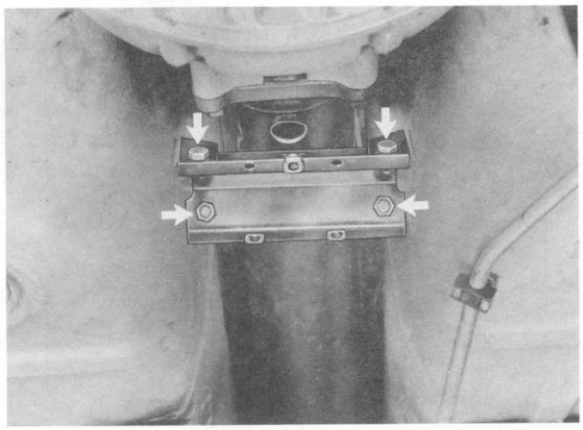


14. Support transmission on stabilizer bar with chain US 8031 and remove rear axle.



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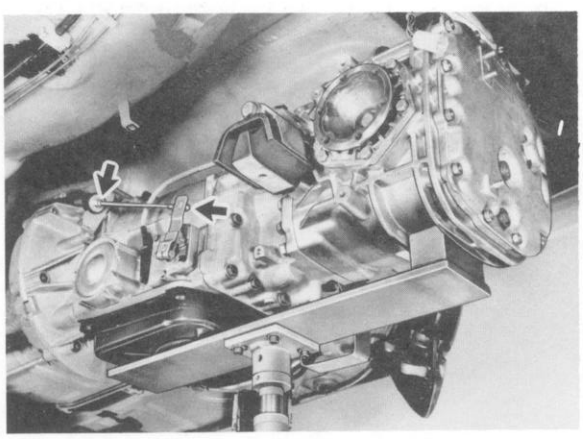
15. Remove rear reinforcement plate.



16. Bolt transmission plate 9163 on universal transmission jack and place underneath transmission.

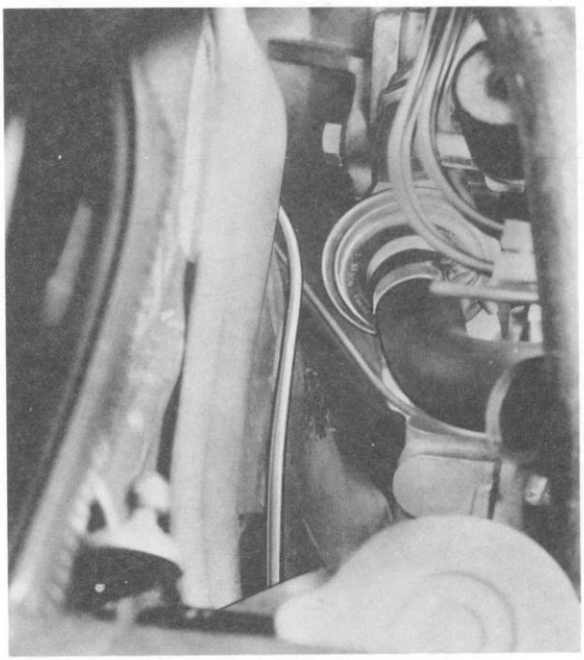
17. Lift transmission and detach holding chain.

18. Lower transmission only so far, that selector lever cable and cable sleeve on holder can be detached.

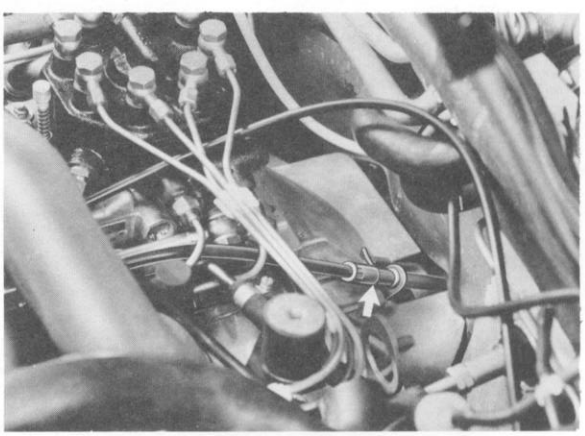


Note

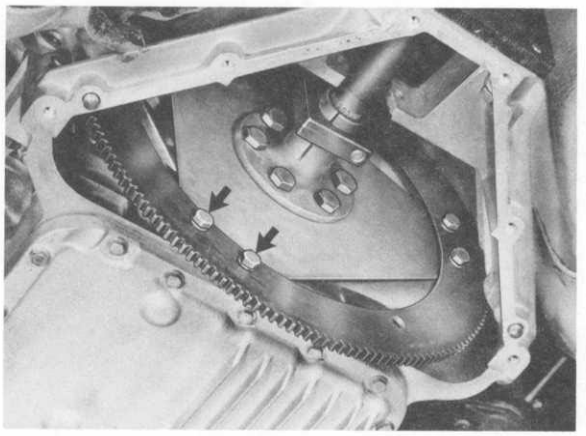
When lowering transmission, it is important to be careful that the engine check valve for air injection does not damage the brake line.



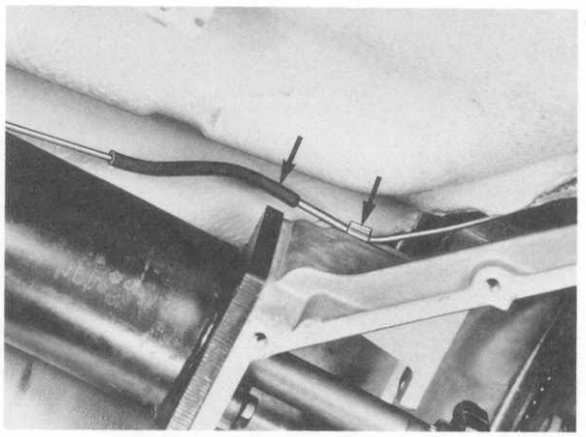
19. Detach control pressure cable. Unscrew ball head and locknut. Pull off rubber grommet and pull out cable from engine compartment. Be careful not to bend cable.



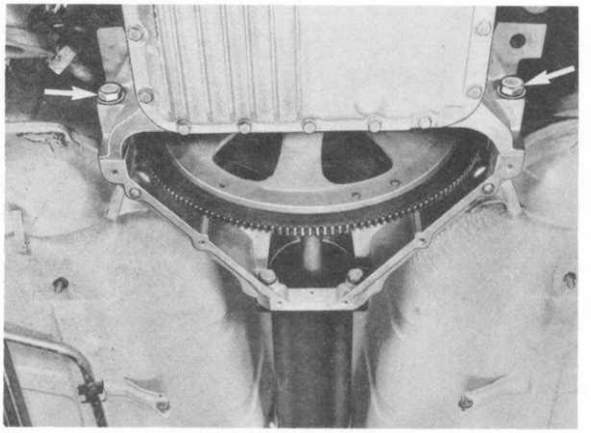
20. Screw out pan-head screw for clamping sleeve and mounting bolts for driver plate



21. Press out vacuum line from retaining clips and pull of hose.



22. Unscrew lower monting screws for clutch housing



23. Pull back central tube with transmission slightly and lower with universal transmission jack.

Note

Two persons will be required to remove central tube.

Istalling

Note

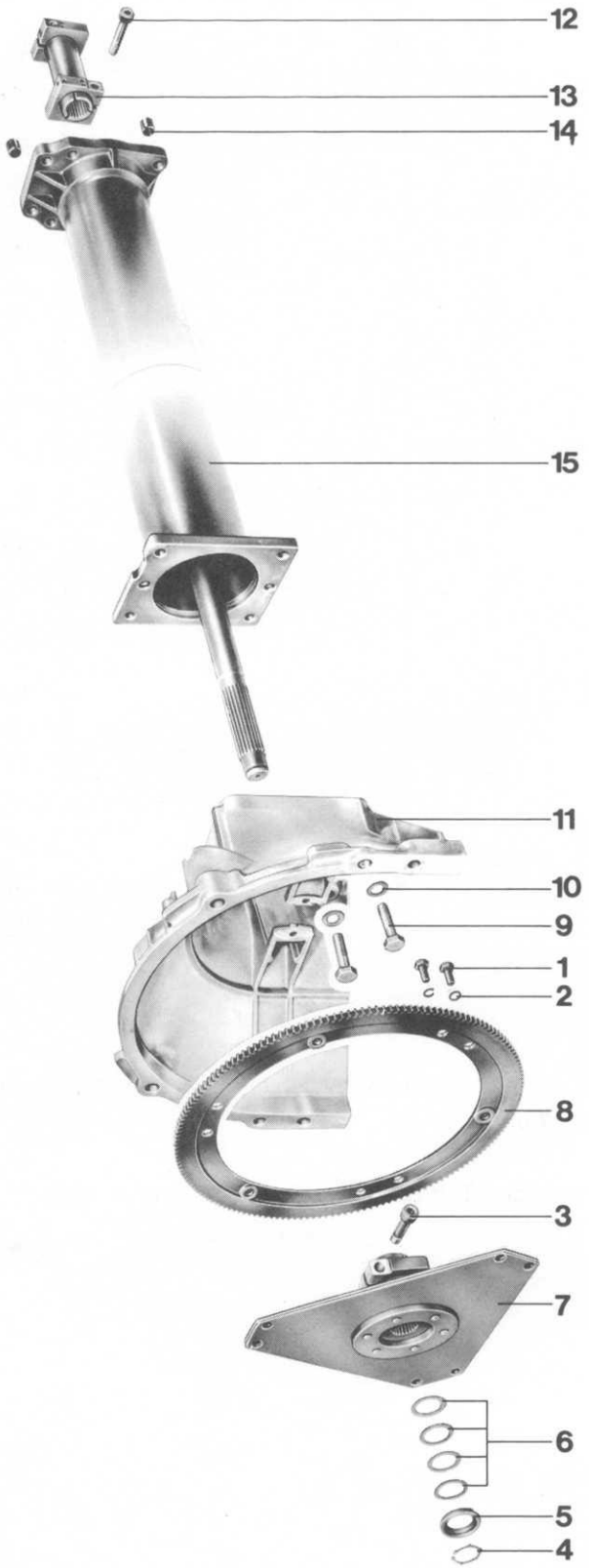
To avoid placing the driver plate of the flywheel under strain, start by tightening the six driver plate bolts and only tighten the pan-head screw of the clamping sleeve afterwards.

1. Note specified tightening torque values.

2. Adjust selector lever and control pressure cables.

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DISASSEMBLING AND ASSEMBLING CENTRAL TUBE (AUTOMATIC TRANSMISSION)



No.	Description	Qty.	Note when Removing	Note when Installing
1	Bolt	9		Torque: 32...39 Nm (24 ftlb...29 ftlb)
2	Lockwasher	9		Replace
3	Pan head screw	1		Torque: 80 Nm (59 ftlb)
4	Circlip*	1		Replace if necessary
5	Bushing*	1		
6	Shim*	X		
7	Driver plate	1		
8	Starter ring gear	1		
9	Bolt	4		Torque: 39...46 Nm (29 ftlb...34 ftlb)
10	Washer	4		
11	Drive plate housing	1		
12	Pan head screw	1		Torque: 80 Nm (59 ftlb)
13	Coupling	1		
14	Dowel sleeve	2		
15	Central tube	1		Check, replacing if necessary

Note

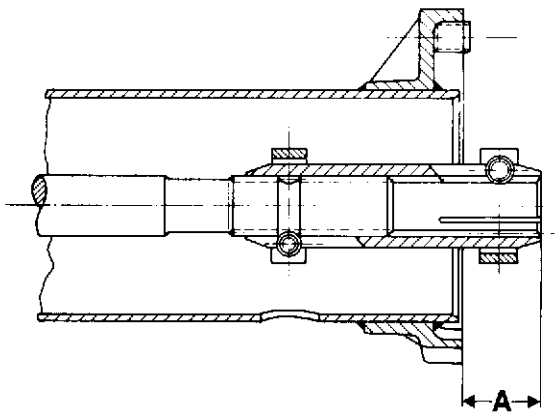
* Parts are deleted as of MY '85. Adjustment of the driver plate is no longer required (also refer to page 39 - 138, Vol. III).

The ring gear can only be replaced if the central tube has been removed.

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Checking Drive Shaft

Since the position of the drive shaft is important to proper operation, the coupling must protrude by 36 ± 0.5 mm.



A = 36 ± 0.5 mm

The amount of protrusion can be corrected by tapping with a plastic hammer against face of drive shaft.

Check for easy movement of drive shaft bearings by turning shaft by hand. Shaft must turn easily and without binding at any point.

Note

If bearings or shaft are damaged, replace entire central tube with shaft and bearings. There are no plans for replacement of individual parts.

Modification on Coupling

Note

At the beginning of standard production, manufacturing methods made it necessary to build about 120 transmissions without an undercut at the end of the spline on the drive shaft for the torque converter. This meant that 4.5 mm had to ground off of the face of the coupling.

The distance A = 36 $\pm$ 0.5 mm as mentioned on page 39 - 49 must not be applied to the shortened coupling.

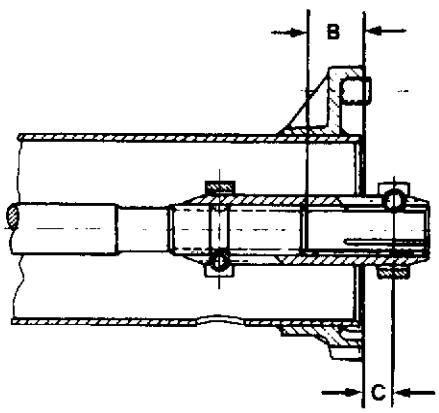
Total length of coupling = 130.00 mm
Total length of shortened coupling = 125.50 mm

When installed shortened end faces torque converter.

When using the shortened coupling, procedures for measuring the drive shaft are as follows.

1. Measuring without coupling:
   Distance "B" must be 30 $\pm$ 0.5 mm

2. Measuring with coupling:
   Distance "C" must be 17 $\pm$ 0.5 mm.



Distance B = 30 $\pm$ 0.5 mm
Distance C = 17 $\pm$ 0.5 mm

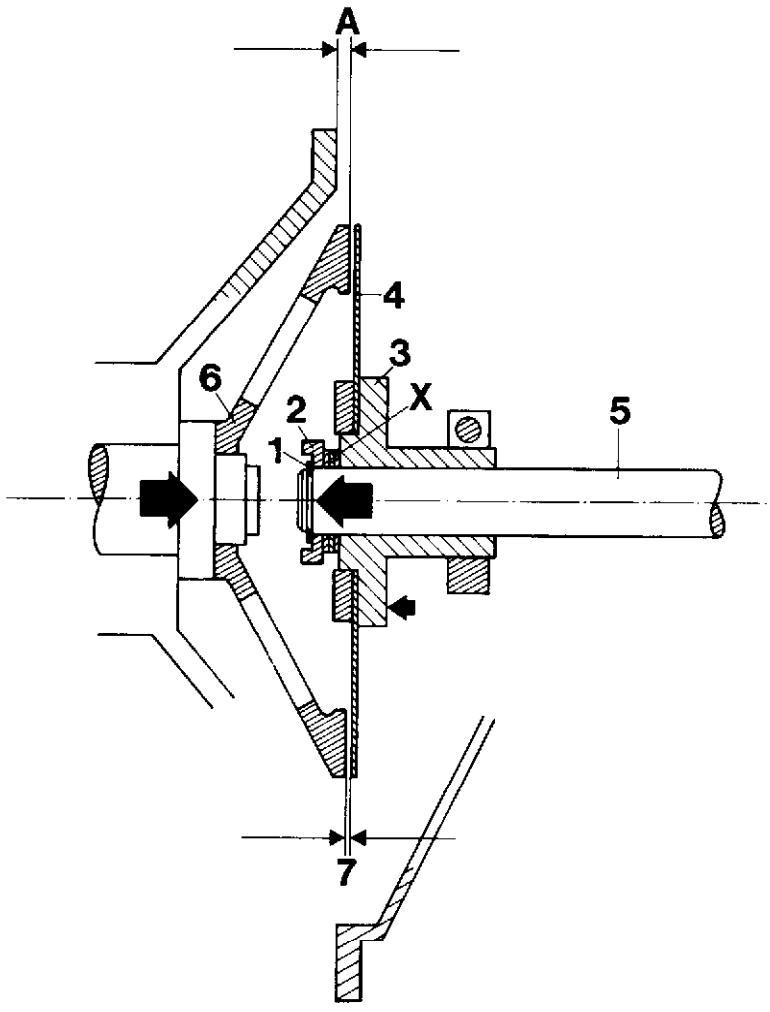
Note

The distances 30 $\pm$ 0.5 mm and 17 $\pm$ 0.5 mm apply to all couplings.

The protrusion can be corrected slightly with light taps from a plastic hammer against the face of the drive shaft.

Adjusting Drive Plate

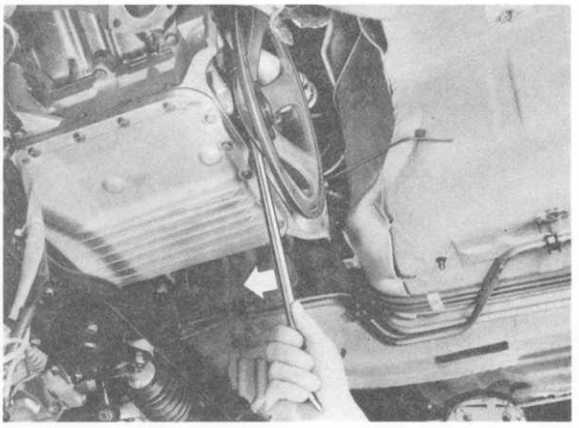
To prevent axial loads on crankshaft and consequently additional loads on crankshaft thrust bearings, the connections between flywheel and drive plate (distance X) must be checked and adjusted after replacement of engine, central tube, coupling, front converter housing or drive shaft for converter.



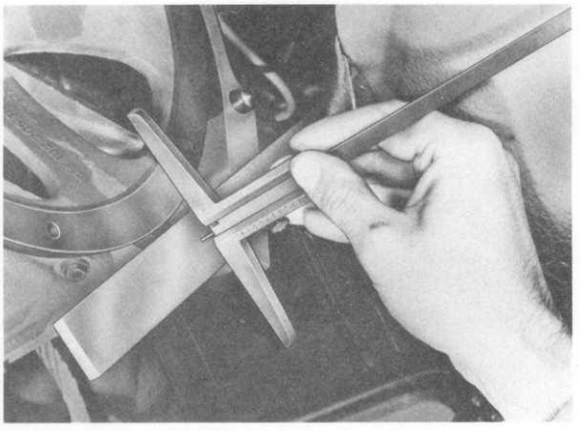
1 = Circlip
2 = Bushing
3 = Coupling flange
4 = Drive plate
5 = Drive shaft
6 = Engine flywheel
7 = Pre-load 0.3 + 0.2 mm
A = Distance A, engine flange/flywheel mating surface
X = Shim thickness (must be determined again)

Determining Distance X

1. Crankshaft must contact thrust bearing in direction of transmission. Pry flywheel with a lever until end play of crankshaft is eliminated.



2. Determine distance A, by using a ruler and measuring distance from engine flange to flywheel mating surface.



Note

Remember thickness of ruler when measuring.

Example:

Measured value	6.7 mm
Ruler thickness	+ 5.5 mm
Distance A	12.2 mm

3. Push coupling on to drive shaft and mount transmission on central tube. Tighten bolts to specified torque.

4. Screw in coupling screws by hand (finger tight).

5. Push drive flange with bushing, but without shims, on to drive shaft and install circlip.

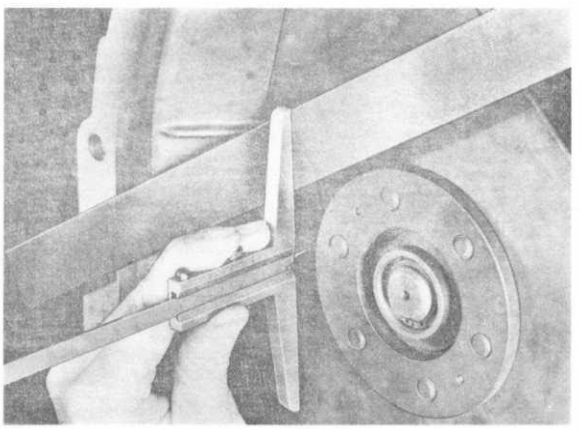
6. Use a suitable lever and push drive shaft on drive flange far enough forward so that drive shaft rests on screws on shaft groove.

7. Tighten screws for coupling to specified torque.

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8. Push drive flange forward against stop on circlip and tighten screw to specified torque.

9. Determine distance B. Use ruler and measure distance from drive plate housing to drive plate bearing surface (as far in as possible).



Determining Distance X

X = A - B + 0.5 mm pre-load

A =		12.2 mm
B =	-	7.4 mm
		4.8 mm
Preload =	+	0.3 mm
X =		5.1 mm

Install shim having thickness X (in example 5.3 mm).

Shims are available in thicknesses of 0.2 mm, 0.5 mm and 1.0 mm.

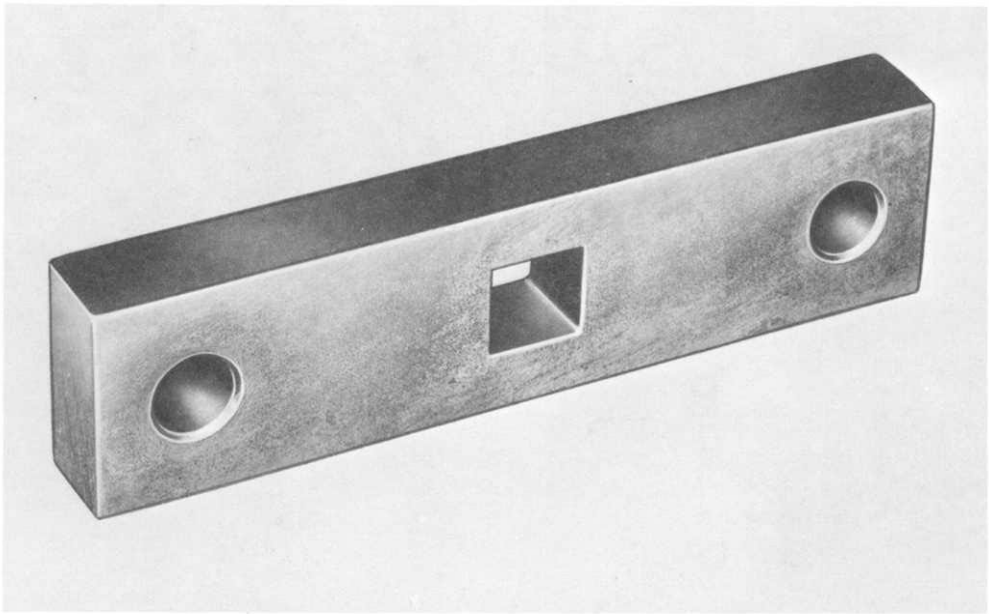
Note

Remember thickness of ruler used for measuring.

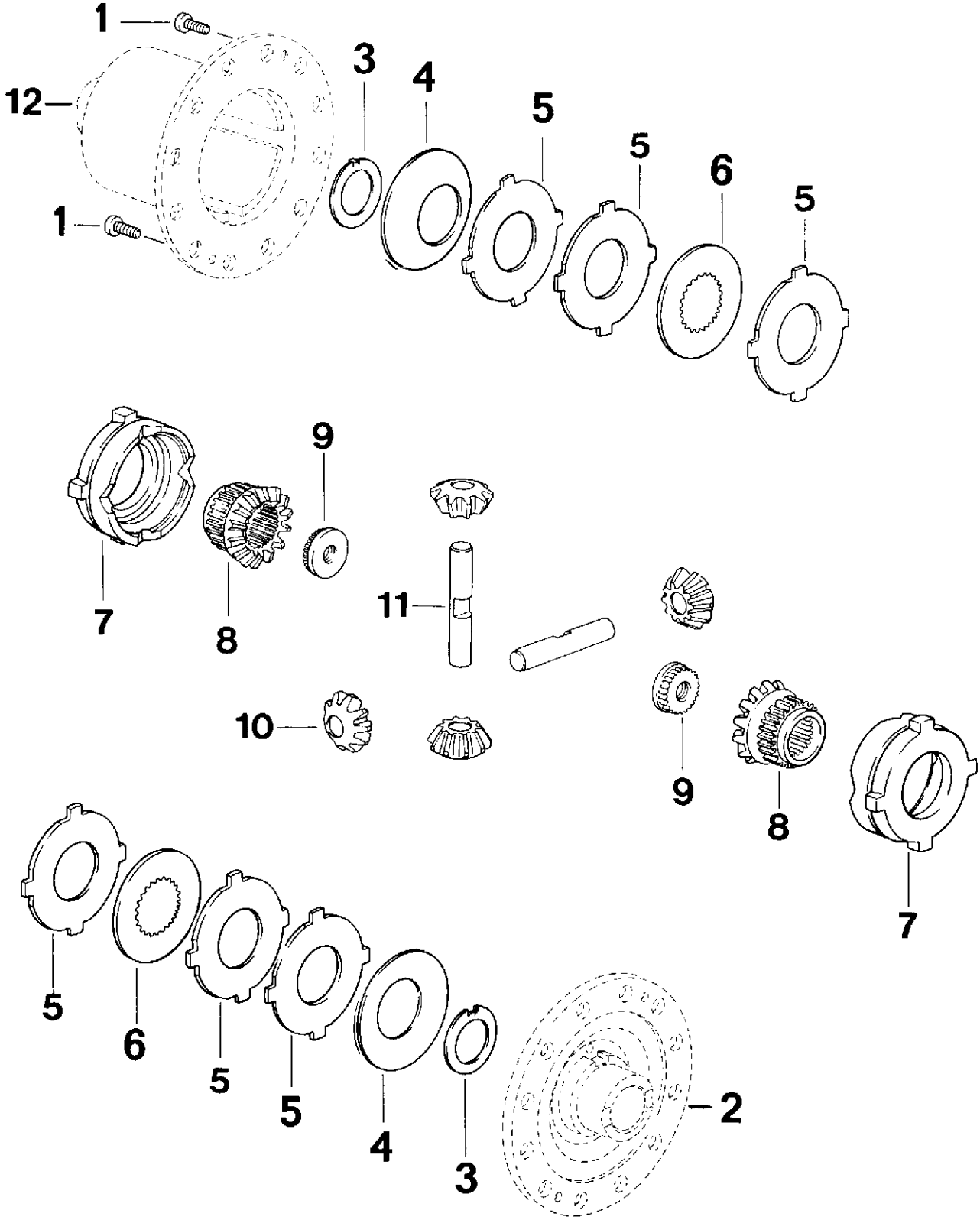
Example:

Measured value		12.9 mm
Ruler thickness	-	5.5 mm
Distance B		7.4 mm

TOOLS



No.	Description	Special Tool	Remarks
1	Connector	---	Local manufacture. Connector of joint flange can be made of 30 x 15 x 120 mm flat steel and must have a 1/2" square opening in the middle.


1
12
1
3
4
5
5
6
5
9
7
8
11
10
9
8
7
5
6
5
5
4
3
2

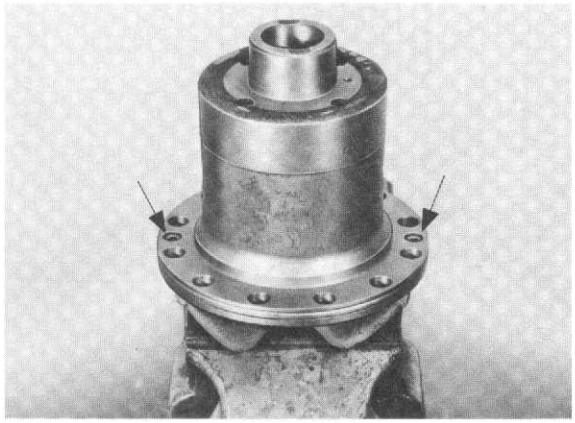
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bolt	2		Torque: 14 Nm (10 ftlb)	
2	Housing cover	1			
3	Thrust washer	2		Position correctly	
4	Spring retainer	2		Position correctly	
5	Outer plate	6			
6	Inner plate (molybdenum coated)	2			
7	Thrust ring	2			
8	Differential gear	2			
9	Splined nut	2	Press out of differential gear	Press in to correct position	
10	Differential pinion	4			
11	Differential shaft	2			
12	Differential housing	1			

DISASSEMBLING AND ASSEMBLING LIMITED SLIP DIFFERENTIAL

Disassembling

1. Take off ring gear.

2. Loosen screws on housing flange and remove cover.



3. Remove all inner parts.

Note

Note order of installed plates in order to have same locking ratio when reassembled.

Assembling

1. Check all parts for wear or damage and replace, if necessary.

   a) Differential housing:
   Check guide grooves for outer plates and thrust rings for wear.

   b) Thrust rings:
   Guide tabs and bearing surfaces must not be worn seriously or scored. In addition, they must move easily in differential housing.

   c) Differential gears:
   Bearing surfaces for thrust washers must not be worn and inner plates must move easily on splines of differential gears.

   d) Plates:
   Check inner and outer plates for wear. Guide tabs of outer plates and splines of inner plates must not be seriously worn.

2. Lubricate all sliding surfaces of plates, thrust rings and differential shafts with SAE 90 hypoid gear lube prior to installation.

3. Install thrust washers so that holding tabs engage in bore of housing or housing cover. Applying grease to the washers to hold them in position will facilitate installation.

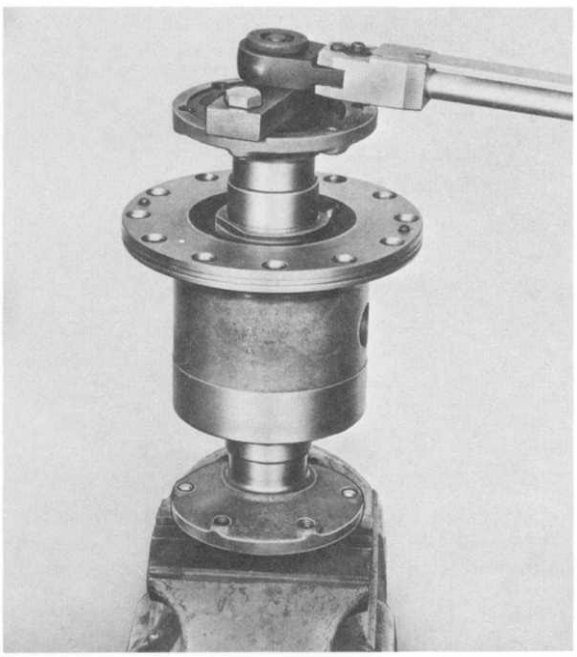
4. Install other parts as shown in exploded drawing.

It is essential that plates be installed in correct order and position to reach the same locking ratio.

Note

Diaphragm springs must be installed so that concave sides face in toward plate assembly.

5. Check torque slip with one differential gear held tight and one driven. This requires clamping a flange with two bolts in a vise and installing the differential. Install a second flange with the local manufactured connector and turn the differential with a torque wrench. A torque of 5 to 20 Nm (4 to 14 ftlb) must be reached.



Note

If the specified torque cannot be reached, a change can be made by installing pertinent outer plates. Outer plates are available in thicknesses of 1.9, 2.0 and 2.1 mm.

If the thickest outer plates are installed and the specified torque is still not reached, all plates are worn and must be replaced.

REMOVING AND INSTALLING CENTRAL TUBE (Manual Transmission)

REMOVING AND INSTALLING INSTRUCTIONS

Removing

1. Remove exhaust assembly with heat shields.

2. Remove rear axle.

Note

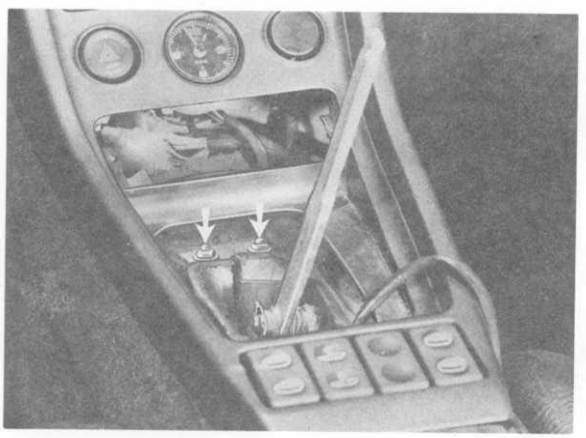
Let rear axle of cars with a bolted battery console hang down on the trailing links and support same (tie up).

3. Remove transmission (see page 34 - 3).

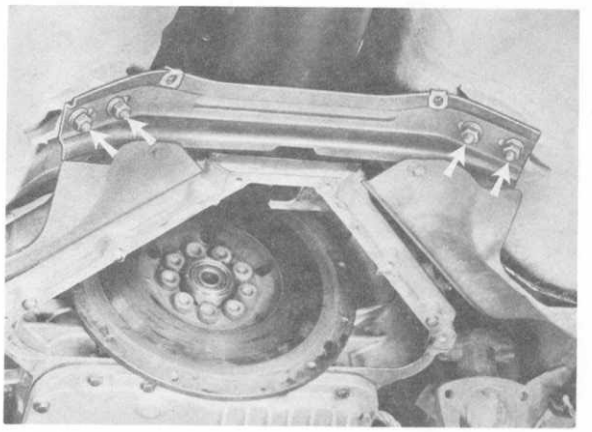
4. Remove clutch (see page 30 - 3).

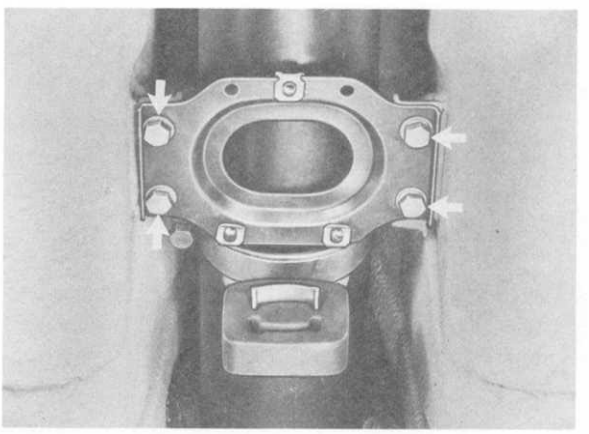
5. Remove shift lever.

6. Remove ashtray and unscrew guide tube mount from body (only for cars manufactured up to August 7, 1978).

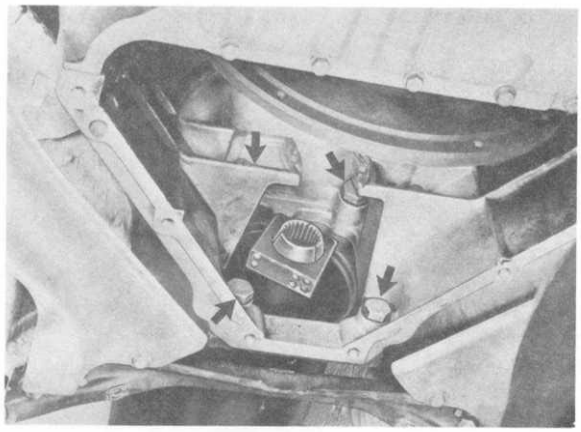


7. Remove front and rear reinforcement plates.





8. Support central tube from underneath and remove clutch bell housing/central tube mounting bolts.



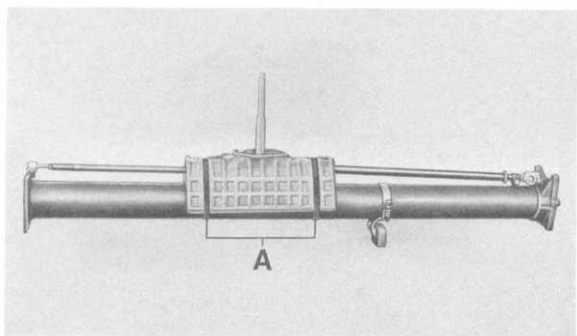
4. Tighten all mounting bolts to specified torque.

Installing

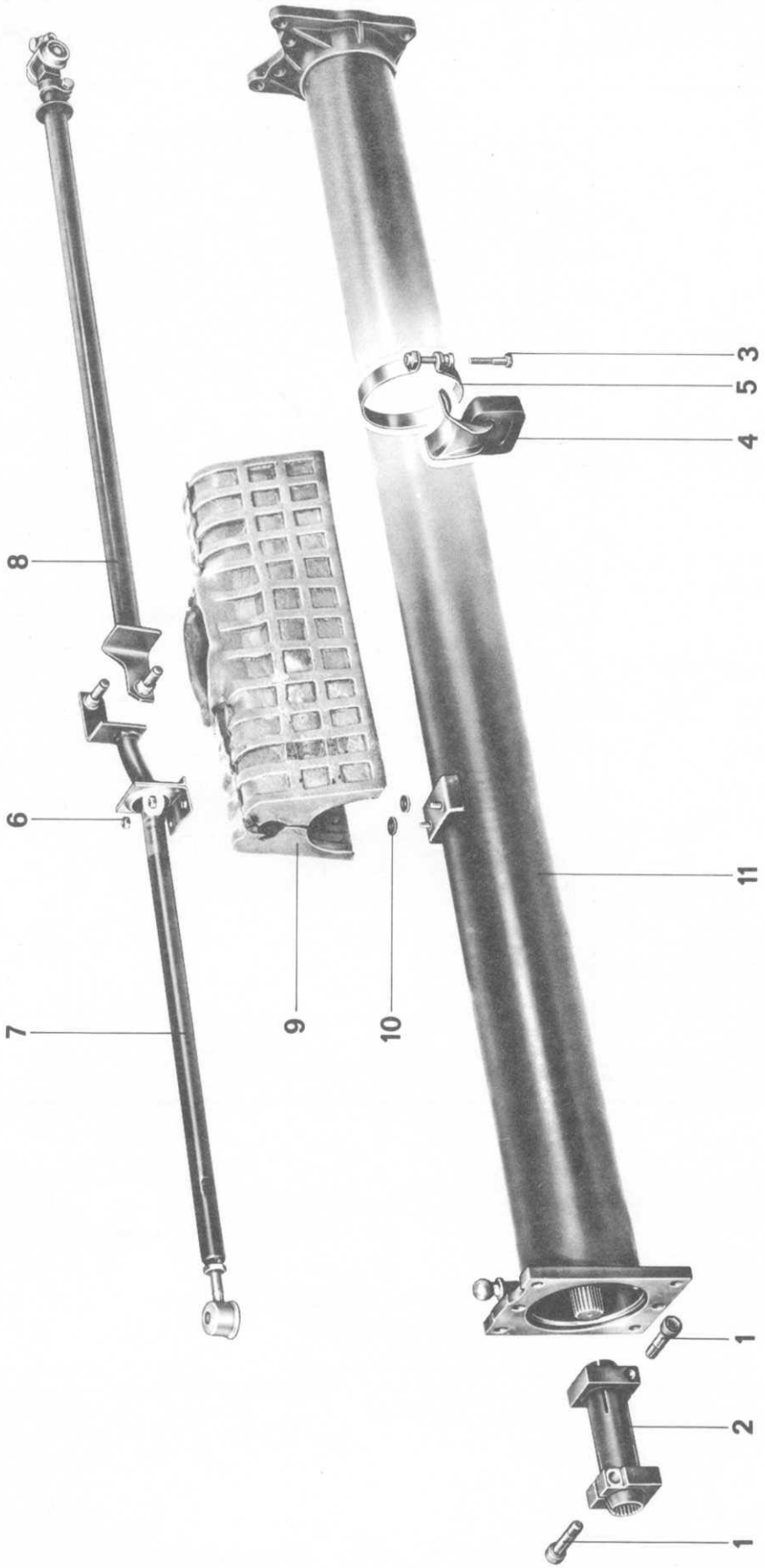
1. Adjust selector linkage, if necessary.

2. Brush a thin coat of Optimoly HT paste on spline of central shaft.

3. Wrap strips of tape around insulation sheet and coat bearing surfaces on body with Contifix grease to facilitate installation.



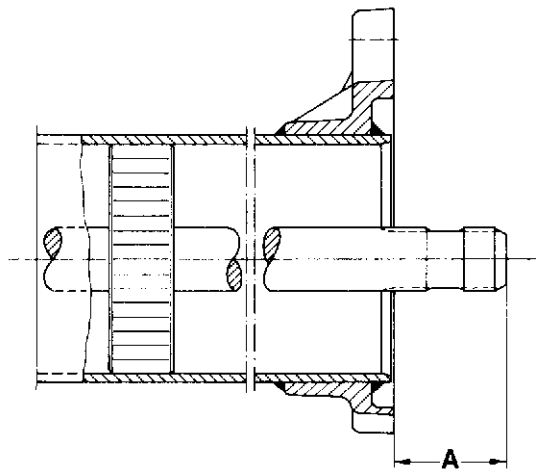
A - Tape strips


3
5
4
8
6
11
7
9
10
1
2
1

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt	2		Tighten to 80 Nm (8.0 kpm)	
2	Double clamp	1			
3	Bolt	1			
4	Hook with rubber mount	1			
5	Strap	1	Mark position for installing later		
6	Nut	2			Not for cars produced up to 7.8.78
7	Guide tube with mount and angle joint	1	Pry off angle joint with suitable open-end wrench	Coat ball shell and ball head of ball joint white lube paste and drive on carefully	On cars produced up to 7.8.78 mount of guide tube is on body
8	Selector rod	1			
9	Insulation sheet	1		Wrap strips of tape around and coat bearing surfaces to body with Contifix grease	
10	Rubber washer	2			Not for cars produced up to 7.8.78
11	Central tube	1		Check, replacing if necessary	

Checking Drive Shaft

Since the position of the drive shaft is important to guarantee proper operation, the drive shaft must protrude by 46.85 - 0.5 mm.



A = 46,85 - 0,5 mm

The amount of protrusion can be correctly slightly by tapping with a plastic hammer against face of drive shaft.

Check easy movement of drive shaft bearings by turning shaft by hand. Shaft must turn easily and without restriction at any point.

Note

If bearings or shaft are damaged, replace entire drive tube with shaft and bearings. There are no plans for replacement of separate parts.

Max. permissible runout for central shaft: 0,8 mm.

The procedures described for repairing the 5-speed manual transmission

Type G 28 '85 models onward

are arranged by repair groups and 200-series page numbers.

To keep the documents in correct order, please file all pages with 200-series page numbers behind the yellow Marker Sheet.

For example:

30 - 0201.....

34 - 201.....

35 - 201.....

39 - 201.....

Page

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Checking adjustment of selector lever cable and starter locking / backup light switch . . 37-111
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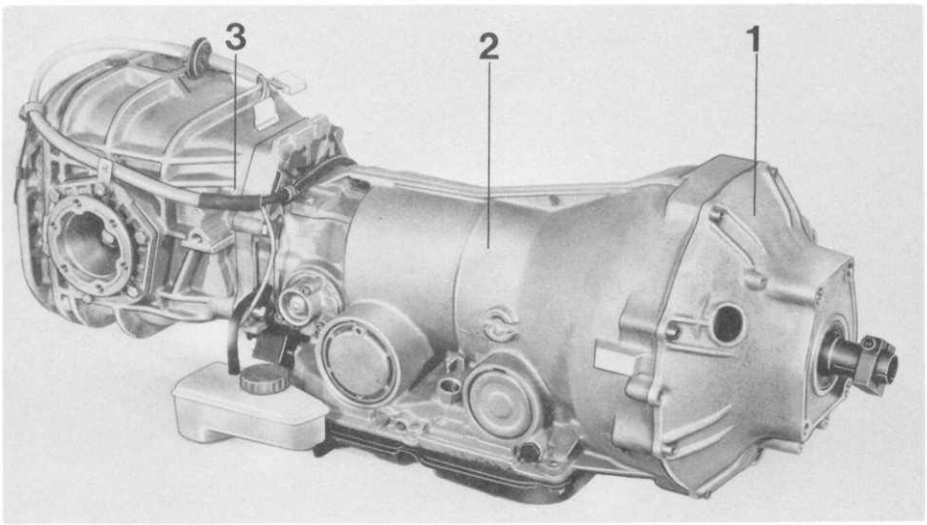
Disassembling and assembling secondary pump 38-155
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4 - SPEED AUTOMATIC TRANSMISSION (UP TO '86 MODELS)

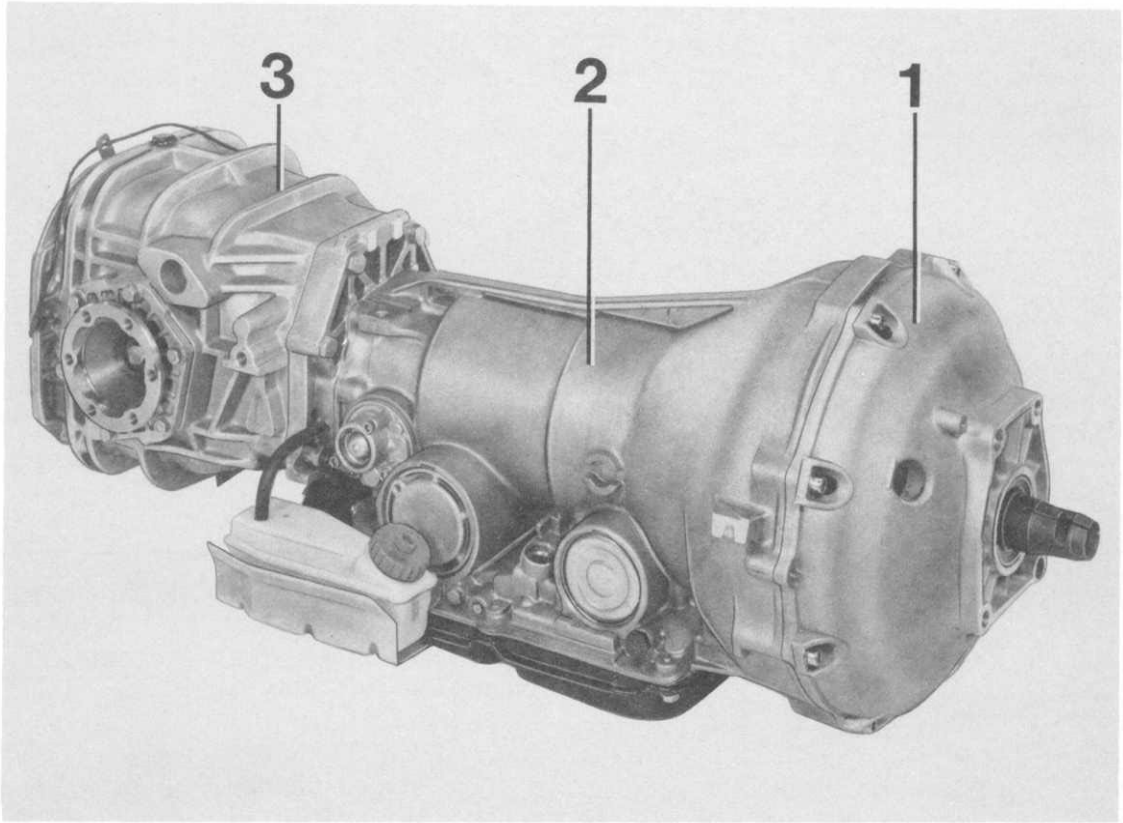


1 - Front converter casing
2 - Automatic transmission
3 - Final drive

Transmission Type	installed in
A 28.01	928 S, USA series / '83 and '84 models for Japan
A 28.02	928 S, Special option for Europe / rest of the world, '84 models
A 28.03	928 S, Special option (M 251) Europe / rest of the world 3/84 onward (as 28.02, but rear axle transmission ratio 13 : 33)
A 28.04	928 S, USA series / '85 models for Japan
A 28.05	928 S, Special option Europe / '85 models rest of the world
A 28.06	928 S, Special option (M 251) Europe / '85 models rest of the world (as A 28.05, but with rear axle transmission ratio 13 : 33)
A 28.07	928 S, USA series / '86 models for Japan
A 28.08	928 S, Special option Europe / '86 models rest of the world
A 28.09	928 S, Special option (M 251) Europe / '86 models rest of the world (as A 28/08, but with rear axle transmission ratio (13 : 33)
A 28.11	928 S, Australia series, special option (M 299) for FGR, Switzerland, Austria, Sweden ('86 models)

Technical Data

4-speed automatic transmission ('87 models onward)



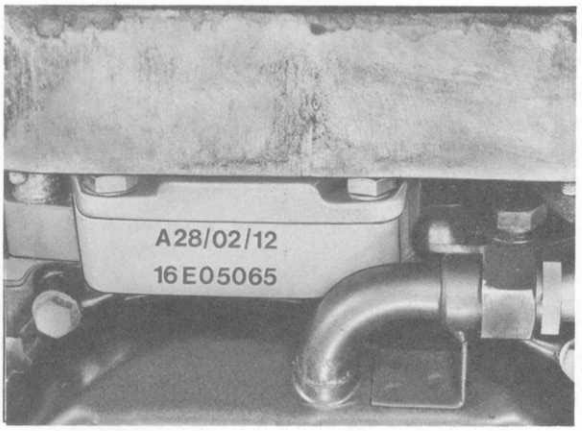
1 - Front converter casing
2 - Automatic transmission
3 - Final drive

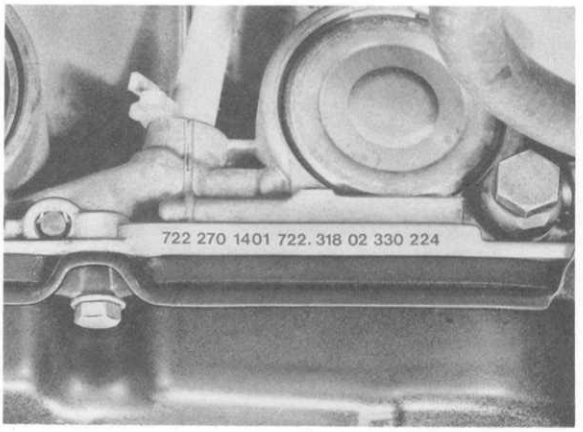
Type	Key-number	Equipment	installed in	model
A28.12	—	4 speed	928 S 4 USA/Jap.	87/88
A28.14	—	4 speed	928 S 4 R.d.W.	87/88
A28.16	—	4 speed	928 S 4 worldwide	89/90/91
A28.18	—	4 speed	928 GTS worldwide	92/93

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Technical Data

Transmission Designation





A 28 02 12 1 6 E 05065

- Serial number
- year of manufacture
  D = 1983 E = 1984 F = 1985
  G = 1986 H = 1987
- Type
  1 = 5 - speed transmission
  6 = Automatic
- Transmission for 8 cylinder vehicles
- Limited-slip differential 40 %
- Country code
- Transmission type
  A 28 = four speed automatic
  A 22 = three-speed automatic
  G 28 = five-speed manual transmission

Product Number Combinations:

722 270 **12** 01 722 **316** 02...= A 28.01
722 270 **14** 01 722 **318** 02...= A 28.02/03
722 270 **17** 01 722 **316** 02...= A 28.04
722 270 **18** 01 722 **318** 02...= A 28.05/06
722 270 **21** 01 722 **318** 02...= A 28.08/09

722 270 **25** 01 722 **316** 02...= A 28.07
722 270 **26** 01 722 **316** 02...= A 28.11
722 270 **21** 01 722 **326** 02...= A 28.12/14
722 270 **32** 01 722 **360** 03...= A 28.16
722 270 **34** 01 722 **360** 03...= A 28.18

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Technical Data

Transmission numbers (12 digits)



Transmission type

Index for variants within the assembly number

0 = no differential
1 = normal differential
2 = ZF limited slip differential
3 = proportional slip differential

Model year

J = 1988
K = 1989
L = 1990
M = 1991

Serial number
e.g. 00903

Note:

As from model '88, the gear box number will be readable from below, stamped on the rear stiffening rib of the rear-axle housing

* As of MY '92, the model letter is omitted.

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General data	A28.01/04/07/12	A28.02/03/05/06/08/09/11/14/16/18
Design	Fully automatic 4-speed sun-and-planet transmission	
Ratios		A 28/16
1st gear	3,68	3,87
2nd gear	2,41	2,25
3rd gear	1,44	1,44
4th gear	1,00	1,00
Rückwärtsgang	5,14	5,59
Final drive	Drive pinion without hypoid displacement	
Final drive ratio	15 : 33 i = 2,200	14 : 33 i = 2,357 (A 28.02/05/08) 13 : 33 i = 2,538 (A 28.03/06/09/11/14/16/18)
(Stall speed)	A 28.01 = 2200...2600 rpm	A 28.02/03/05/06/08/09/11 = 2200...2600 rpm
	A 28.04/07 = 1650...2050 rpm	A 28.14/16/18 = 1750...2150 rpm
	A28.12 = 1750...2150 rpm	
Capacity, rear axle final drive	up to MY '86 = approx. 2.7 l from MY '87 to '90 = approx. 3.0 l MY '91 = 2.3 l* as of MY '92 = 1.9 l	
Oil grade	Multigrade transmission oil 75 W 90 to MIL - L 2105 B or API classification GL5	
Capacity, auto. unit with converter	Total capacity = approx. 8.01 ('87 models onward, approx. 9.31). Capacity for fluid change with converter = approx. 6.01 ('87 models onward, approx. 7.31) ATF Dexron II D.	

* refer to Technical Information No. 1/91 of 08.3.91

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TIGHTENING TORQUE FOR AUTOMATIC TRANSMISSION

Location	Description	Threads	Material	Torque Nm (ftlb)
Primary pump to front cover	Bolt	M 8	8.8	20 (14)
Plug (converter)	Bolt	M 10 x 1	10.9	14 (10)
Front cover to transmission case	Bolt	M 8	8.8	13 (9)
Support flange to transmission case	Bolt	M 6	10.9	11 (8)
Plug (brake band B 1 mount)	Plug	M 27 x 1.5	–	70 (51)
Catch plate on range selector shaft	Bolt	M 6	8.8	8 (6)
Leaf spring to transmission case	Bolt	M 6	8.8	8 (6)
Starter interlock and backup light switch to transmission case	Bolt	M 6	8.8	8 (6)
Range selector lever to shaft	Bolt	M 6	8.8	8 (6)
Secondary pump to transmission case	Bolt	M 6	8.8	8 (6)
Governor axial hold on shaft	Nut	M 6	8	6 (4.3)

TIGHTENING TORQUE FOR AUTOMATIC TRANSMISSION

Location	Description	Threads	Material	Torque Nm (ftlb)
Lower cover with reinforcement plate	Bolt	M 5	5.8	4 (3)
Lower cover assy. to transmission case	Bolt	M 6	8.8	8 (6)
Plug (test connection for modulating, governor and operating pressure)	Plug	M 8 x 1	–	13 (9)
Vacuum unit bracket	Bolt	M 6	8.8	8 (6)
Kickdown solenoid valve	Solenoid	M 14 x 1.5	–	20 (14)
End plate on valve body housing	Bolt	M 4	8.8	3.3 (2.3)
End plate on drive housing	Bolt	M 4	8.8	3.3 (2.3)
Drive housing to valve body housing	Bolt	M 5	4.8	0.15 (0.11)
Valve body housing to transmission	Bolt	M 6	8.8	8 (6)
ATF filter to lower cover	Bolt	M 5	8.8	4 (3)

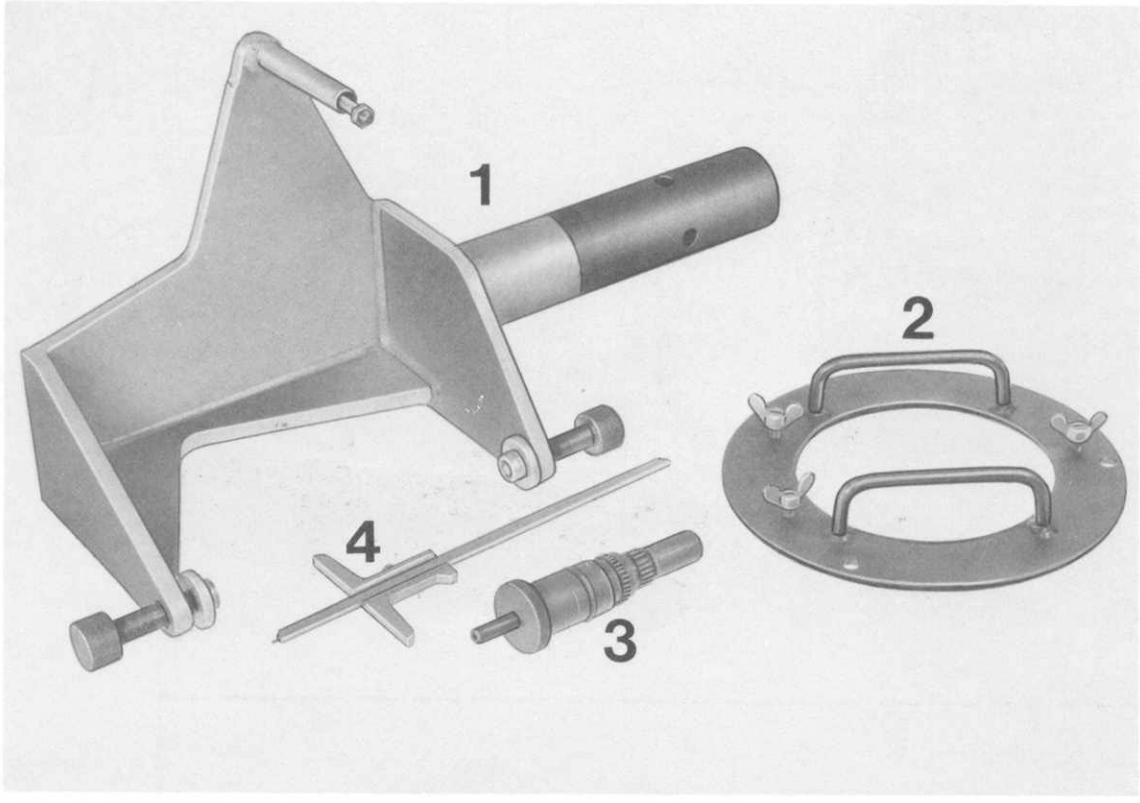
Tightening torques (automatic transmission)

Location	Thread	Tightening Torque Nm (ftlb)
Threaded plug (ATF pan)	M 10 x 1	22 (12)
ATF pan to transmission case	M 8	8 (5.9)
Front converter casing to transmission case	M 8	23 (17)
Carrier plate to converter	M 8	46 (34)
Rear transmission cas to transmission case	M 10	42 (31)
Bearing assembly to rear transmission case	M 8	33 (24)
Final drive to transmission case	M 10	46 (34)
Collar nut (drive pinion)	M 26 x 1.5	380* (280)
ATF filler tube to ATF pan	M 24	78 (58)
ATF reservoir to ATF pan	M 6	6 (4.4)

* As of MY '92 (transmission type A28.18) = **450 Nm** (332 ftlb).

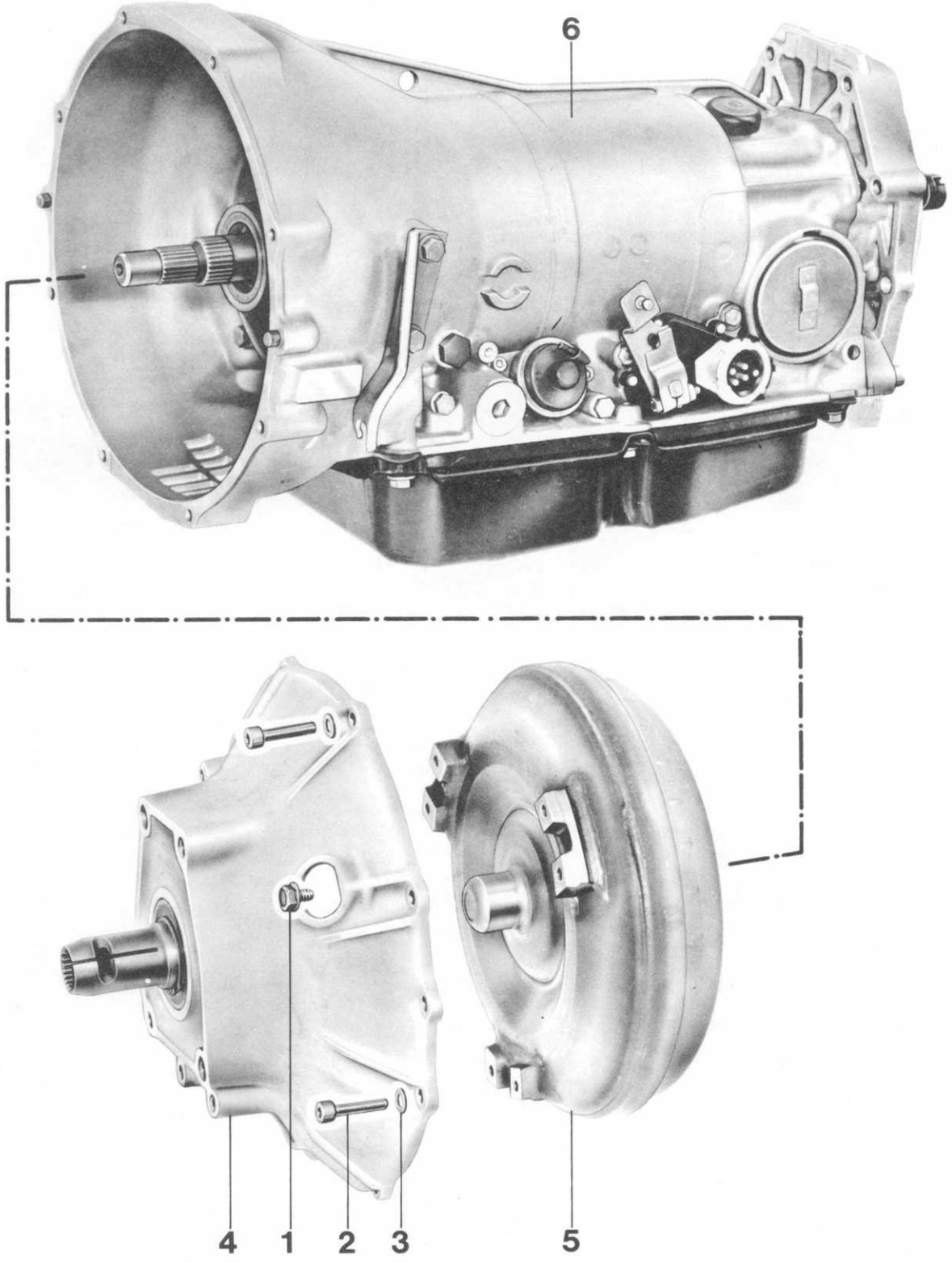
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TOOLS



No.	Description	Special Tool	Remarks
1	Transmission holder	9216	
2	Grip plate	9301	
3	Mandrel	9310	
4	Depth gauge	–	Standard tool

REMOVING AND INSTALLING TORQUE CONVERTER



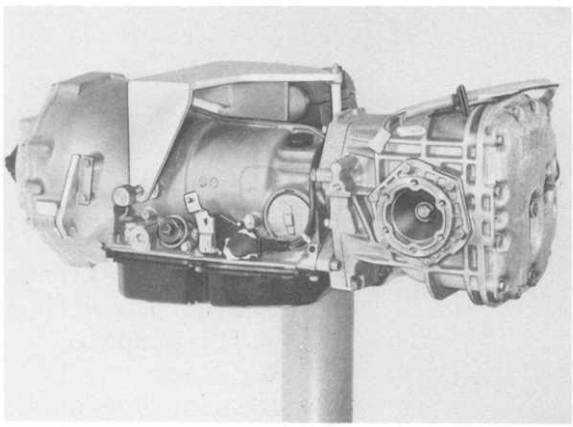
No.	Description	Qty.	Note When: Removing	Installing
1	Mounting bolt	6		Tightening torque: 46 Nm (34 ftlb)
2	Panhead bolt	8		Tightening torque: 23 Nm (17 ftlb)
3	Washer	8		
4	Front converter casing	1		
5	Torque converter	1	Lift out carefully with Special Tool 9301	Renew if badly worn or if particles are found in ATF. Lubricate drive flange and bearing pin with MoS_2 multi-purpose grease. Place transmission upright and insert carefully using Special Tool 9301. Note installation depth.
6	Automatic transmission	1		

NOTES ON REMOVING AND INSTALLING

Removing

1.Remove transmission.

2.Using Special Tool 9216, attach transmission to assembly support.

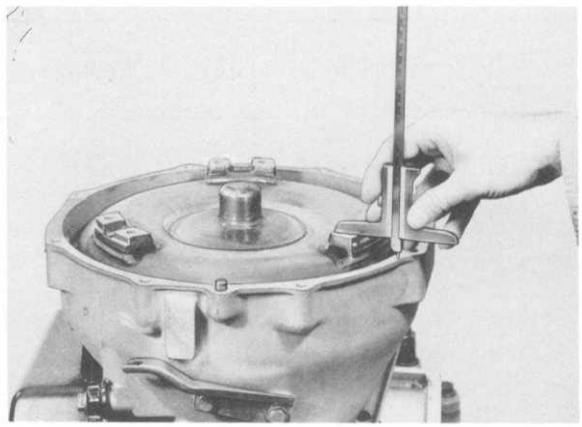


3.Place transmission upright and working through the openings in the converter casing, remove converter mounting bolts.

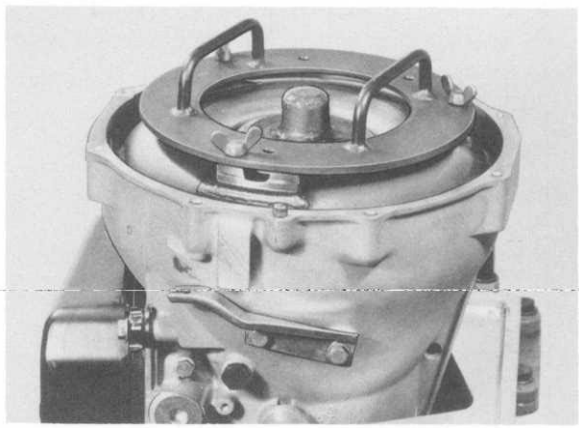
4.Remove mounting bolts for converter casing and remove casing.

5.Measure installation depth of converter and make a note for reassembly.

Up to '86 models = approx. 16 mm
'87 models onward = approx. 28 mm



6.Attach Special Tool 9301 to torque converter and carefully lift out converter.

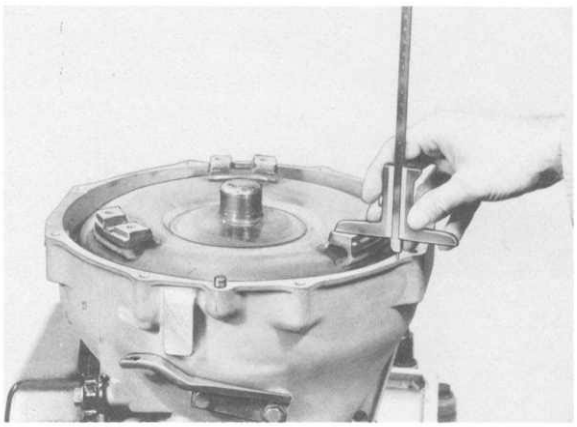


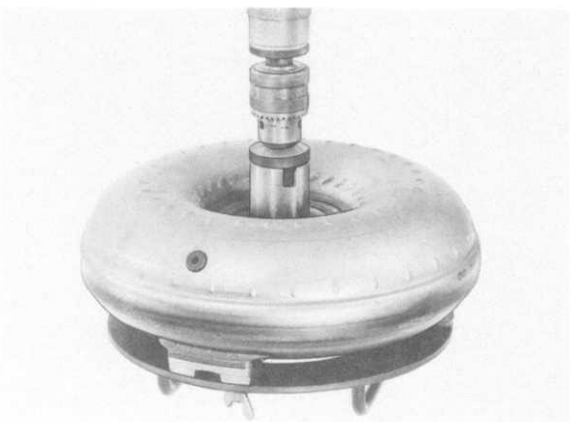
Installing

Note:

If the ATF smells burnt or if the fluid contains particles of pad material, torque converter and ATF cooler must be rinsed.
If particles of metal are found in the ATF pan, the torque converter must be replaced. Rinsing will not remove all metal particles and damage to the transmission may result.

1. Rinse torque converter with Special Tool 9310. To rinse, fill converter with approx. 1l of kerosine, insert the rinsing pin and use a hand drill to turn the pin at low speed. Then drain kerosine off through drain plug. Repeat rinsing 2 - 4 times until the kerosine drained from the converter is clean.





2. Attach Special Tool 9301 to torque converter.

3. Coat drive flange and bearing pin of converter with MoS_2 multi-purpose grease.

4. Place transmission upright and carefully insert converter, turning unit in both directions to engage the teeth.

5. Check installation depth of converter.

   Up to '86 models = approx. 16 mm
   '87 models onward = approx. 28 mm

REMOVING AND INSTALLING SELECTOR LEVER COVER FRAME

Removing

1. Remove selector lever grip and take off rubber boot.

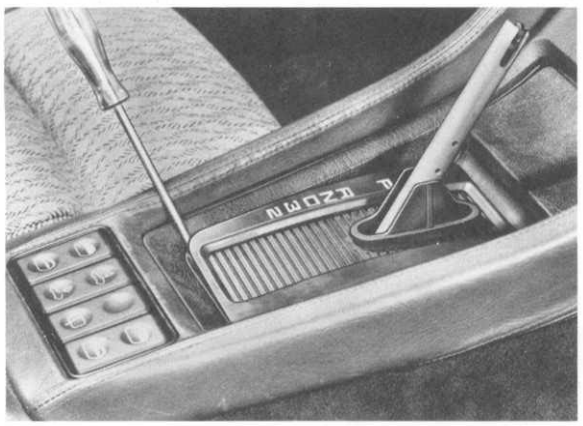
2. Move selector lever to position "2" and push rear locking bar forward against stop with a suitable tool (e. g. scribe).



3. Move selector lever to position "R", disconnect gate and push forward as far as possible.

4. Push front locking bar forward against stop with a suitable tool (e. g. scribe).

5. Move selector lever to position "P" and press out cover frame carefully with a suitable screwdriver applied at the left rear corner.



6. Move selector lever to position "N" and remove frame inclined toward rear.

Installing

1. Move selector lever to position "3".

2. Push gate in frame forward all the way.

3. Install cover frame in correct position and move selector lever to position "P".

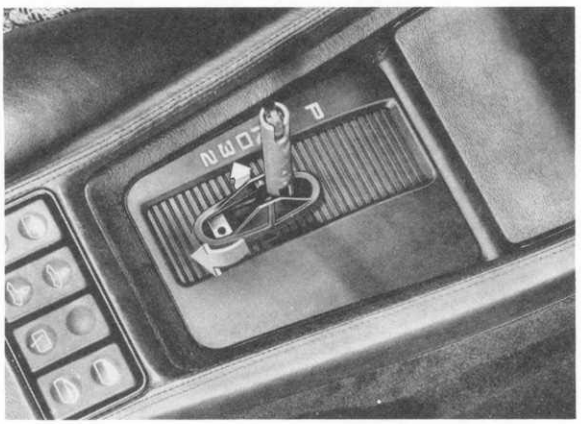
4. Push cover frame forward and move right side to correct installed position (this is done by lifting left rear corner slightly and pushing down on right side).

5. Push down on left rear corner until frame fits in center console correctly.

6. Position selector lever between "R" and "P", disconnect gate on selector lever and push forward.

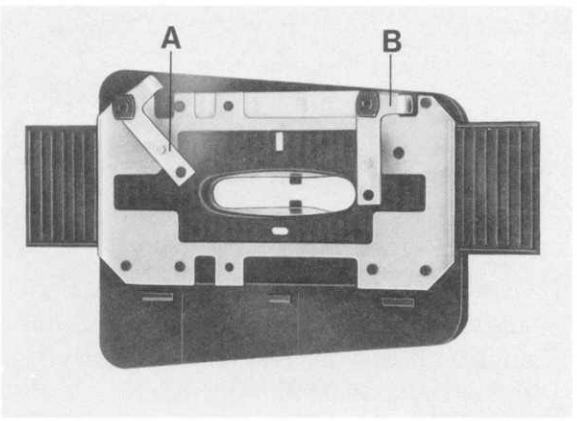
7. Push front locking bar toward rear until it engages.

8. Move selector lever to position "3" and push rear locking bar toward rear until it engages.



9. Attach gate in selector lever, install rubber boot in correct position and install selector lever grip.

10. Move selector lever in and out of all positions and make sure that cover frame fits properly.



A – Locked

B – Unlocked

REMOVING AND INSTALLING SELECTOR LEVER CABLE

Removing

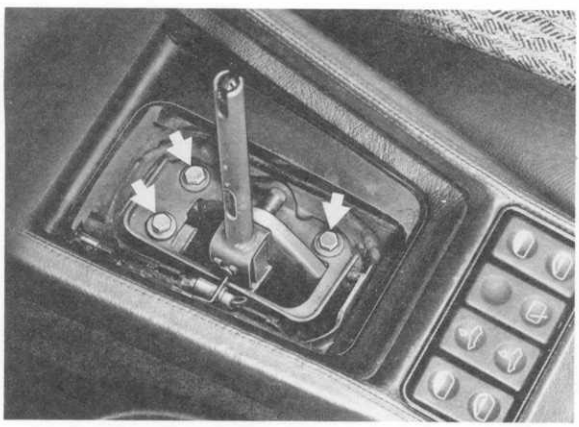
1. Unscrew ground strap of battery on body.

2. Remove selector lever grip and take off rubber boot.

3. Remove cover frame (see page 37 - 101).

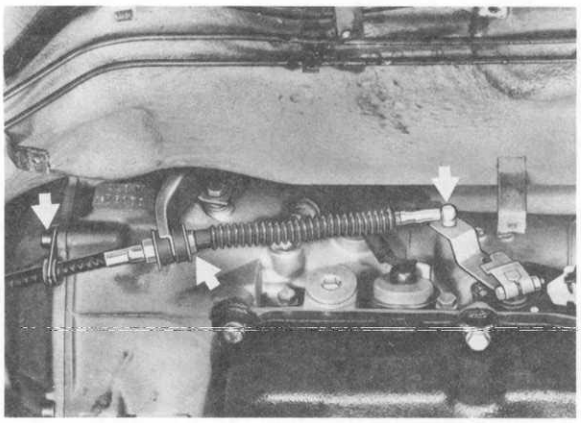
4. Pull bulb holder carrier out of retaining clips.

5. Mark location of selector lever base for reinstallation and remove mounting screws.



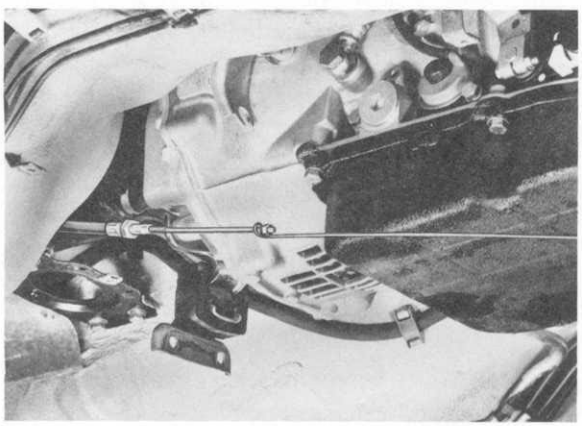
6. Loosen intermediate muffler shield and push aside as far as possible.

7. Disconnect selector lever cable on transmission lever and detach cable sleeve on brackets.

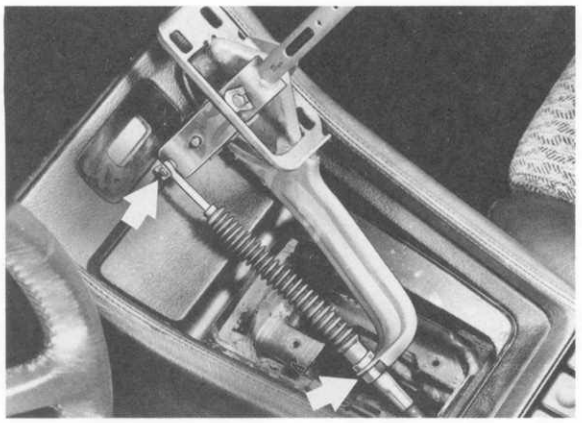


8. Take off ball head, hexagon nut and mounting parts.

9. Attach tailing wire on cable and pull out selector lever base with cable by pulling forward at an angle.



10. Remove cable circlip on selector lever and detach cable sleeve on selector lever base.



Installing

1. Attach cable sleeve on selector lever base, tightening the hexagon nut carefully.

2. Push cable on to selector lever pin and install circlip.

3. Attach tailing wire, pulled forward during removal, on cable and pull cable toward rear, whereby one person should guide in the selector lever base and a second person must pull wire and cable.

4. Install selector lever base in correct position (watching mark) and tighten mounting screws with 15 Nm/11 ftlb.

5. Install cover frame and selector lever grip. Place selector lever at "N".

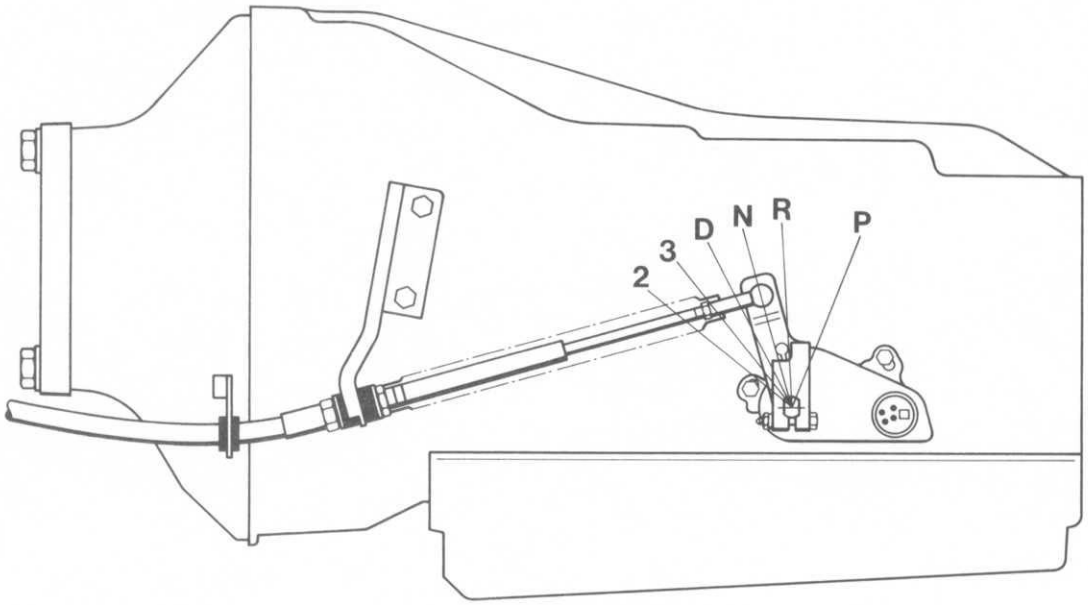
Note:

If light opening of gate and letter "N" are not exactly opposite each other in cover frame, remove cover frame again and reposition selector lever base in slots.

6. Mount selector lever cable on transmission as specified.

7. Adjust selector lever cable (see page 37 - 105).

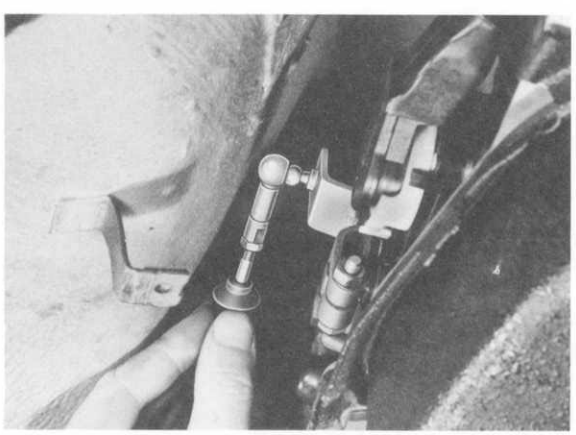
ADJUSTING SELECTOR LEVER CABLE



1. Move selector lever to position "N".

2. Place range selector lever on transmission in "N".

3. Adjust ball end on cable that attachment is possible without tension.



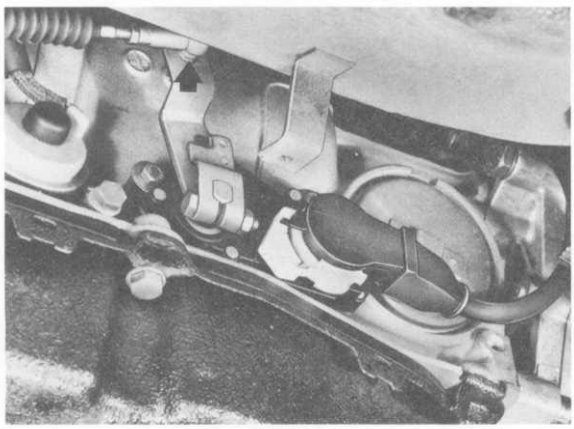
Note:

Bolt for range selector lever must be tightened for adjustments.

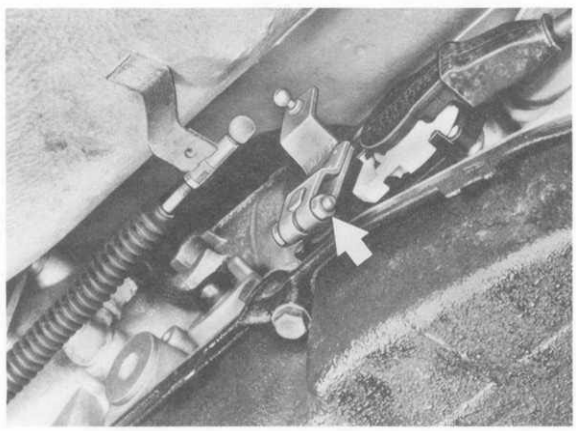
REMOVING AND INSTALLING STARTER LOCKING AND BACKUP LIGHT SWITCH

Removing

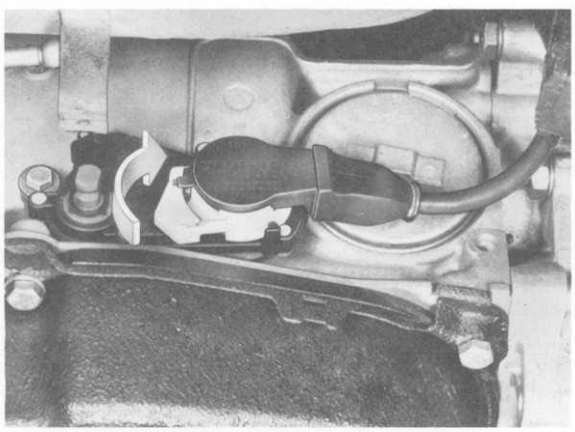
1. Disconnect selector lever cable.



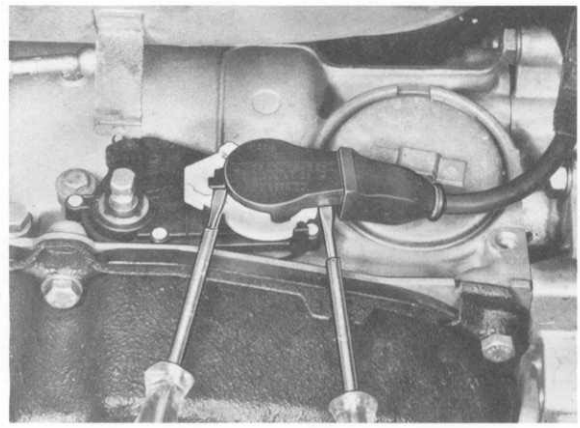
2. Remove bolt for range selector lever and pull off lever.



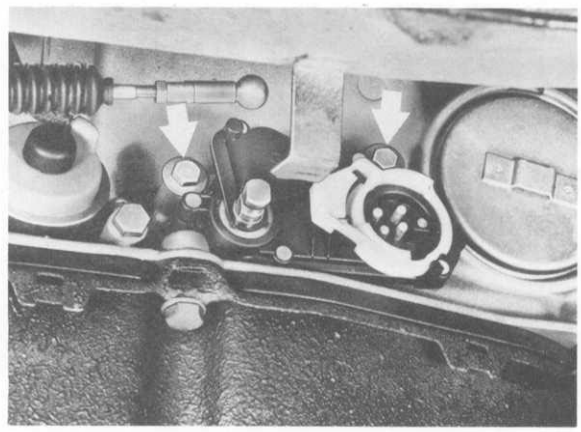
3. Unlock plug by turning white plastic ring (arrow) upwards in direction of arrow.



4. Pry off plug carefully with two screwdrivers applied on cable outlet and bar.



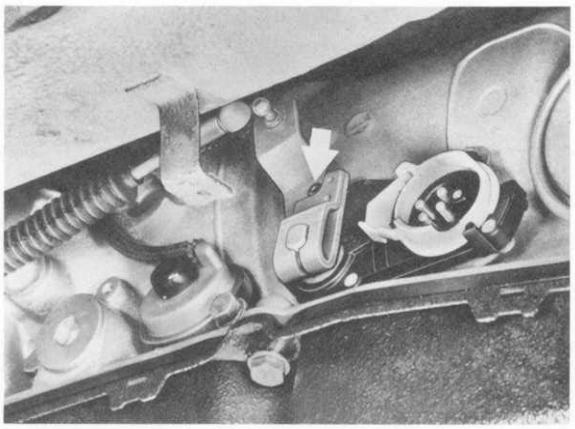
5. Remove switch mounting screws and take off switch.



Installing

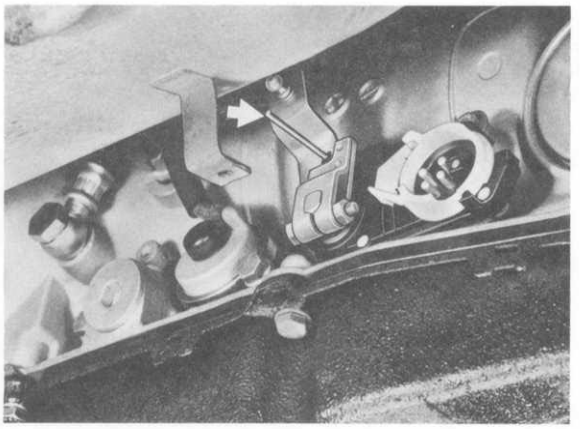
1. Install switch with both mounting screws, but do not tighten.

2. Install range selector lever that lug on switch engages. Move range selector lever to position "N".



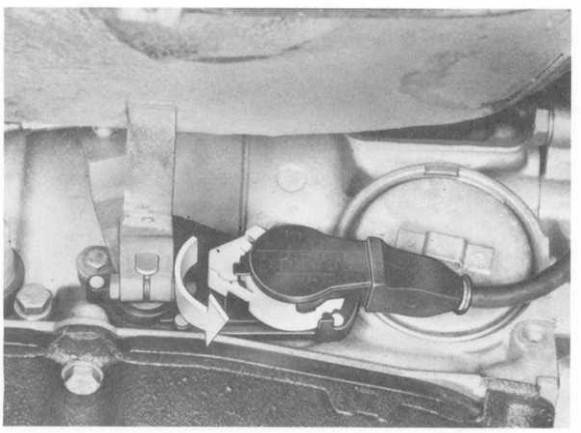
ADJUSTING STARTER LOCKING AND BACKUP LIGHT SWITCH

1. Insert locating pin made of 4 mm dia. welding wire (or 4 mm dia. drill) through lug into locating bore in switch housing.



2. Tighten switch mounting screws with 10 Nm (7 ftlb) and pull out locating pin.

3. Press on plug and turn white plastic ring down.



CHECKING ADJUSTMENT OF SELECTOR LEVER CABLE AND STARTER LOCKING/BACKUP LIGHT SWITCH

Move selector lever to position "N". Run engine at fast idle speed.
Pull up parking brake lever and press down on brake pedal for following tests.

1. Move selector lever to position "R". Engine speed must drop as gear engages.

2. Move selector lever to position "P". Engine speed should increase as reverse gear disengages.

3. Repeat test in point 1.

4. Move selector lever to position "N". Engine speed should increase as reverse gear disengages.

5. Move selector lever to position "D". Engine speed should drop as gear engages.

6. Starting engine should only be possible in "P" or "N".

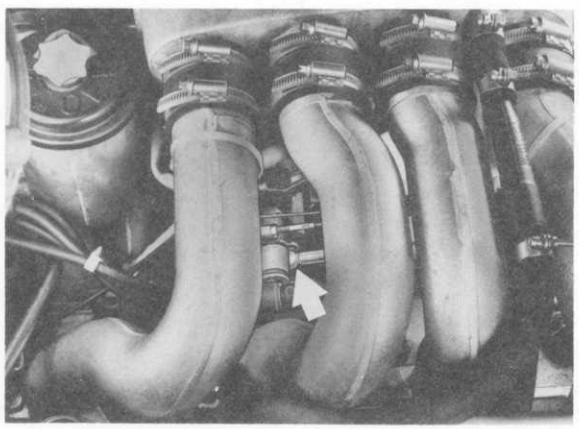
7. Backup lights must be on in position "R".

NOTES ON REMOVING AND INSTALLING

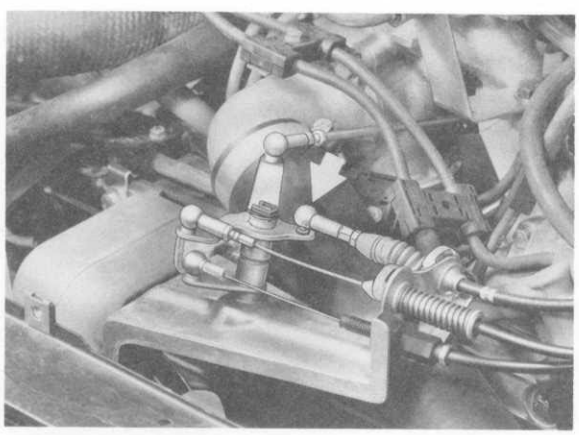
Removing

1. Remove top and bottom halves of air filter(16-valve engines only)

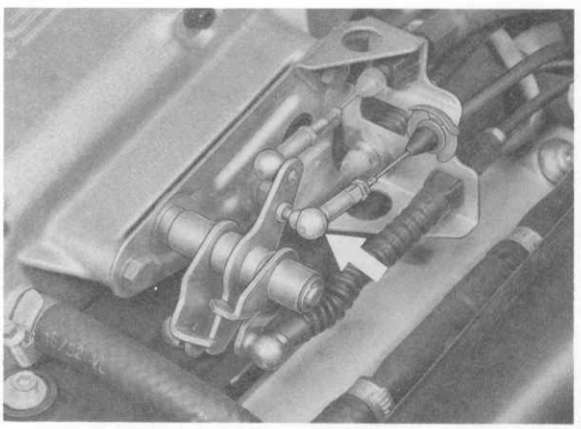
2. Disconnect control cable at engine.



16-valve engines



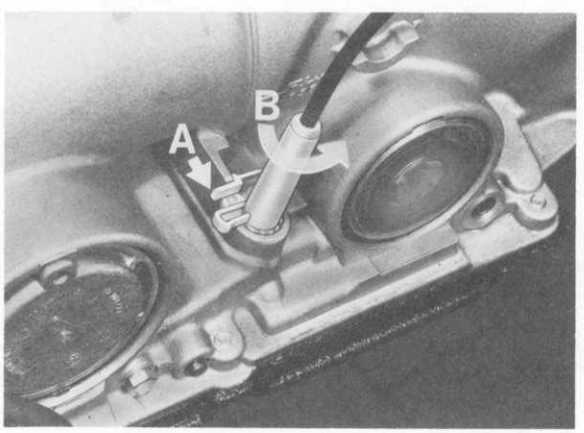
32-valve engines (up to '86 models)



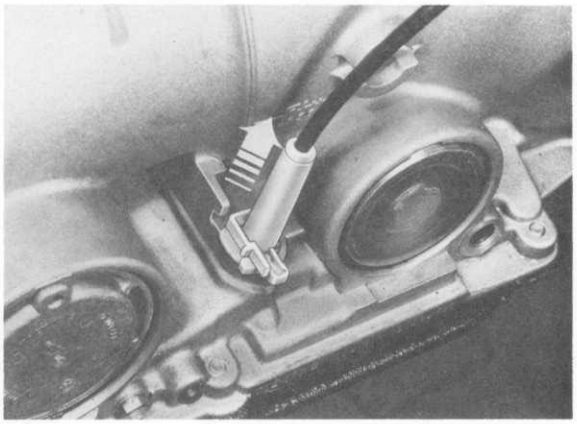
32-valve engines ('87 models onward)

3. Sever bowden cable behind threaded connector.

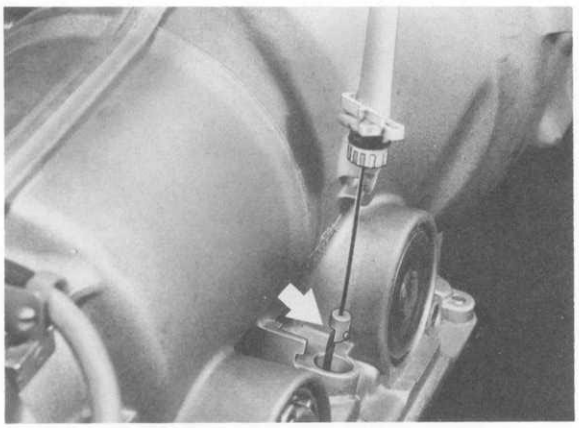
4. Disengage control cable from transmission by pressing locking tab of guide as arrowed (arrow A) and turning guide anti-clockwise (arrow B).



5.Carefully lift out guide.



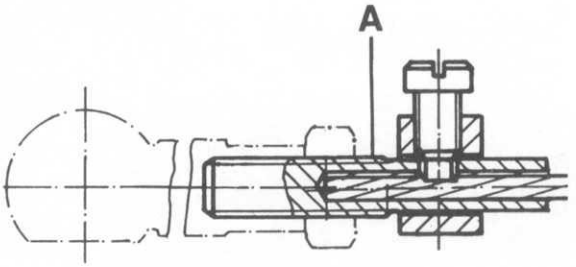
6.Detach control cable from actuating rod and pull out toward rear.



Installing:

1.Carefully feed control cable through sleeve from rear.

2.Install clamp correctly and attach spherical head with hex nut.



A = Clamp

3.Attach Bowden cable to transmission

4.Adjust cable for control pressure (see page 37 - 115).

CONTROL PRESSURE CABLE, ADJUSTING

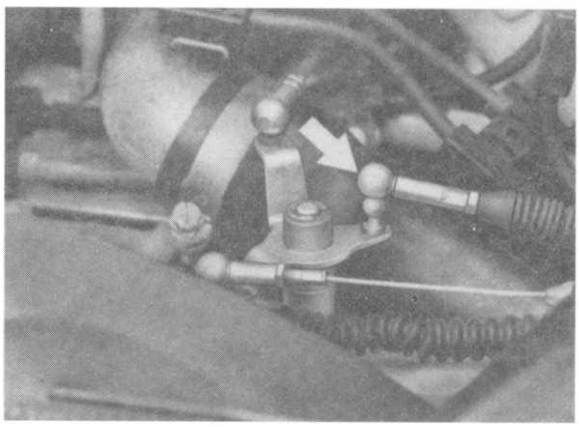
Note:

Correct adjustment of the Bowden cable for control pressure is vitally important for faultless operation of the transmission.

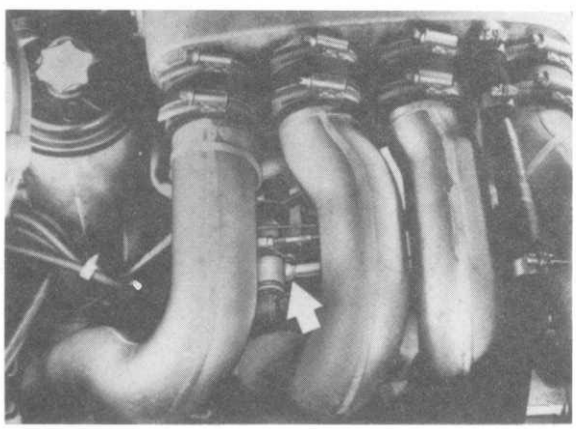
1. Set idle speed.

2. Take up play in throttle cable.

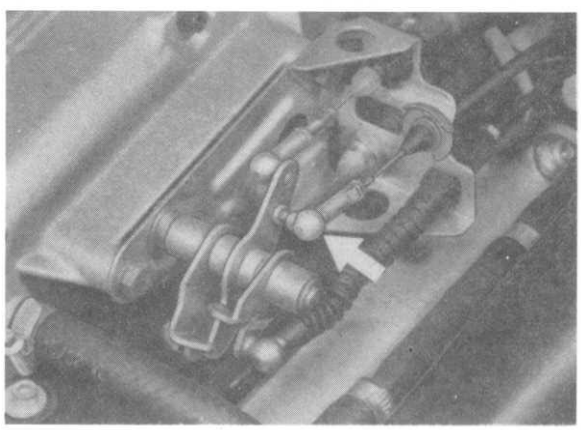
3. Adjust spherical head of control cable until cable can be installed without strain.



32-valve engines (up to '86 models)

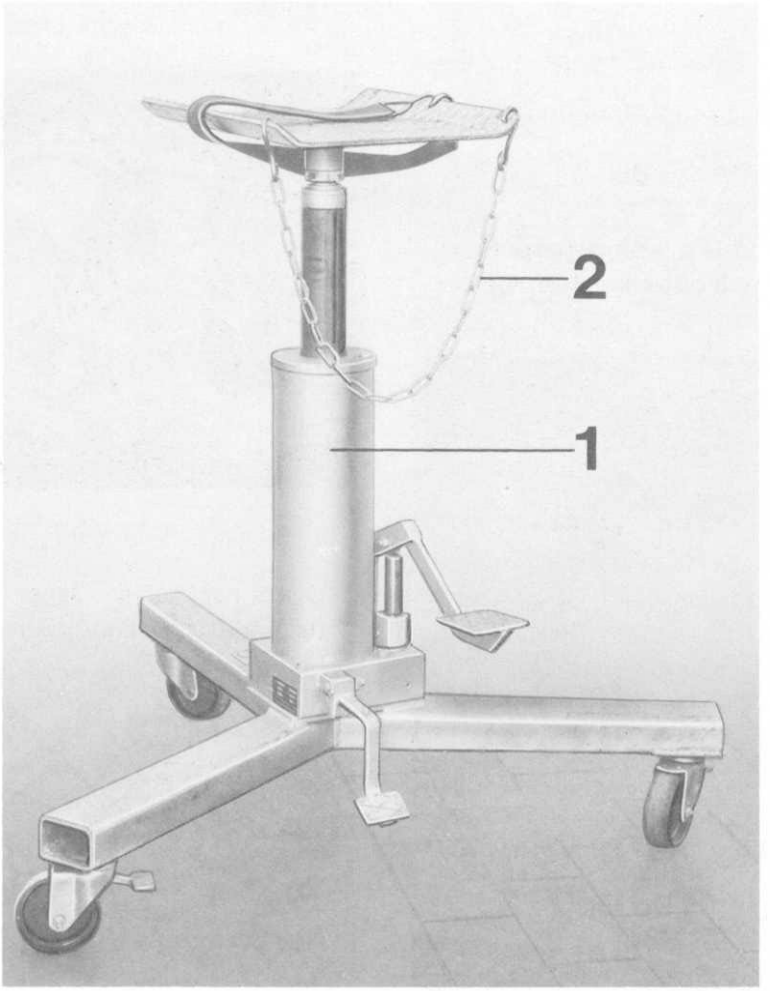


16-valve engines



32-valve engines ('87 models onward)

TOOLS



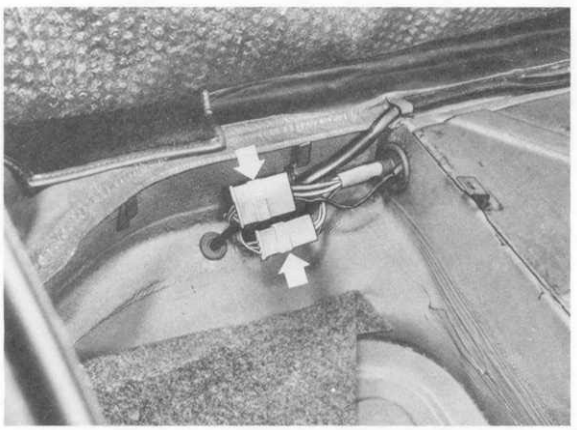
No.	Description	Special Tool	Remarks
1	Universal transmission jack	—	Standard, e. g. from Hahn, Metallbau GmbH 7012 Fellbach
2	Holding chain	9164	

REMOVING AND INSTALLING TRANSMISSION

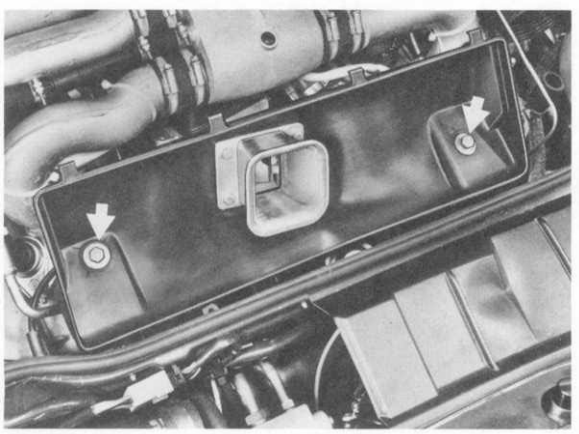
Removing

1. Unscrew battery ground strap on body.

2. Disconnect multiple pin plugs in spare wheel well and pull out wires from below.

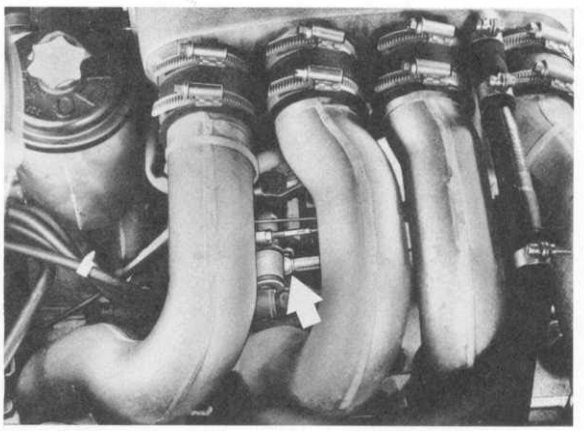


3. Remove upper and lower air cleaner housings.



4. Remove upper air guide section.

5. Disconnect control cable on throttle housing.



6. Disconnect oxygen sensor wire on central fuse/relay panel and pull out from below (USA cars).

7. Remove engine air guide.

8. Remove complete exhaust assembly with shields.

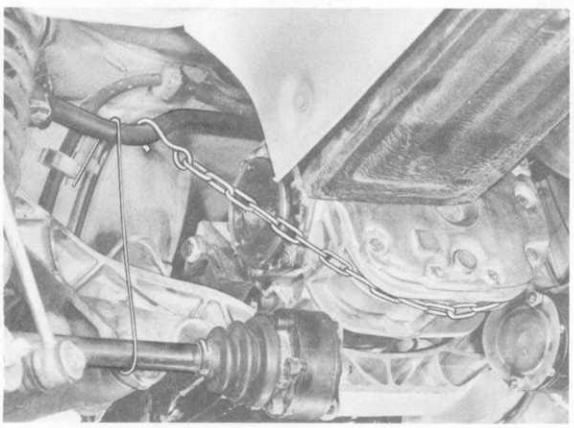
9. Remove starter and suspend in suitable position.

10. Drain ATF and remove reservoir.

11. Disconnect drive shafts on transmission end and suspend on wire in horizontal position.

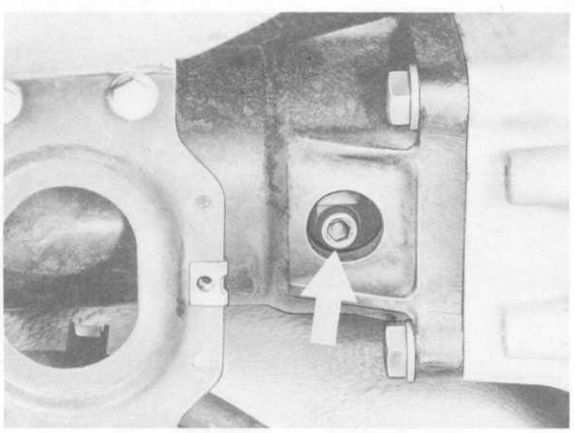
12. Remove rear axle cross member/transmission suspension mounting bolts.

13. Support transmission on stabilizer with Special Tool 9164 (if necessary, lift transmission on transmission support slightly).

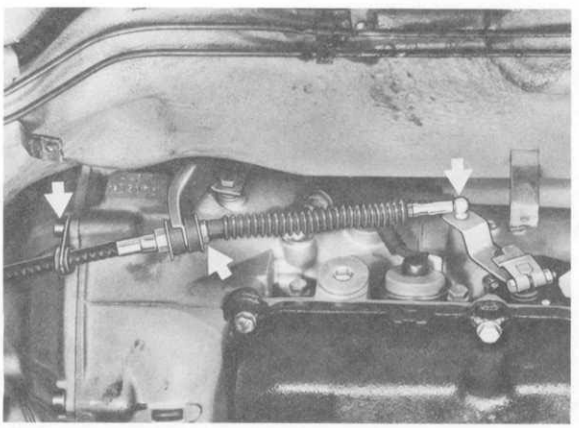


14. Mark position of toe eccentric and rear axle cross member for reinstallation and remove entire rear axle.

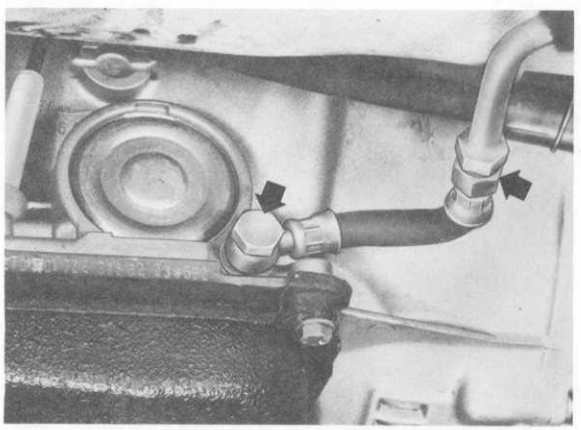
15. Remove clamp bolt.

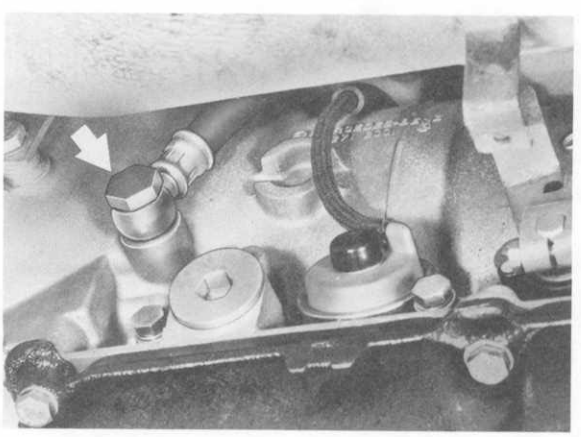


16. Disconnect selector lever cable on transmission lever and unscrew cable sleeve on holder and case.



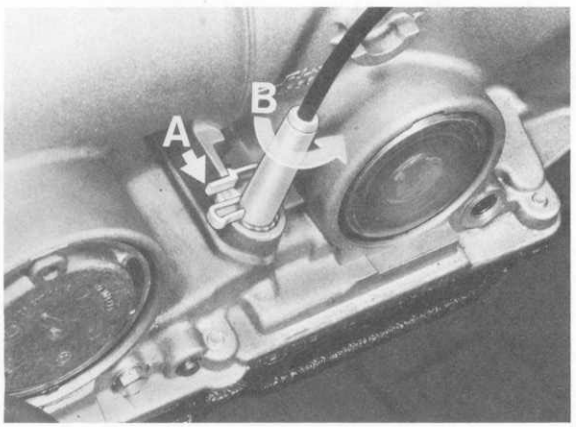
17. Remove feed and return lines for ATF cooler. Plug open bores in case.



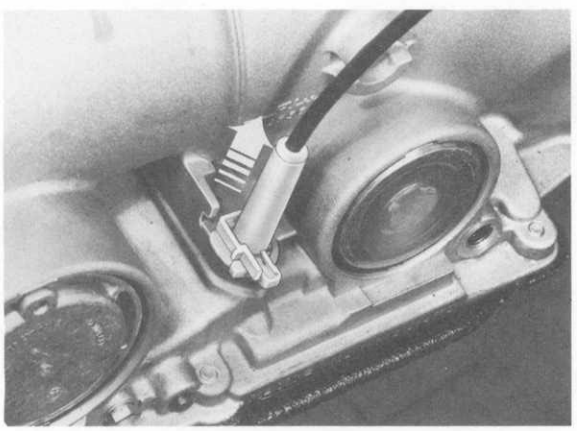


18. Pull off vacuum hose on modulating pressure box.

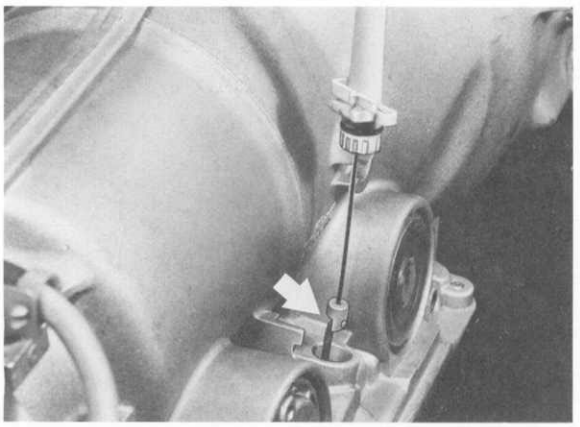
19. Disconnect control pressure cable on transmission. This is done by pushing locking bar of guide in direction of arrow (arrow A) and turning guide counter-clockwise (arrow B).



Pull out guide from above carefully.

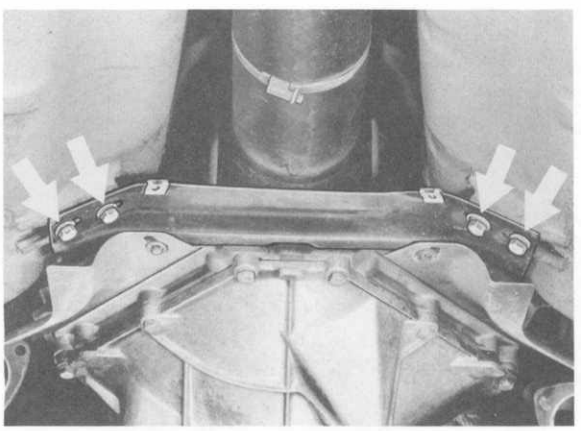


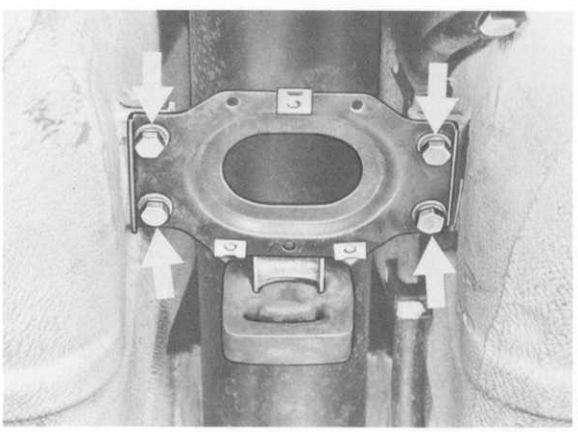
Disconnect control cable on operating rod.



20. Place universal transmission jack underneath transmission and tighten rubber strap.

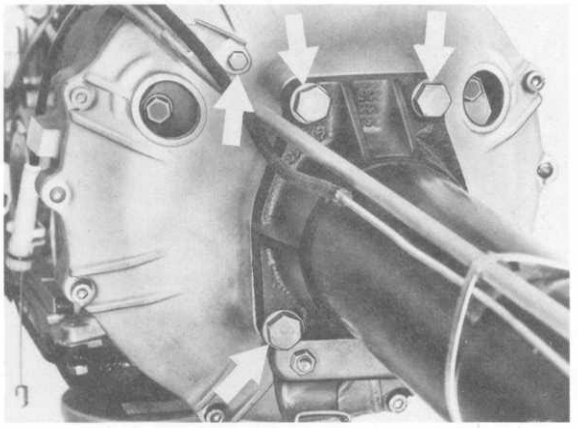
21. Remove front and rear reinforcement plates.





22. Lift transmission slightly and disconnect holding chain.

23. Lower transmission only far enough that central tube/transmission mounting bolts and control cable mounting bolt can be removed.



24. Move central tube to installed position, mount rear brace with two bolts and place a suitably thick block of wood between central tube and brace.

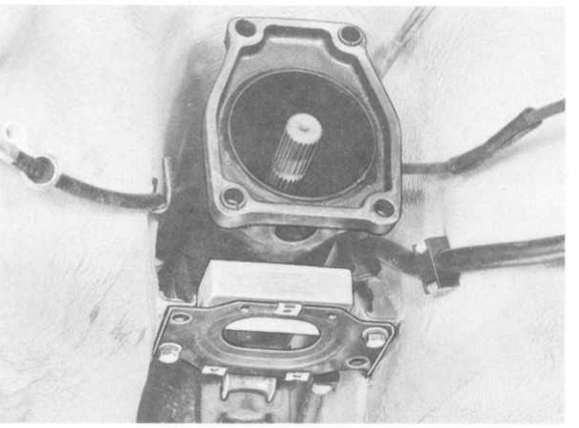
25. Pull back transmission and lower carefully.

Installing

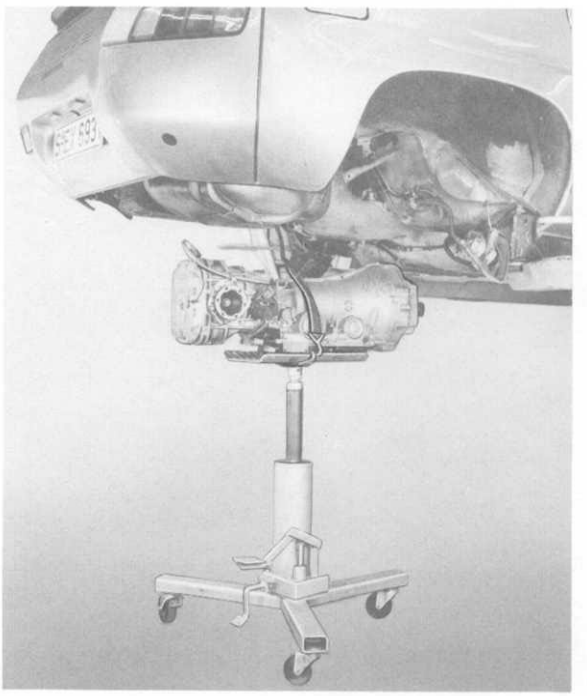
Note:

Installation is in reverse order of removal procedures, but also conform with following points.

1. Place central tube in installed position with a suitably thick block of wood and coat splines on central shaft with Optimoly HT.



2. Lift transmission with universal transmission jack and push on to central shaft.



3. Install and slightly tighten accessible bolts on central tube flange.

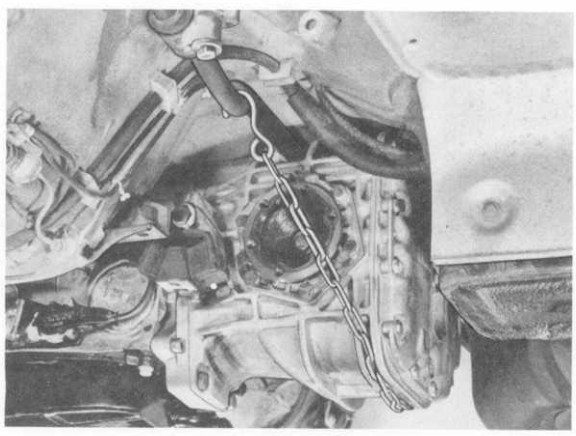
4. Lift transmission, remove block of wood and take out brace again.

5. Lower transmission only far enough that remaining bolts can be screwed in central tube flange (tightening torque: 120 Nm/ 87 ftlb).

6. Mount guide tube for control cable on converter housing (tightening torque: 8 Nm/6 ftlb).

7. Push wire harness upwards through opening in spare wheel well.

8. Lift transmission and hold in installed position with Special Tool 9164.



9. Lower universal transmission jack.

10. Install rear axle and tighten all bolts except for two transmission mount bolts.

11. Lift transmission and disconnect Special Tool 9164.

12. Adjust transmission suspension (see page 37 - 123).

13. Mount transmission on cross member (tightening torque: 85 Nm/61 ftlb).

14. Check adjustment of selector lever and control pressure cables, correcting if necessary.

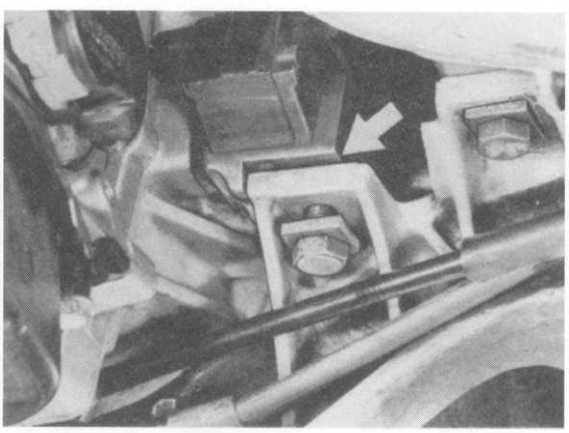
ADJUSTING TRANSMISSION SUSPENSION

The transmission mounts have to be adjusted to avoid tension in the transmission suspension and to also guarantee good insulation.

1. Install transmission and rear axle. Tighten transmission mount/transmission case mounting bolts with 85 Nm/61 ftlb.

2. Screw in cross member/transmission mount bolts several turns.

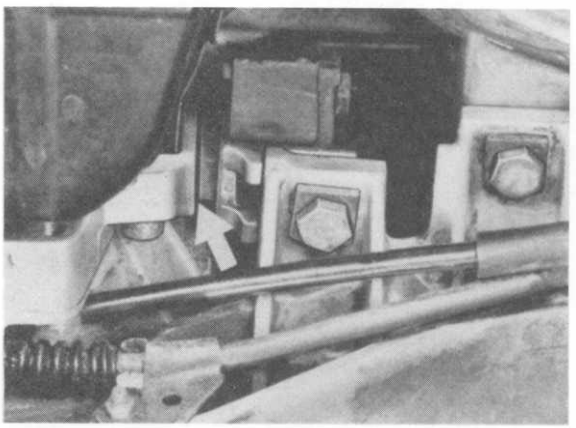
3. Lift transmission in middle of case far enough that there is a gap between both transmission mounts and the cross member. Measure this gap on both sides and take up difference with shims.



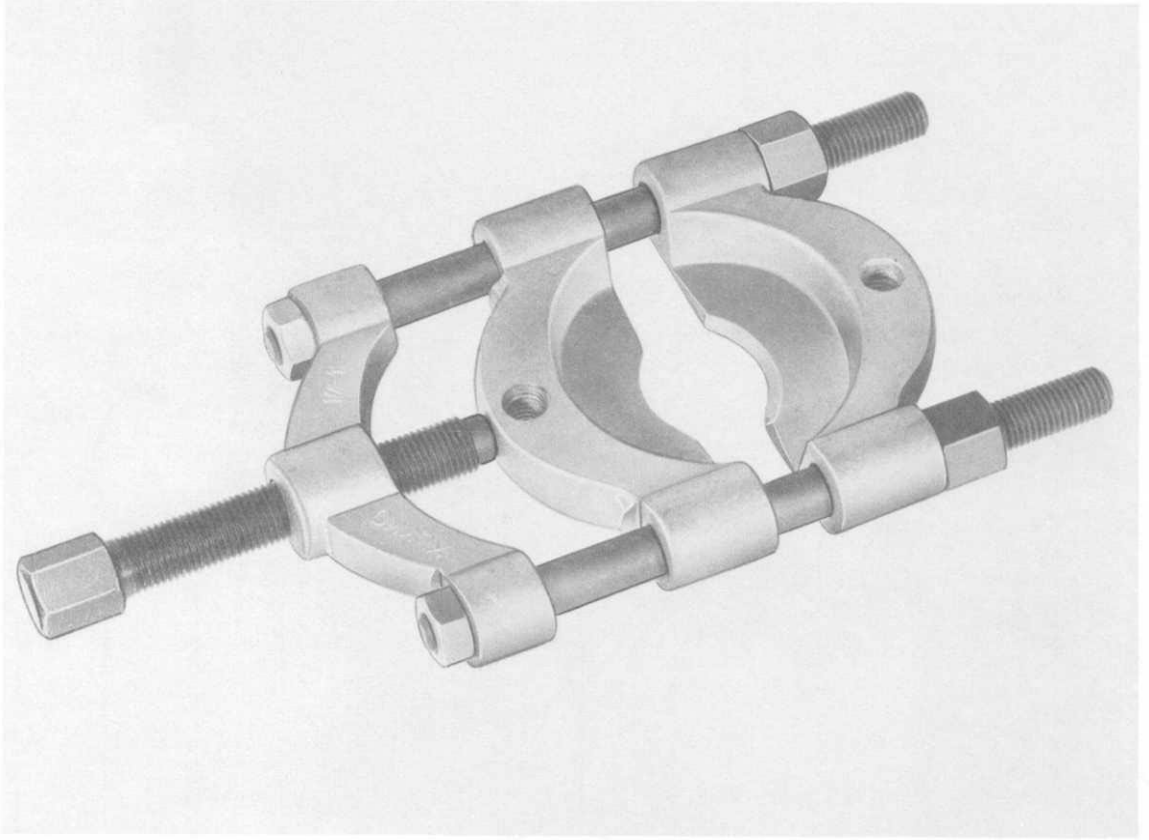
4. Place shims of pertinent thickness between transmission mounts and cross member, lower transmission and tighten transmission mounts/cross member bolts with 85 Nm/ 61 ftlb.

N o t e :

After tightening the mounting bolts there must be at least 1 mm clearance between the transmission case and stop on side of transmission mount.

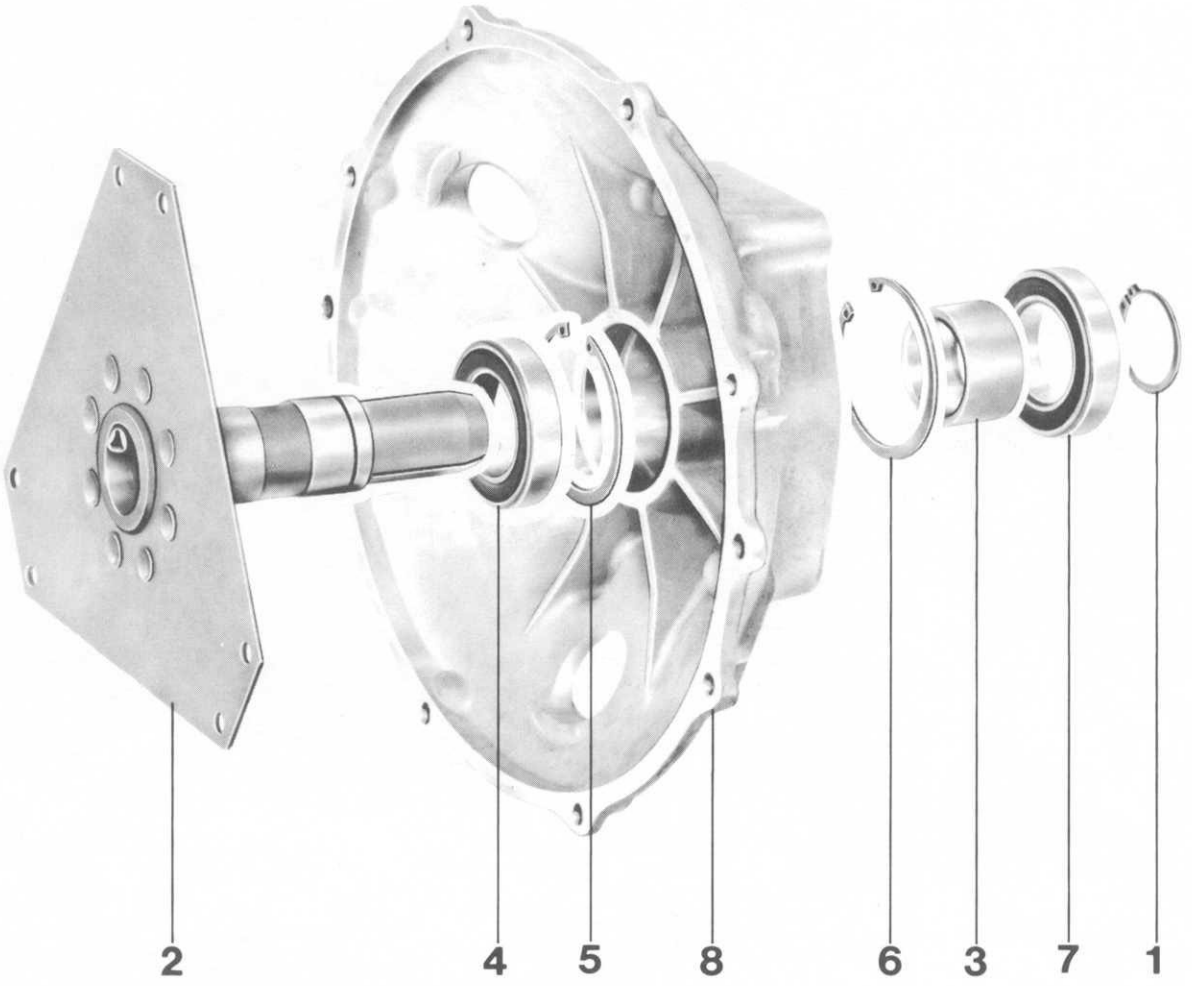


TOOLS



No.	Description	Special Tool	Remarks
	Support rail	–	Standard (e. g. Kukko, Size 1)

DISASSEMBLING AND ASSEMBLING FRONT CONVERTER HOUSING

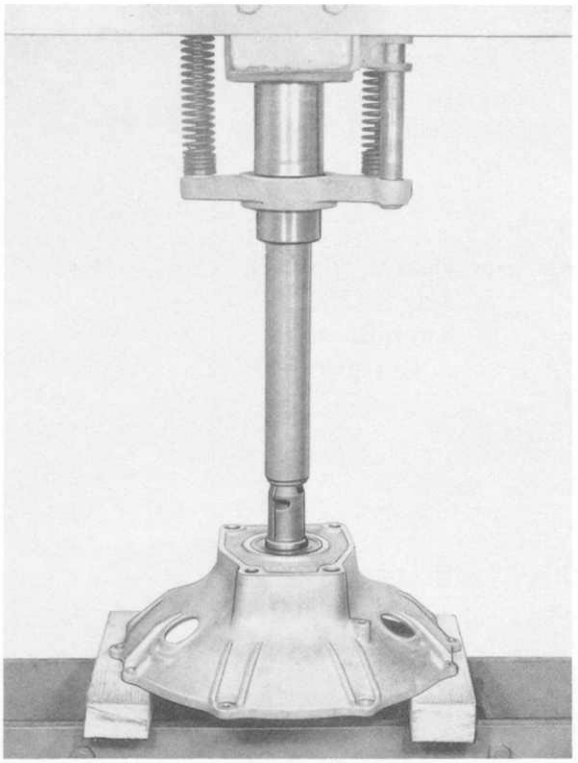


No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Circlip	1			
2	Drive flange	1	Press out	Press into case with grooved ball bearing (no. 4)	
3	Spacer	1			
4	Grooved ball bearing	1	Press off with support rail, e. g. Kukko, size 1	Heat to approx. 120 °C/250 °F and push on to drive flange	
5	Circlip	1			
6	Circlip	1			
7	Grooved ball bearing	1	Press out with suitable piece of pipe	Heat case to approx. 120 °C/250 °F and press in with suitable piece of pipe, supporting with drive flange	
8	Housing	1			

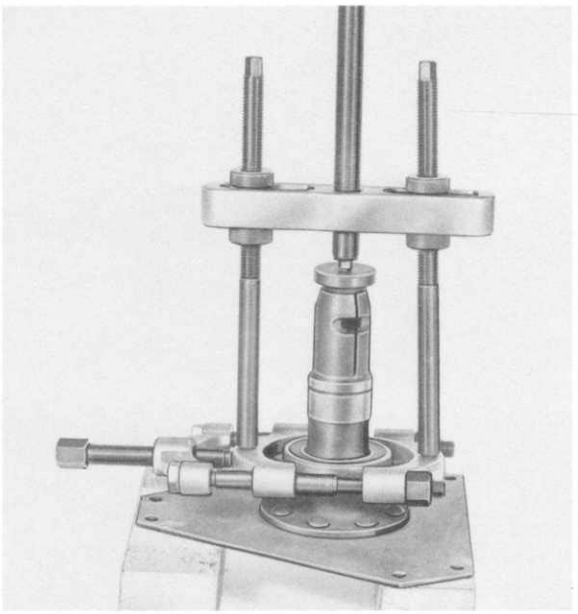
DISASSEMBLING AND ASSEMBLING FRONT CONVERTER HOUSING

Disassembling

1. Remove circlip and press out drive flange.



2. Press grooved ball bearing off of drive flange with a support rail (e. g. Kukko, size 1).

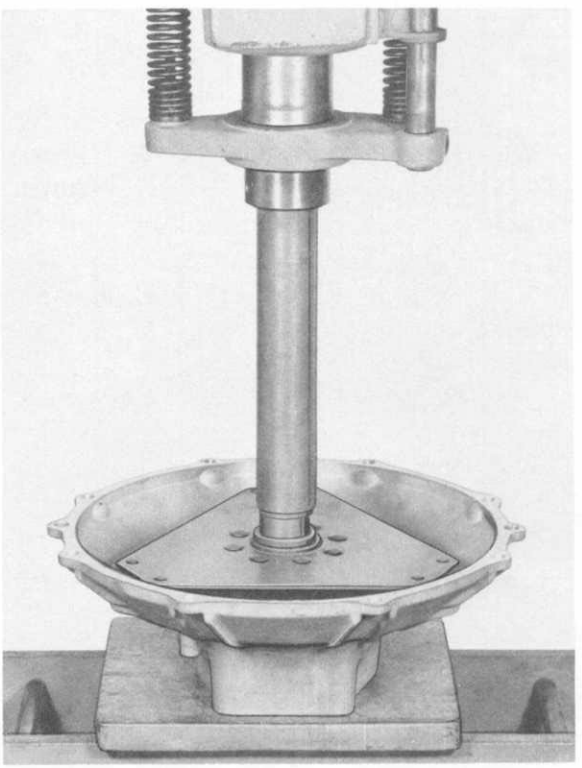


Assembling

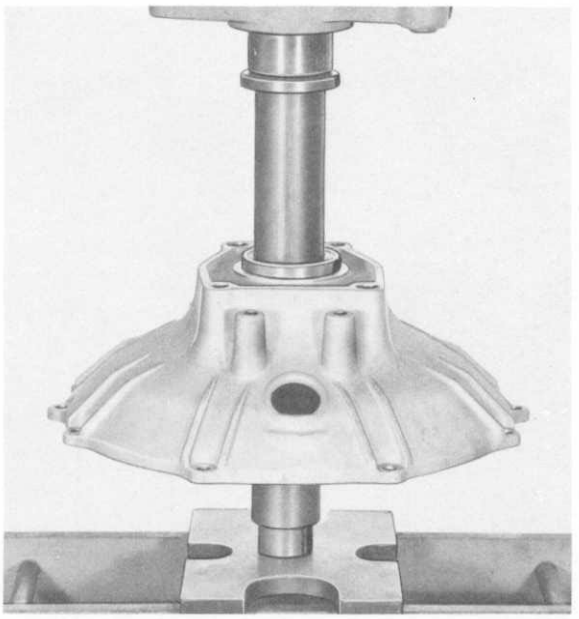
1. Install both circlips in converter housing.

2. Heat grooved ball bearing to about 120 °C/250 °F and press bearing on drive flange against shoulder with a suitable piece of pipe applied on bearing inner race.

3. Heat converter housing to about 120 °C/ 250 °F and press in drive flange with grooved ball bearing against circlip.



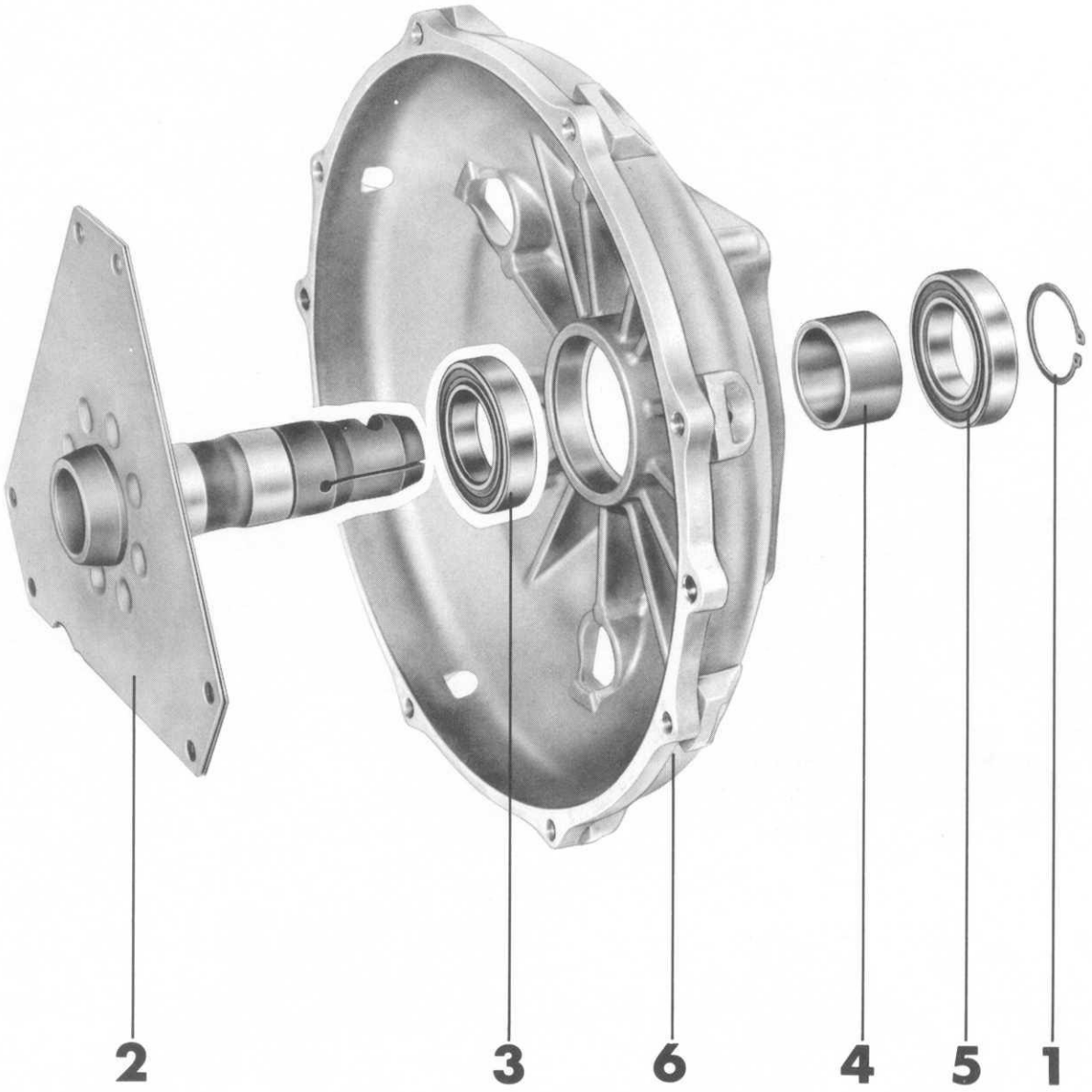
4. Insert spacer sleeve and using a suitable piece of pipe, press front deep-groove ball bearing over inner race until bearing contacts circlip.



Note:

Place a suitable pressure piece beneath the drive-flange bearing to keep it from moving out as the front bearing is pressed in.

DISASSEMBLING AND ASSEMBLING FRONT CONVERTER CASING ('87 MODELS ONWARD)

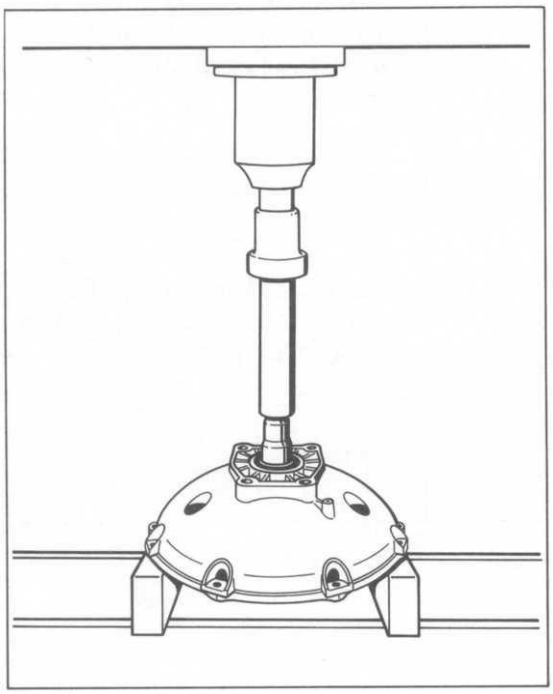


No.	Designation	Qty.	Note when: Removing	Installing
1	Circlip	1		
2	Drive flange	1	Press out	Press in, after inserting deep-groove ball bearing (No. 5)
3	Deep-groove ball bearing	1	Pull off with puller (e.g. Kukko, size 1)	Heat casing to approx. 120°C and press in as far as possible with a suitable piece of pipe.
4	Spacer sleeve	1		
5	Deep-groove ball bearing	1		Heat casing to approx. 120°C and press in with a suitable piece of pipe
6	Case	1		

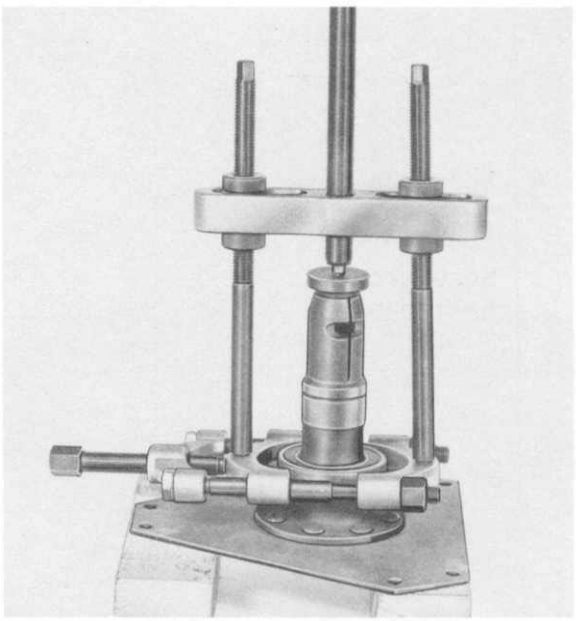
NOTES FOR ASSEMBLY AND DISASSEMBLY

Disassembling

1. Remove circlip and press out drive flange.



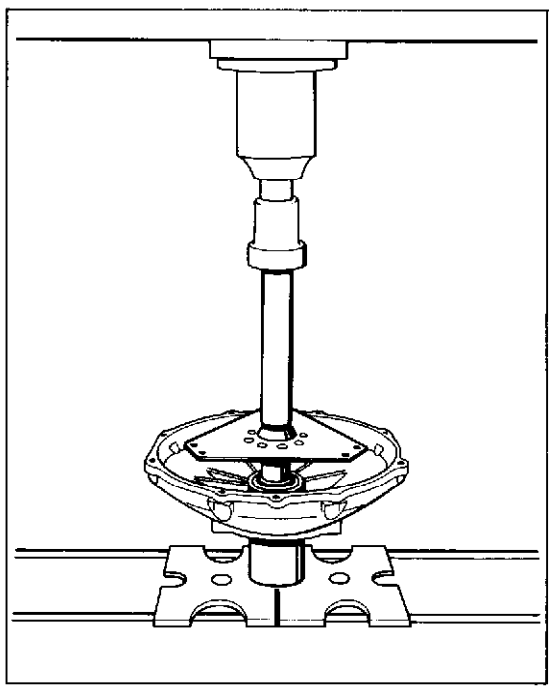
2. Using puller (e.g. Kukko, size 1) pull deep-groove ball bearing off drive flange.



Assembling

1. Heat converter casing to approx. 120°C and install both deep-groove ball bearings with spacer sleeve.

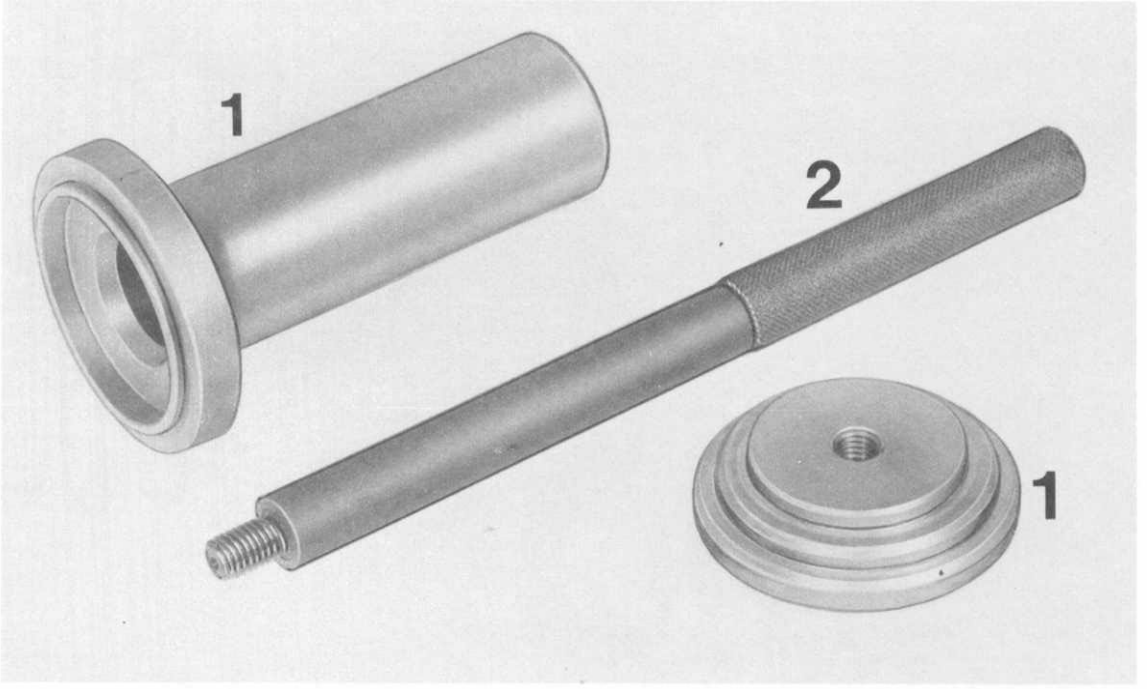
2.Press drive flange in as far as it will go.



Note:

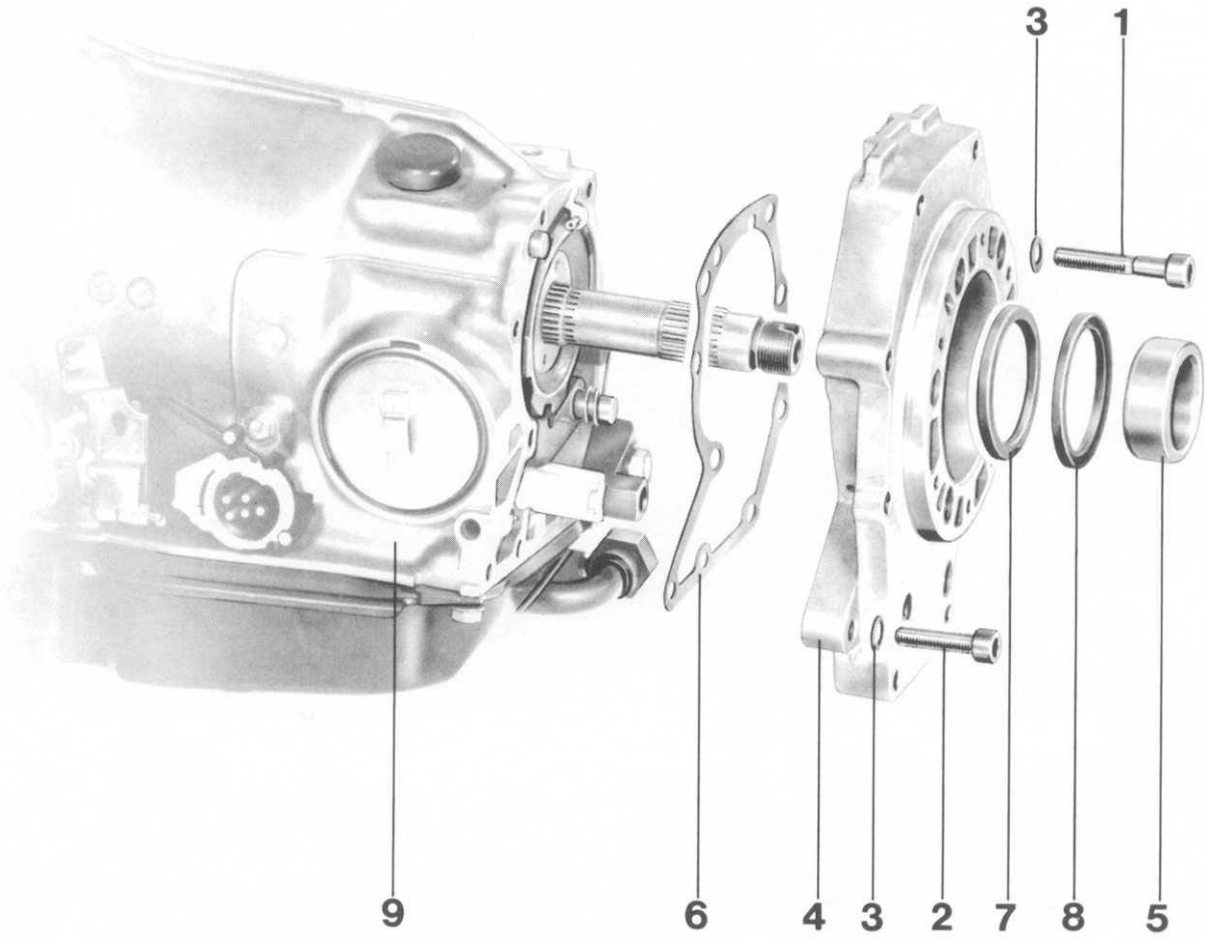
To prevent the deep-groove ball bearing (No.5) moving out as the flange is pressed, position a suitable piece of pipe against the bearing outer race as a support.

TOOLS



No.	Description	Special Tool	Remarks
1	Pressure pad	9180/1	
2	Mandrel	P 254	

REMOVING AND INSTALLING REAR TRANSMISSION CASE



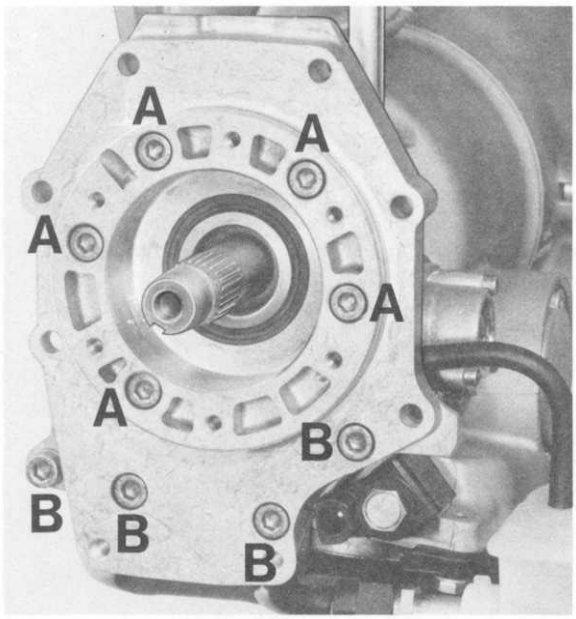
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Bolt M 10 x 55	5		Torque: 42 Nm/30 ftlb	
2	Bolt M 10 x 40	4		Torque: 42 Nm/30 ftlb	
3	Washer	9			
4	Rear transmission case	1			
5	Race	1		Insert after installing case	
6	Gasket	1		Replace	
7	Seal	1	Drive out with suitable screw-driver	Replace, drive in to correct position with Special Tool 9180/1 and coat sealing lip with ATF	
8	Seal	1	Drive out with suitable screw-driver	Replace, drive in to correct position with Special Tool 9180/1 and coat sealing lip with ATF	
9	Automatic transmission	1			

REMOVING AND INSTALLING REAR TRANSMISSION CASE

Removing

1. Remove final drive and bearing assembly (see page 39 - 101).

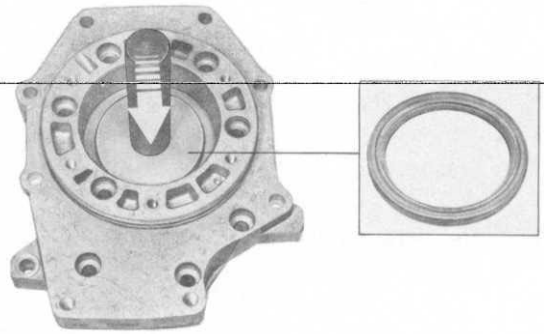
2. Remove case mounting bolts.



A = Five M 10 x 55 bolts
B = Four M 10 x 40 bolts

Installing

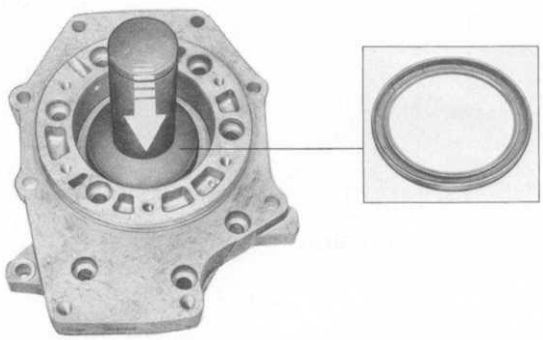
1. Drive in inner seal to correct position with Special Tool 9180/1.



Note:

Hold seal on special tool with a small amount of grease and drive in seal that sealing lip faces automatic transmission.

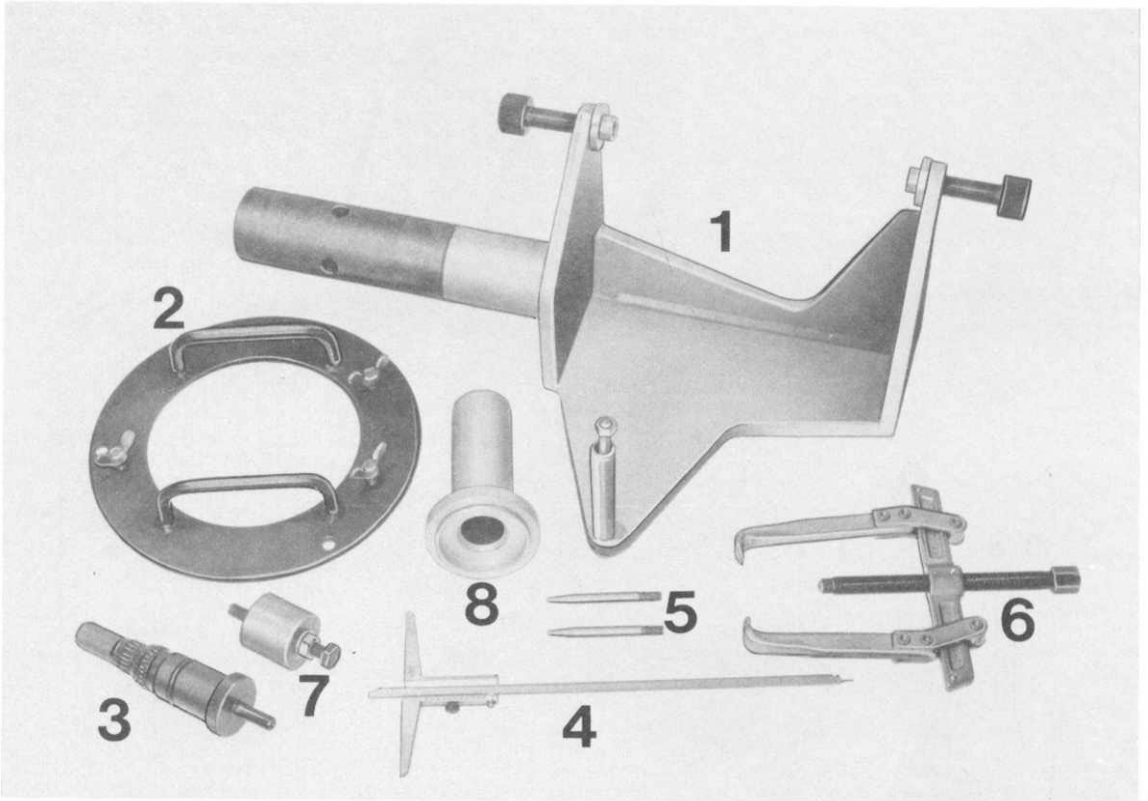
2. Drive in outer seal to correct position with Special Tool 9180/1.



Note:

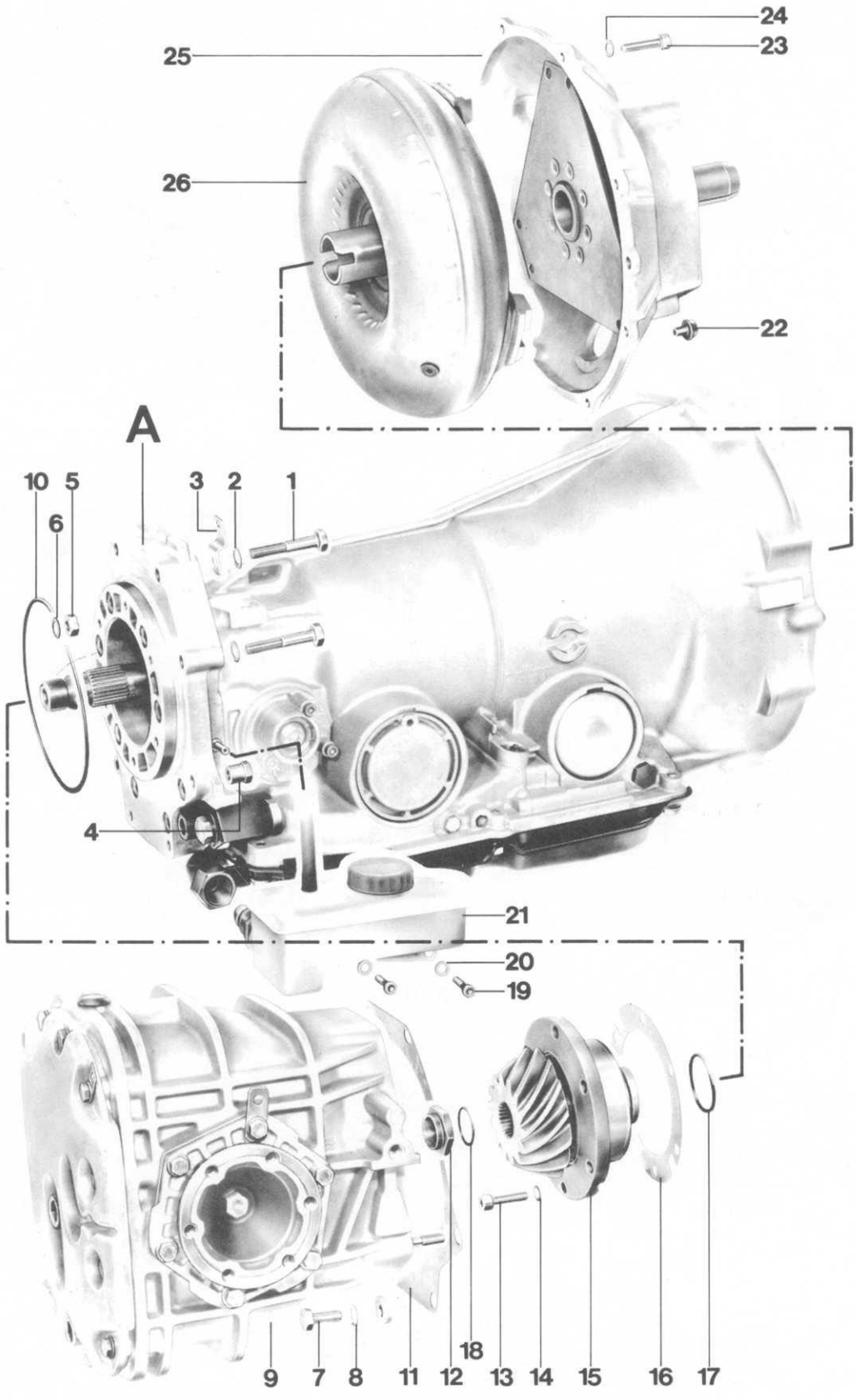
Seal must be installed that its sealing lip faces final drive.

TOOLS



No.	Description	Special Tool	Remarks
1	Holder	9216	
2	Grip	9301	
3	Mandrel	9310	
4	Depth gauge	–	Standard tool
5	Centering pins	9321	
6	Puller	–	Standard tool
7	Pressing in tool	–	Made locally (steel pipe 45 x 5 x 40 mm with welded cover and 11 mm dia. bore)
8	Pressure pad	9180/1	

REMOVING AND INSTALLING REAR TRANSMISSION



No.	Designation	Qty.	Note: Removal	Installation
1	Bolt	4		Torque: 46 Nm / 33 ftlb
2	Washer	4		
3	Holder	1		
4	Collar nut	1		Torque: 46 Nm / 33 ftlb
5	Nut	1		Torque: 46 Nm / 33 ftlb
6	Washer	1		
7	Bolt	1		Torque: 46 Nm / 33 ftlb
8	Washer	2		
9	Final drive	1		
10	O-ring	1		Replace, coat with ATF
11	Shim "S3"	X		Determine thickness
12	Collar nut	1	Engage parking lock and unscrew	Torque: 380 Nm / 275 ftlb (as of mod. '92 = 450 Nm, 367 ftlb), and lock
13	Bolt	6		Torque: 33 Nm / 24 ftlb
14	Lock washer	6		Hollow side faces flange
15	Bearing assembly with drive pinion	1	If necessary, pull out with a suitable puller	If necessary, press in with locally made tool

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No.	Description	Qty.	Note When: Removing	Installing
16	Shim	X	Note number and thickness for reinstallation	Recalculate, if necessary
17	O-ring	1		Replace, coat with ATF
18	O-ring	1		Replace, coat with ATF
19	Panhead bolt	2		Tightening torque: 6 Nm (4.4 ftlb)
20	Washer	2		
21	ATF reservoir	1		
22	Mounting bolt	6		Tightening torque: 46 Nm (34 ftlb)
23	Panhead bolt	8		Tightening torque: 23 Nm (17 ftlb)
24	Washer	8		
25	Converter casing	1		
26	Torque converter*	1	Lift out carefully with Special Tool 9301	Rinse with Special Tool 9310. Install with Special Tool 9301.
A	Mid-mounted transmission	1		

* Note installation depth:

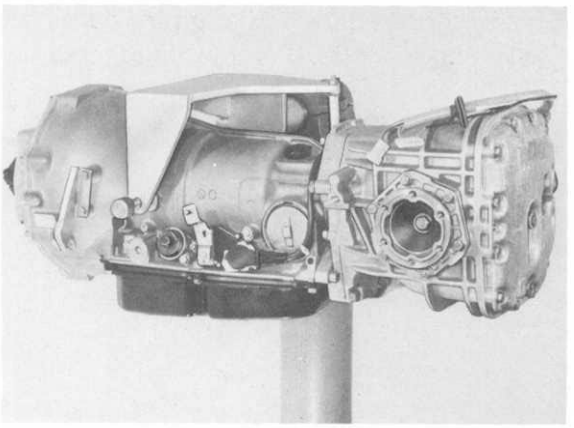
Up to '86 models = approx. 16 mm
'87 models onward = approx. 28 mm

REMOVING AND INSTALLING REAR TRANSMISSION

Removing

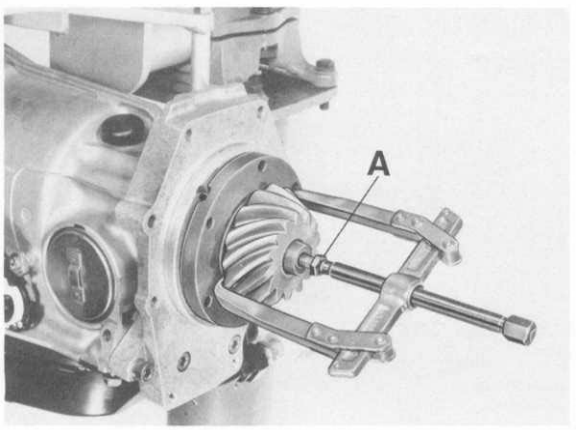
1. Remove transmission.

2. Mount transmission in assembly stand with Special Tool 9216 and drain final drive oil.



3. Engage parking lock and remove collar nut for drive pinion.

4. Remove bearing assembly mounting bolts and pull off bearing assembly (use a suitable puller, if necessary).

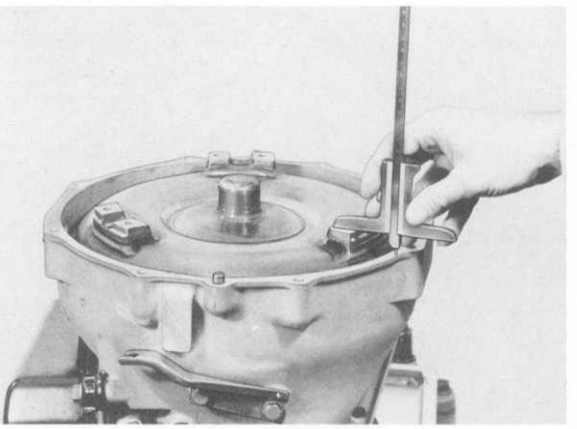


A = Bolt 10 x 30 with centering bore

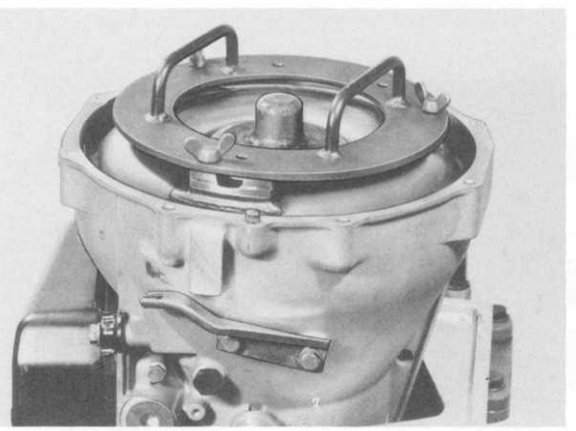
5. Position transmission upright and remove converter mounting bolts through openings in housing.

6. Remove converter housing mounting bolts and take off housing.

7. Measure installed depth of converter (about 16 mm) and note value for reinstallation.



8. Mount Special Tool 9301 on torque converter and lift out converter carefully.

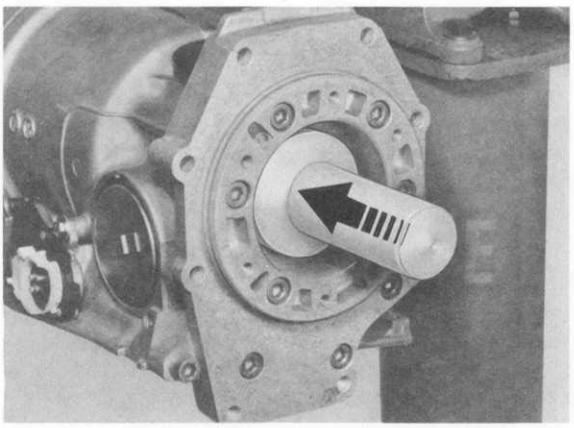


Installing

Note:

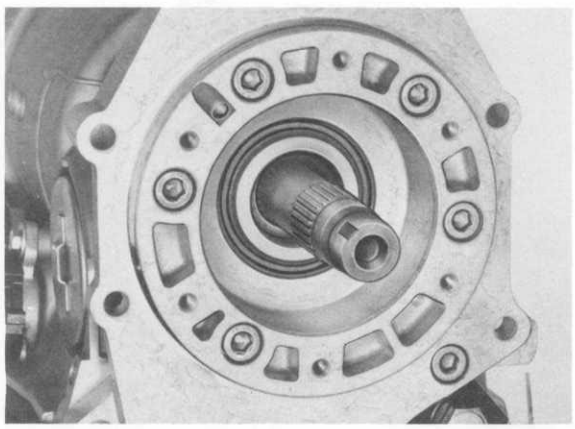
The outer seal on the rear transmission between the transmission case and final drive could be missing due to manufacturing conditions.

1. Drive in outer seal (if not already installed) to correct position with Special Tool 9180/1.



Note:

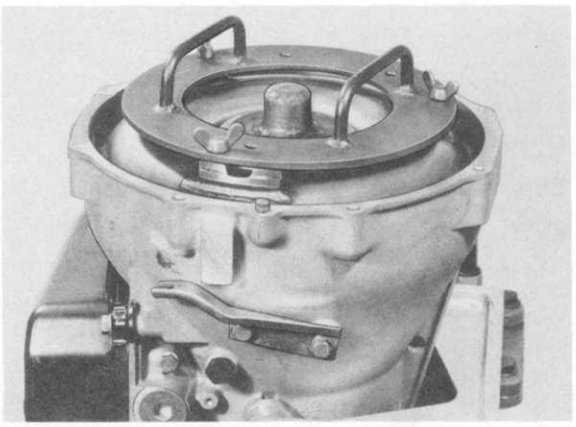
Outer seal must be installed that sealing lip and spring supporting the sealing lip face final drive.



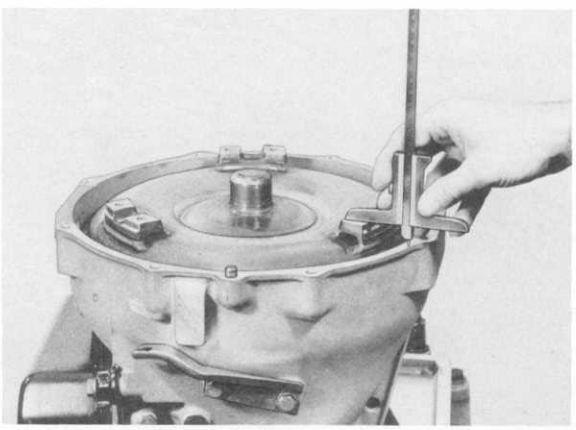
2. Mount Special Tool 9301 on torque converter.

3. Coat drive flange and bearing journal of converter with a multi-purpose grease containing MoS_2 additives.

4. Position transmission upright and install converter carefully, while turning converter back and forth until splines mesh.



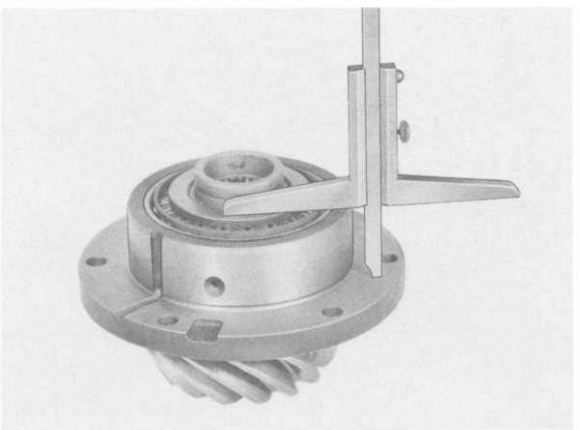
5. Check installed depth of converter (about 16 mm).



Note:

If ATF smells burnt or contains metal particles, torque converter and ATF cooler must be flushed.
If ATF sump contains metal particles, torque converter has to be replaced. Metal particles could not be completely removed by flushing and would lead to transmission damage.

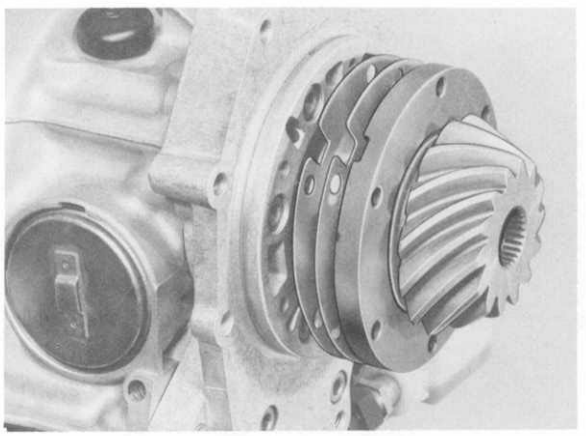
6. Determine thickness of shims for bearing assembly. Measure distance from tapered roller bearing surface to bearing flange surface with a depth gauge (for example: 34.55 mm). Since the distance specified by design is only 34 ± 0.05 mm, shims having a thickness of 0.55 mm must be installed.



Example:

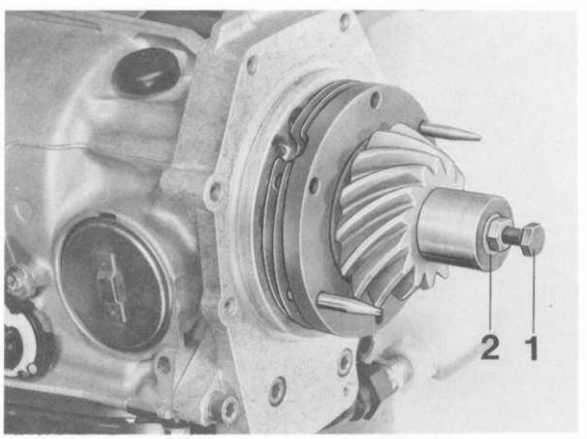
34.55 mm Actual distance (measured)
34.00 mm Nominal distance (specified)
0.55 mm Thickness of shims

7. Install shims of determined thickness and bearing assembly on output shaft.



Note:

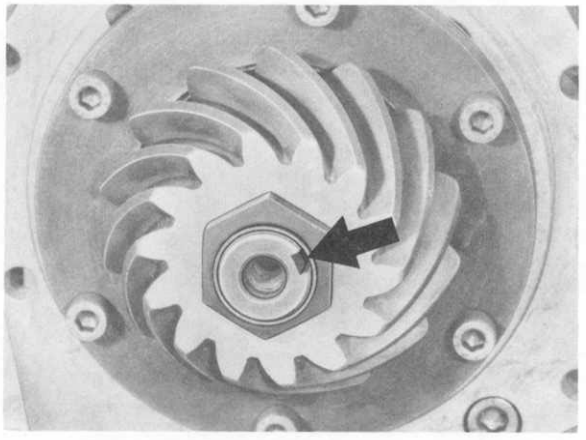
Use Special Tools 9321 and a locally made pressing in tool to make installation easier.



1 = Bolt from Special Tool 9148

2 = Washer

8. Tighten flange nut for drive pinion to specified torque and lock by upsetting the flange.

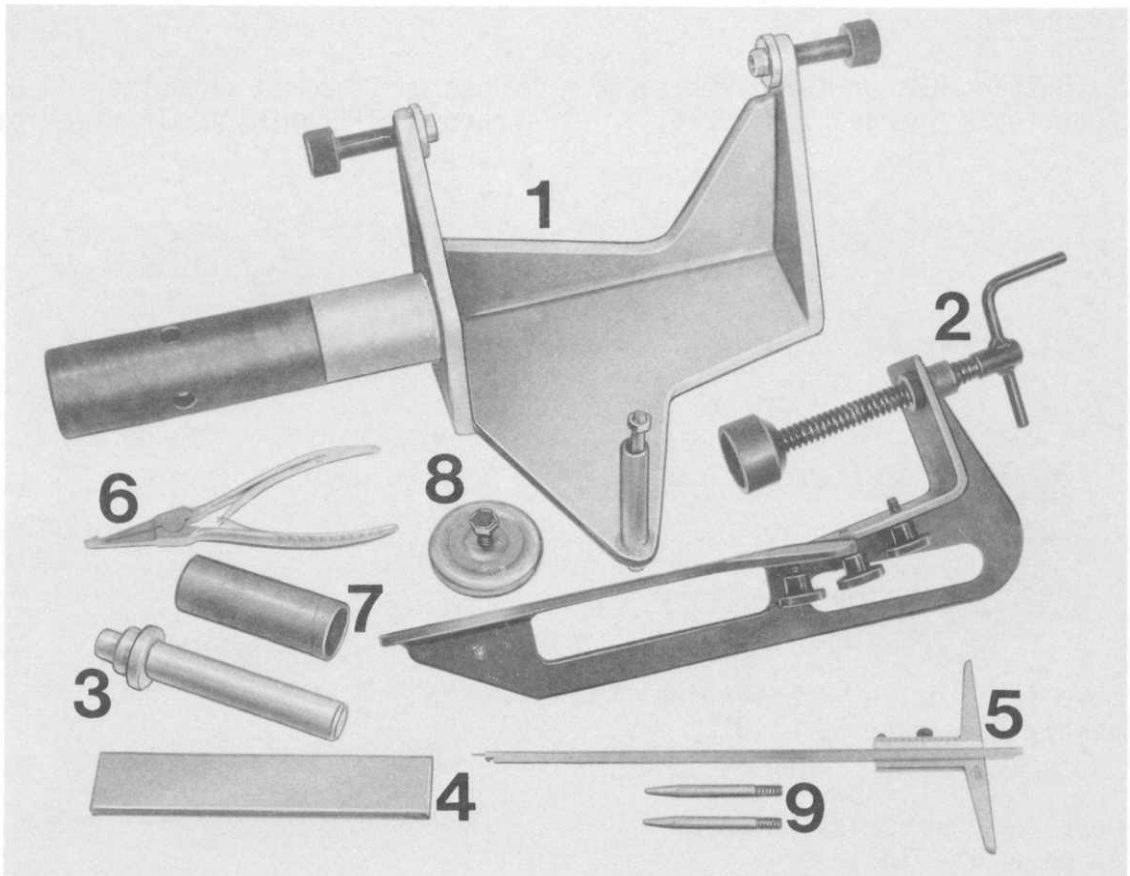


9. Adjust drive pinion and ring gear (see page 39 - 125).

10. Install transmission and check adjustment of selector lever and control pressure cables.

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TOOLS

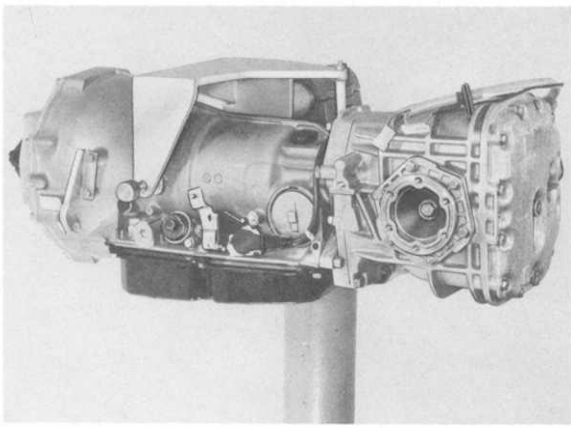


No.	Designation	Special Tool	Remarks
1	Holder	9216	
2	Assembly support	9316	
3	Mandrel	9119	
4	Measuring bridge	9313	
5	Depth gage	-	Commercially available
6	Circlip pliers	-	Commercially available (e.g. Hazet 1847 - 2)
7	Spacer sleeve	9312	
8	Measuring device	9320	
9	Centering pins	9321	

DISASSEMBLING AND ASSEMBLING TRANSMISSION

Disassembling

1.Attach transmission to assembly support with Special Tool 9216.

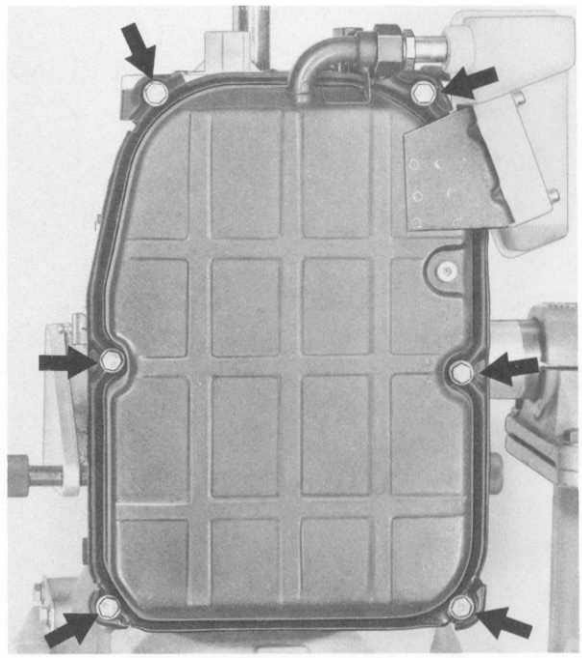


2.Remove final drive with bearing assembly (see page 39 - 101).

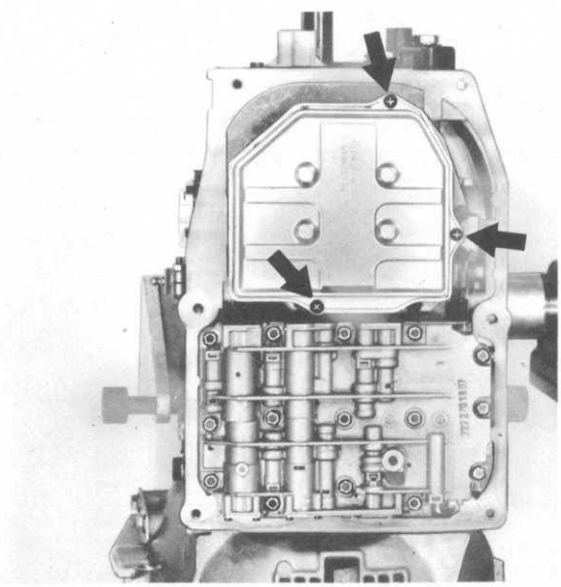
3.Remove rear transmission case (see page 37 - 131).

4.Remove front converter casing and converter (see page 32 - 101).

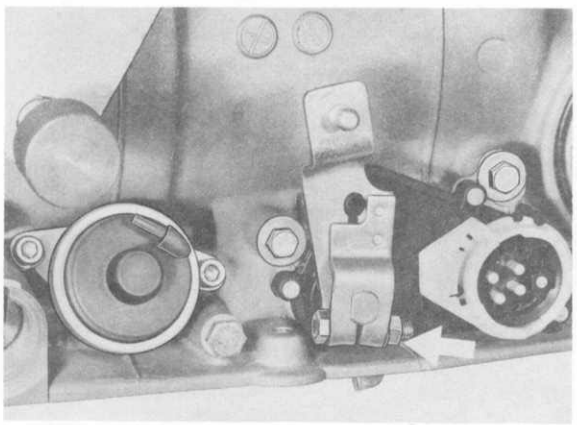
5.Unscrew combination bolts and remove ATF pan with ATF reservoir.



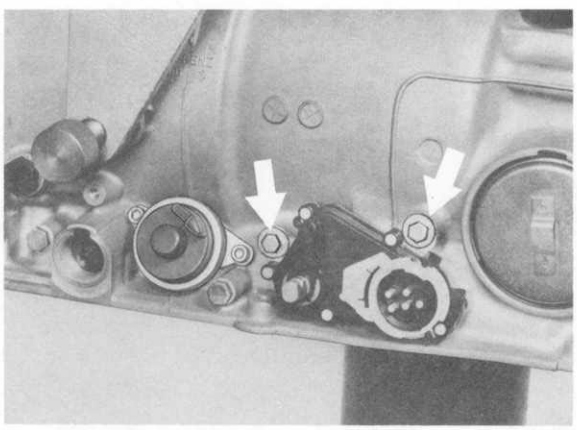
6.Unscrew cross-recess screws and remove filter.



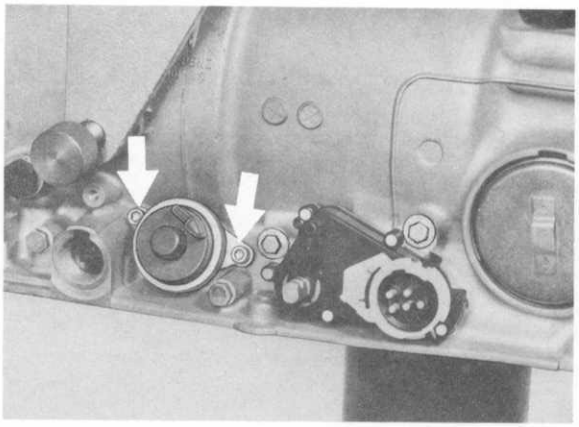
19.Unscrew hex bolt and remove drive-range selector lever.



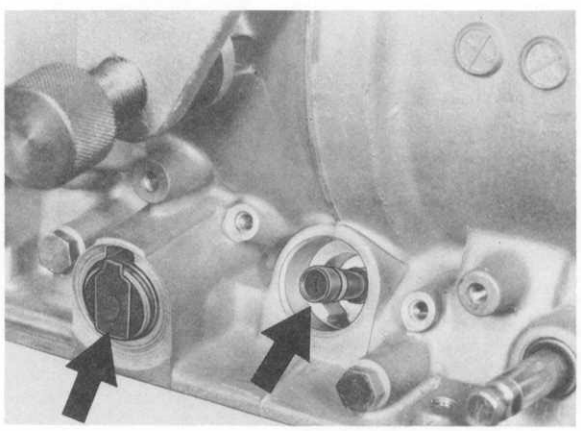
20.Remove starter-interlock switch after unscrewing mounting bolts.



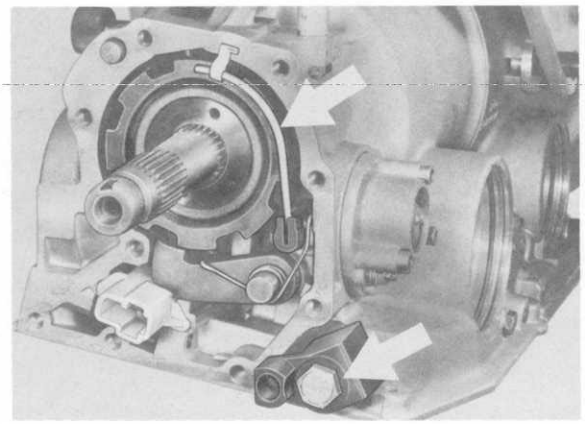
21.Remove vacuum-control unit after unscrewing socket-head bolts.



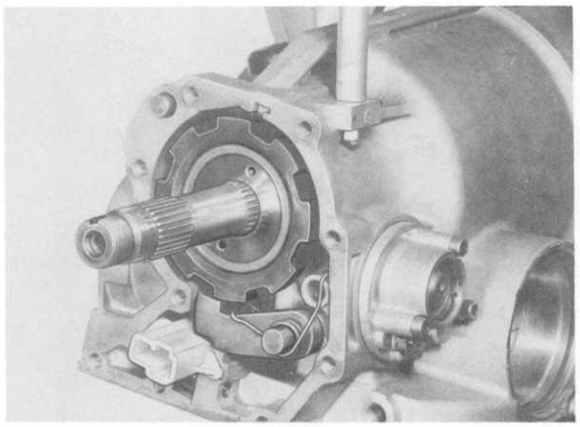
22.Remove pressure unit B 1 and modulating pressure control valve.



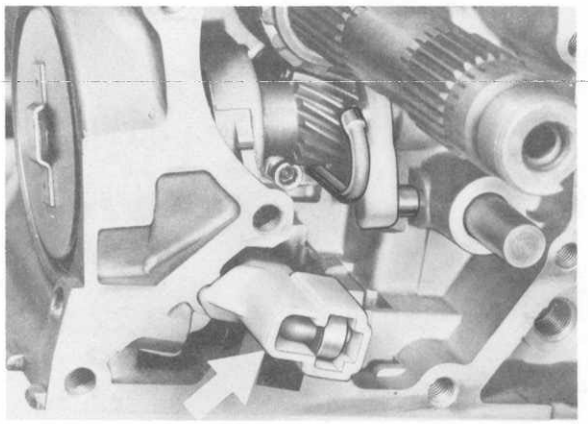
23.Remove kickdown solenoid valve and injector tube.



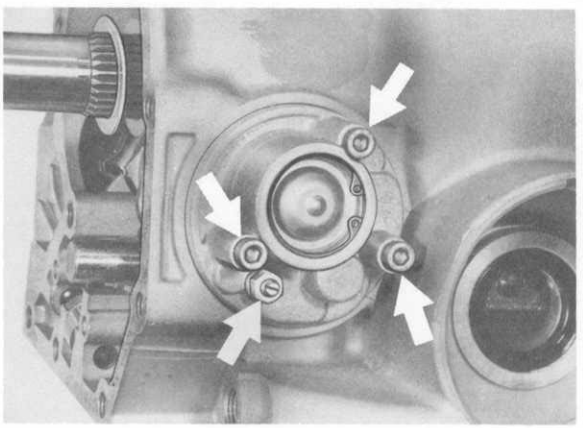
24.Remove parking lock with pawl and expander spring.



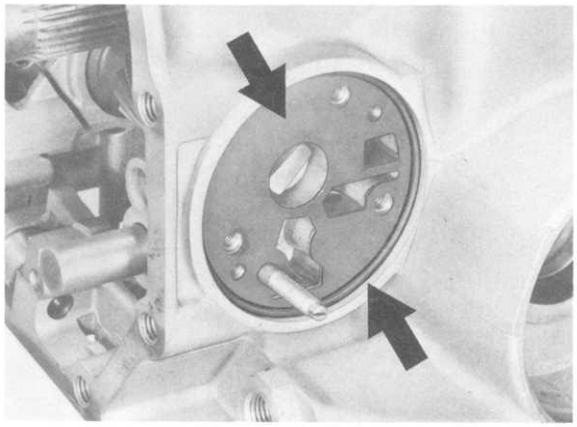
25.Remove plastic guide and roller.



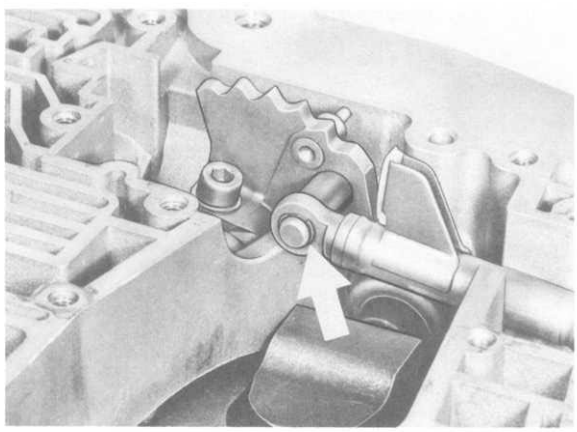
26.Remove secondary pump by unscrewing hex nut from axial holder and removing socket-head bolts.



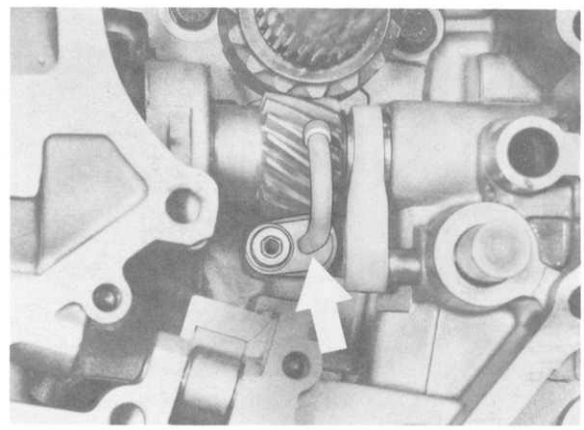
27.Remove O-ring and backer.



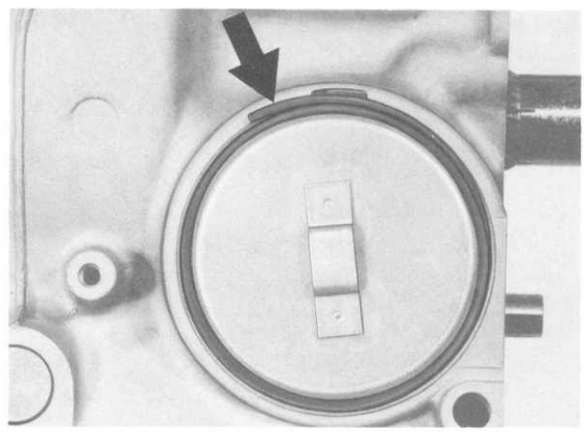
28.Remove circlip and sprung linkage. The circlip has been discontinued as of model year '87. Linkage is staked to detente plate.



29.Unscrew socket-head bolt and remove with oil tube. The oil tube has been discontinued as of model year '87.

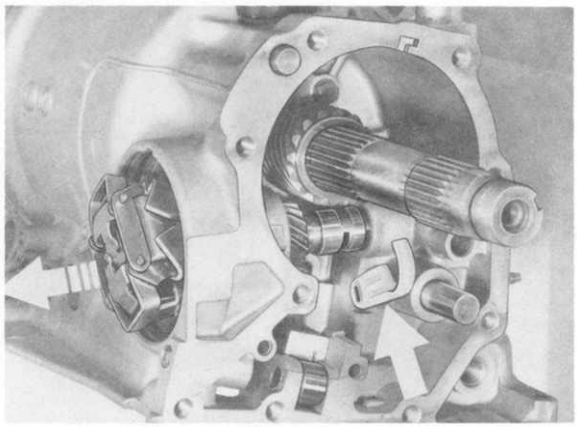


30.Press in cover and remove circlip.



31.Withdraw cover.

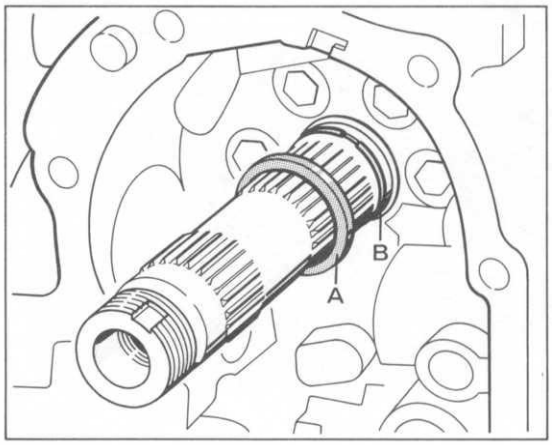
32.Withdraw centrifugal-force controller after swinging back axial holder.



33.Remove axial holder.

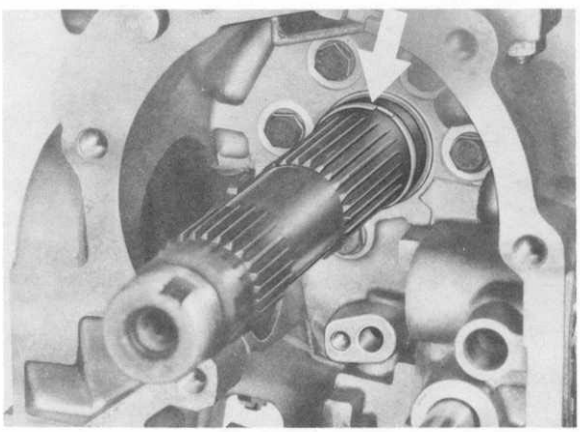
34.Remove helical gear with shims. Note thickness of shims for reinstallation.

35.A modified controller drive gear was fitted as of approx. December 1986. With this design, remove spacer.

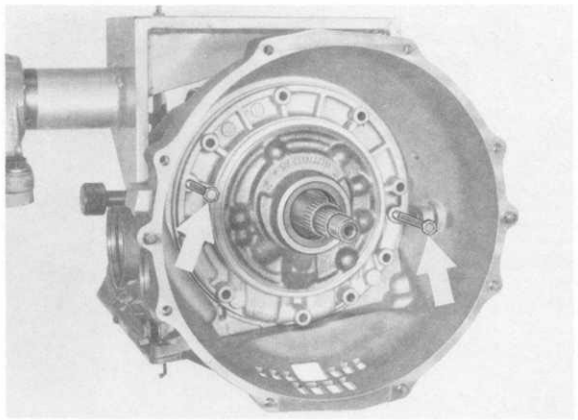


A = Spacer
B = Circlip

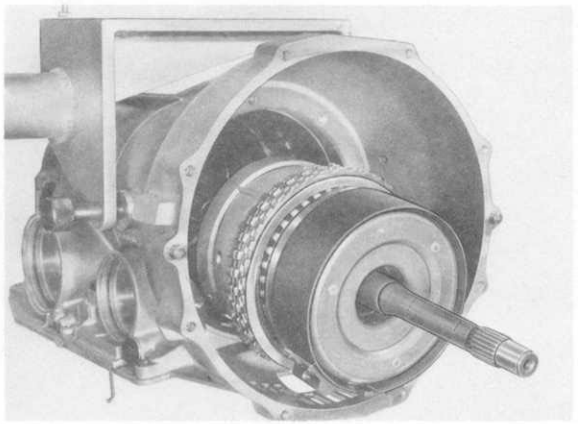
36.With a suitable pair of pliers (e.g Hazet 1847 - 2) disengage circlip from input shaft.



37.Remove front cover by unscrewing combination bolts, screwing two bolts into the threaded holes and using these to pull off cover.



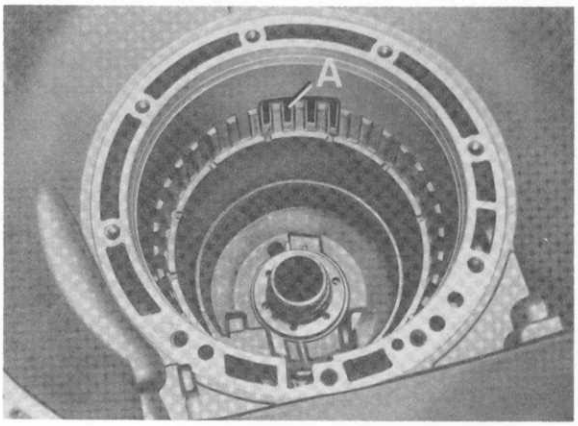
38.Grasp gearset at input shaft and carefully pull forward and out.



39.Pull clutch K 1 with brake band B 1 from gearset.

40.Remove plates B 3.

41.As of transmission No. 379 225 remove damping spring for plates B 3.



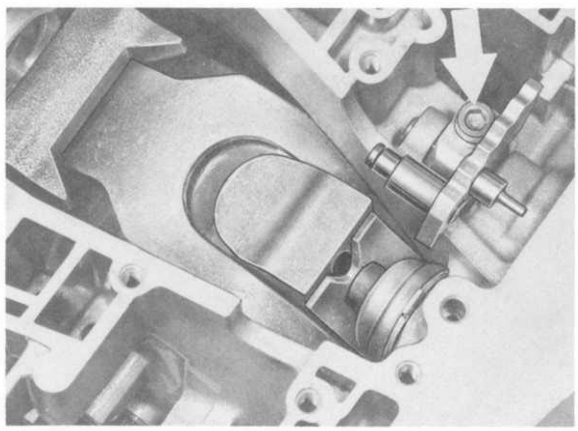
A = Damping spring

42.Remove clutch K 2.

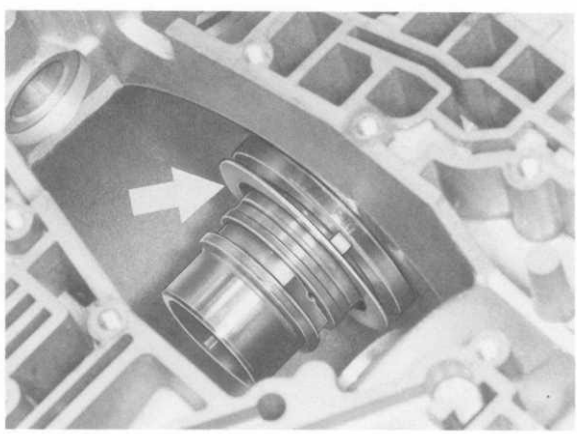
43.Remove pressure pin.

44.Tilt brake band B 2 and remove.

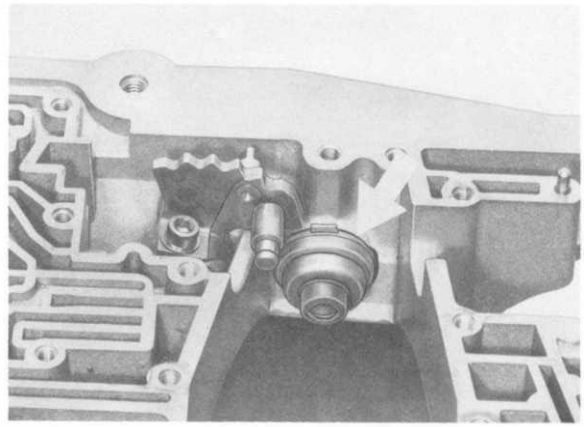
45.Unscrew socket-head bolt, withdraw shaft and remove detente plate.



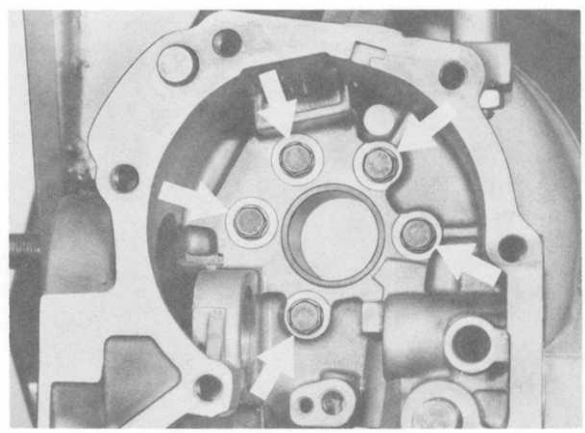
46.Remove thrust washer



47.Withdraw pressure unit B 2.



48.Unscrew hex bolts. Screw two approx. 80 mm long bolts into two opposite holes and release flange from casing by tapping the two bolts with a hammer.



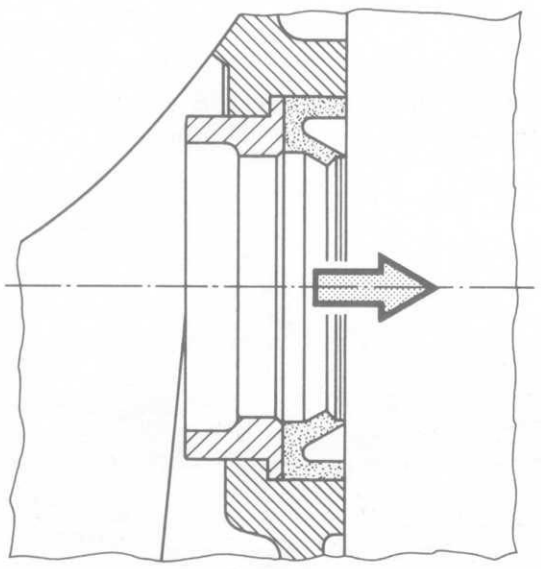
49.Remove any remaining sealing rings, measuring-connection plugs etc. from case.

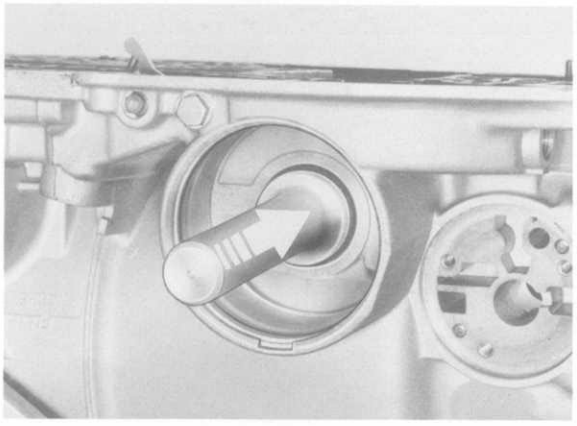
Assembling

Note:

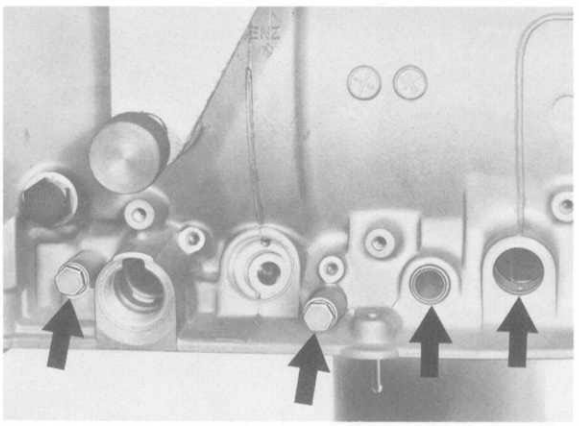
When assembling, coat all bearings and friction surfaces with ATF. Soak new brake bands and coated plates in ATF for approx. 1 hour before installation.

1. Insert guide ring and with Special Tool 9119, drive in sealing ring right way round, sealing lip (arrowed) facing outward toward brake-band piston cover.

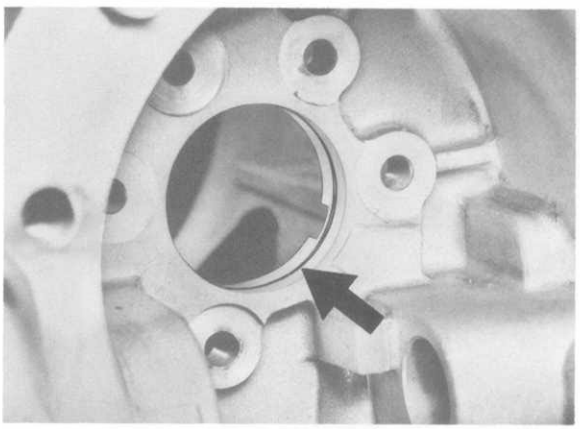




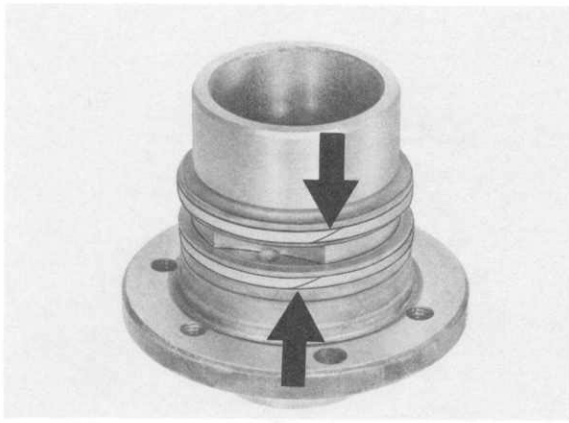
2. Insert O-ring and sealing ring. Screw in threaded plug with new sealing ring and tighten. Tightening torque 10 Nm (7 ftlb).



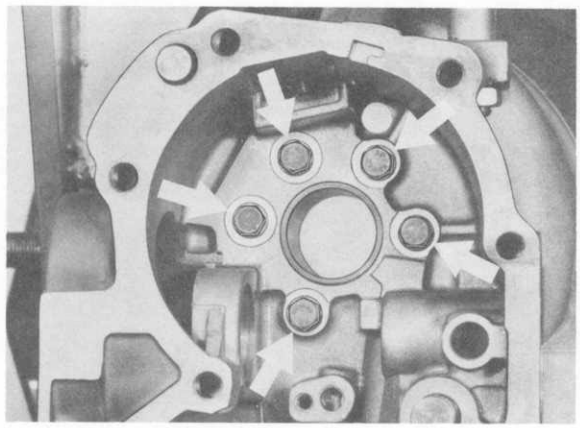
3. Place O-ring (arrowed) in groove.



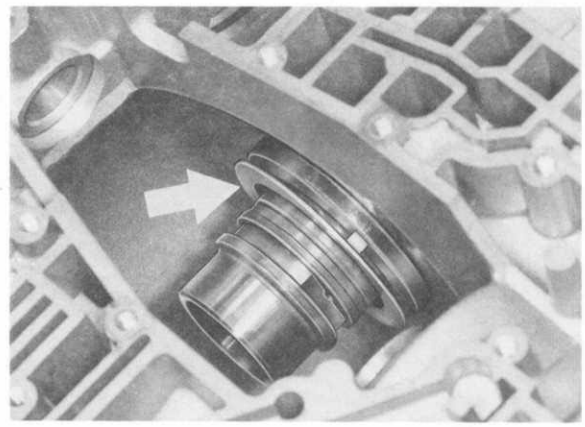
4.Grease grooves in support flange K 2. Insert teflon rings and press into grooves until joints (arrowed) are closed.



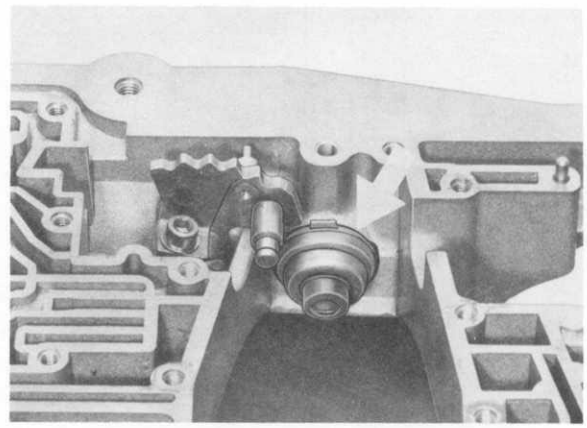
5.Position support flange so that holes are aligned. Tighten mounting bolts. Tightening torque: 11 Nm (8 ftlb).



6.Position thrust washer right way round (positioning lug engages support flange).



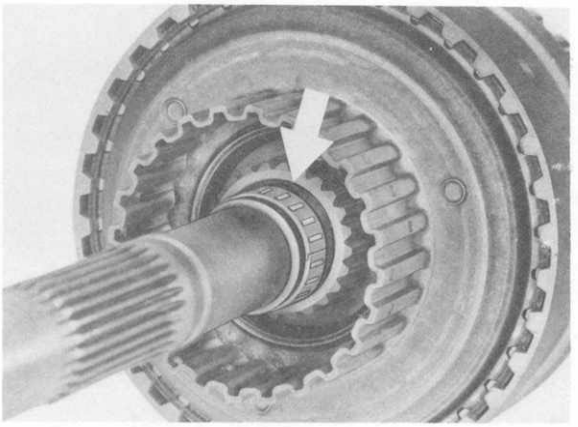
7.Insert pressure unit B 2 with projection (arrowed) upward.



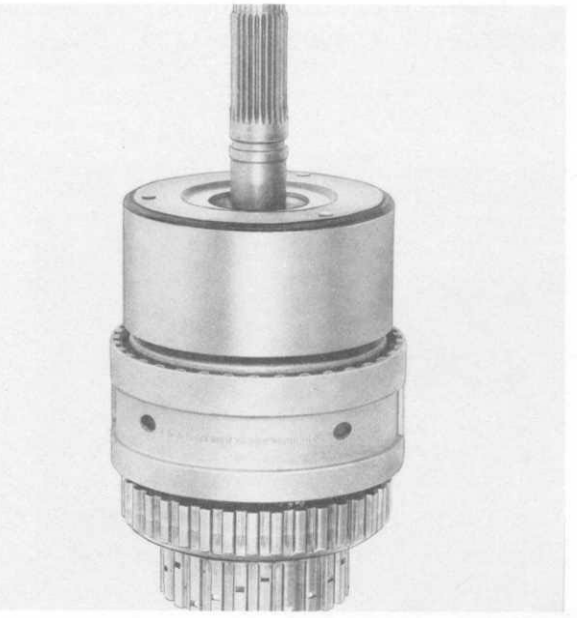
8. Recheck to ensure that teflon rings are correctly seated on support flange.

9. Press brake band B 2 as close together as possible at the support lugs and insert right way round in case.

10. Place greased split radial bearing on output shaft.



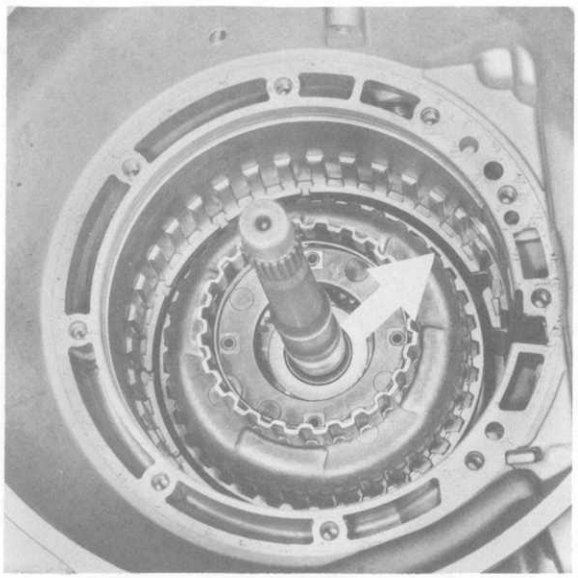
11. Push clutch K 2 onto gearset.



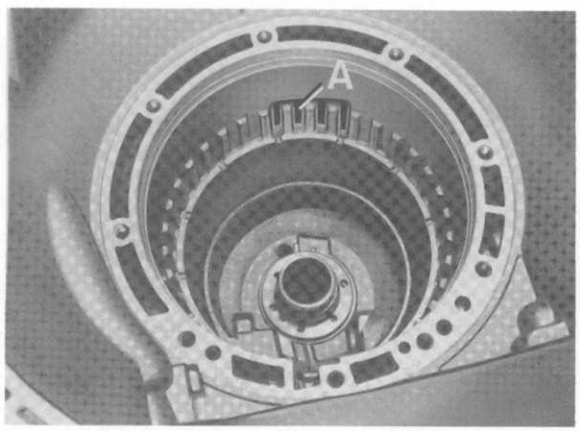
12. Carefully place gearset without clutch K 1 in transmission case while turning input shaft.

13. Set transmission upright with input shaft at top.

14. Check installation position of gearset. The gearset position is correct when the upper edge of the connector element (arrowed) is lower than the contact surface of the outer plate LB 3.

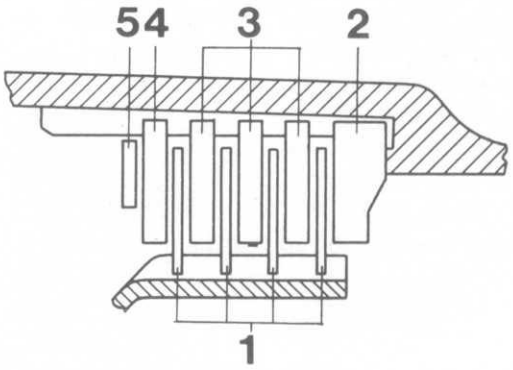


15. As of transmission No. 379225, install damping spring.



A - Damping spring

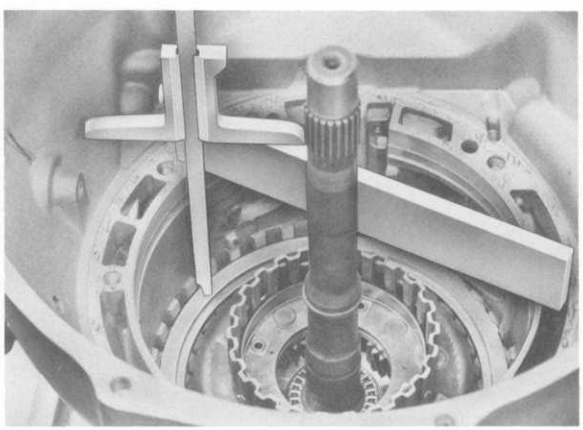
16. Insert plates for plate brake B 3 right way round.



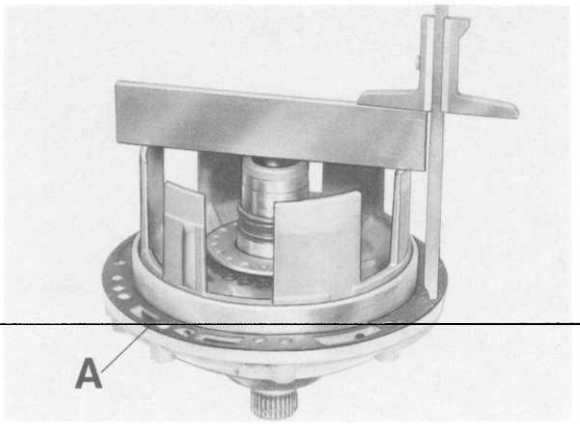
1 = Inner plate 2.1 mm thick
2 = Outer plate 7.7 mm thick
3 = Outer plate 2.3 or 2.8 mm thick*
4 = Outer plate 2.8 mm thick
5 = Shim 2.5-3.0-3.5 mm thick*

* as required to correct play

17. Measure play "L" of B 3 and correct.
Measure distance "d":
Place measuring bridge 9313 on prepared face and measure with depth gage to shim.

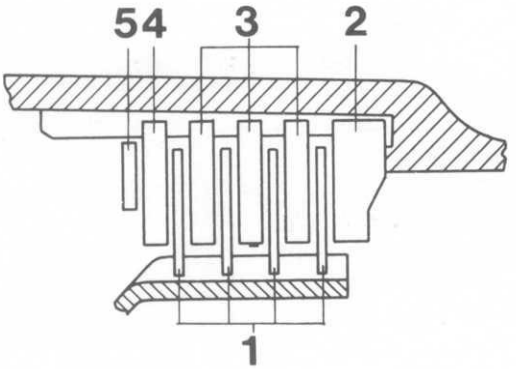


Measure distance "e":
Place measuring bridge 9313 on piston of plate brake and measure with depth gage to seal.



A = seal

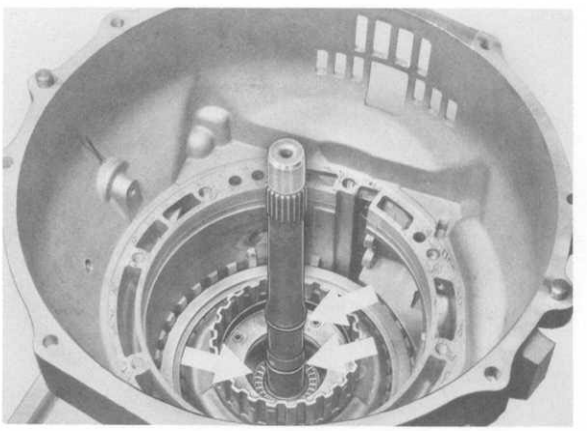
The difference between the two distances is the play "L". Correct play to specified value 1.5...2.0 mm. Correct by inserting outer plates and shims of appropriate thicknesses.



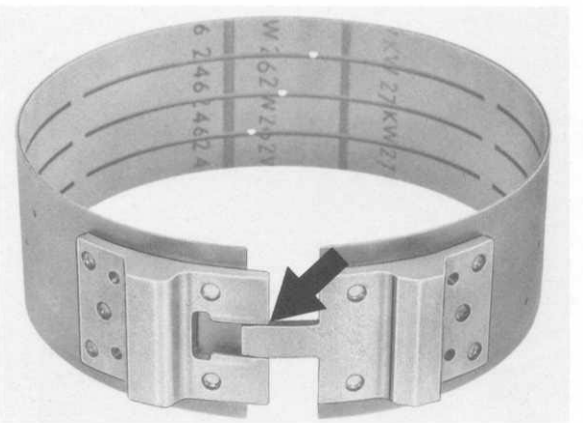
1 = Inner plate 2.1 mm thick
2 = Outer plate 7.7 mm thick
3 = Outer plate 2.3 or 2.8 mm thick*
4 = Outer plate 2.8 mm thick
5 = Shim 2.5-3.0-3.5 mm thick*

* as required to correct play.

18. Place axial bearing in planet carrier. Check that lubricating pressure rings are correctly seated (insert with grease).



19. Engage brake band B 1 in assembly lock (arrowed).

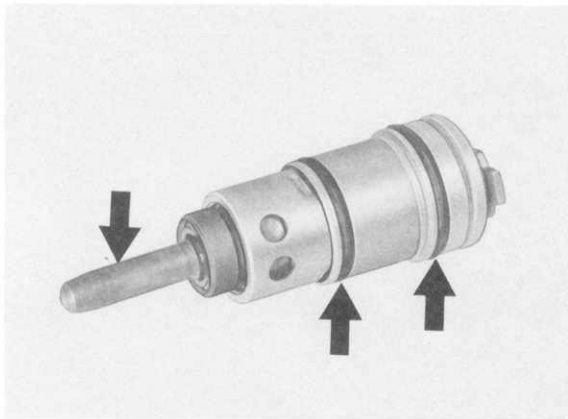


20. Insert clutch K 1 while turning until teeth engage.

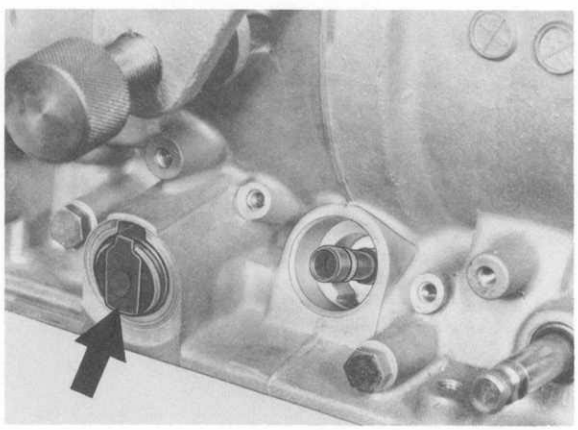
21. Insert brake band such that pin is facing from assembly lock to pressure unit B 1 (see Step 19).

22. Do not insert axial bearing and shims until axial play of clutch K 1 has been measured.

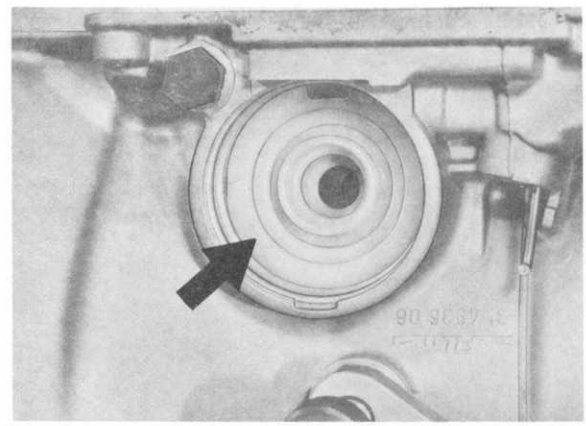
23. Push pressure pin into pressure unit B 1 (replace O-rings).



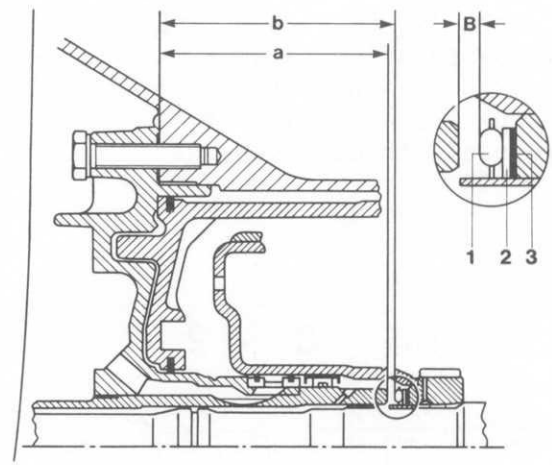
24. Insert pressure unit, screw in threaded plug or transmission protection switch in '87 models onward and tighten. Tightening torque 70 Nm (52 ftlb).



25. Insert brake-band guide. The locating pins must engage the holes in the case.



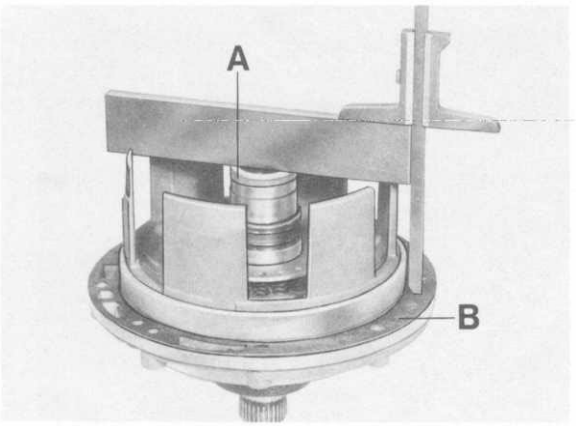
26. Check axial play "B" for clutch K 1 and correct.



1 = Axial bearing
2 = Rotation washer
3 = Shim
B = Axial play

Measure distance "a":

Place seal on front cover. Place Special Tool 9313 on flange and with depth gage, measure to seal. (e.g. 119.0 mm).

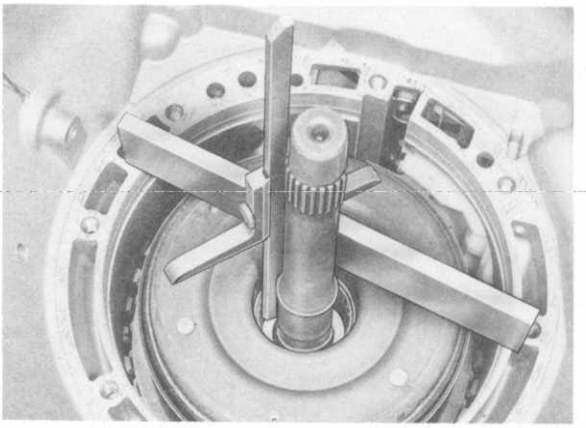


A = Spacer (discontinued as of transmission No. 472 213)

B = Seal

Measure distance "b":

Place measuring bridge 9113 on prepared face and, with depth gage, measure to clutch K 1 (e.g. 123.6 mm)



The difference between the two measurements is the axial play "B" (without axial bearing, rotation washer or shim).

Example

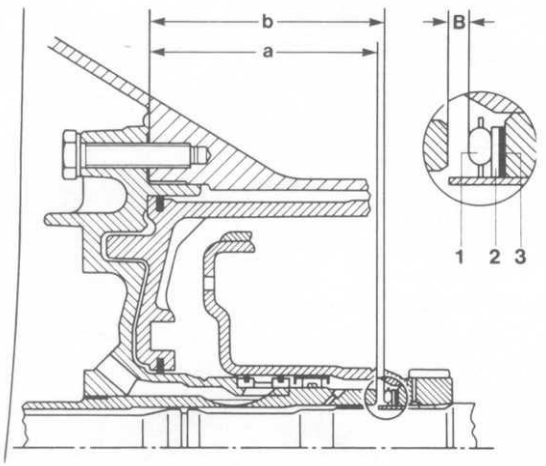
"b" =	123.6 mm	
"a" = -	119.0 mm	
	4.6 mm	
-	0.8 mm	
		specified axial play.
	3.8 mm	Play without axial bearing and shims.

Note:

Correct play to 0.8 mm by installing axial bearing, rotation washer and the appropriate shims.

Select axial bearing, rotation washer and shims such that the overall thickness is 3.8 mm.

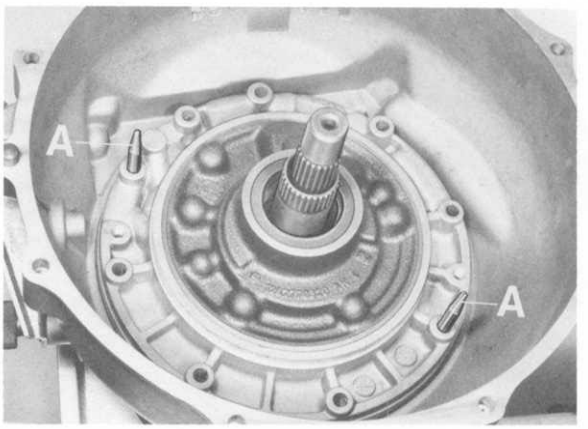
Insert these spacers as calculated (thickness in example, 3.8 mm)



1 = Axial bearing
2 = Rotation washer
3 = Shim

27. Check that teflon rings in front cover and on input shaft are correctly seated.

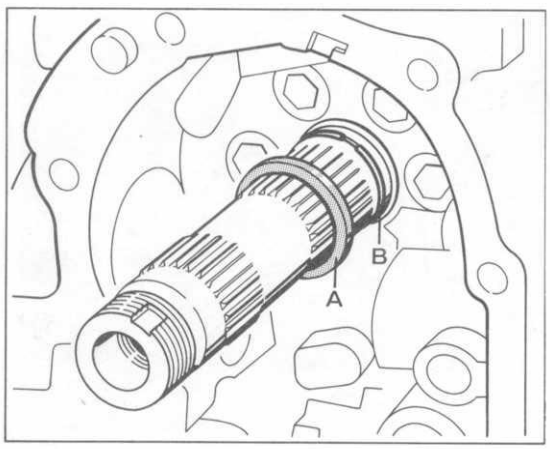
28. With a blob of grease, attach spacer to support and place front cover with seal in position. Tighten mounting bolts. Tightening torque: 13 Nm (10 ftlb).



A - Centering pins 9321

29. Turn assembly support so that output shaft is facing upward.

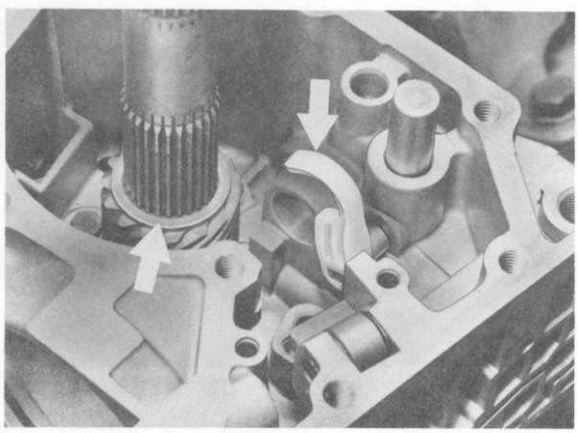
30. Insert circlip and position spacer right way round.



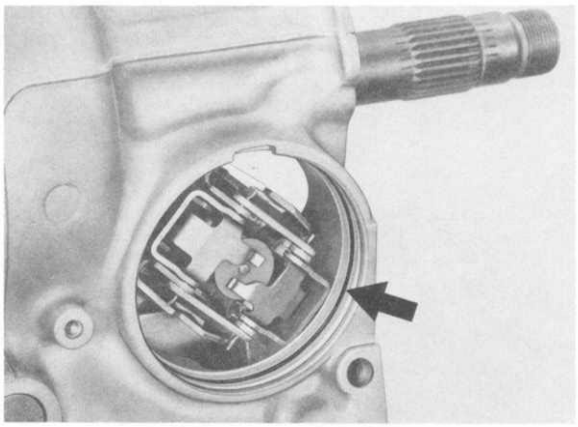
Note:

The spacer has been in use since approx. December, 1986.

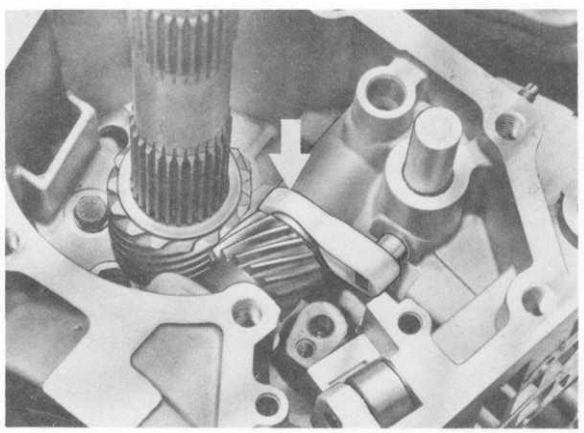
31. Install helical gear and axial holder.



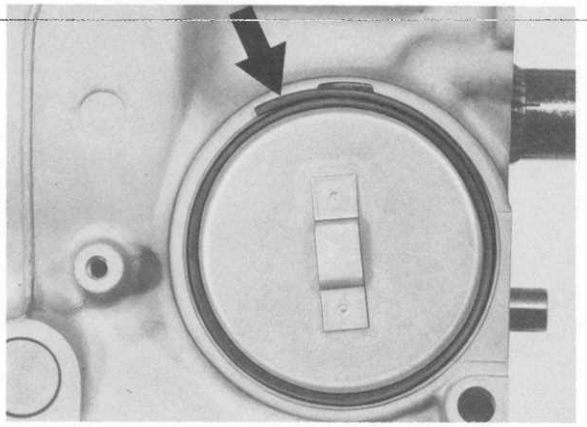
32. Insert O-ring and install centrifugal-force controller



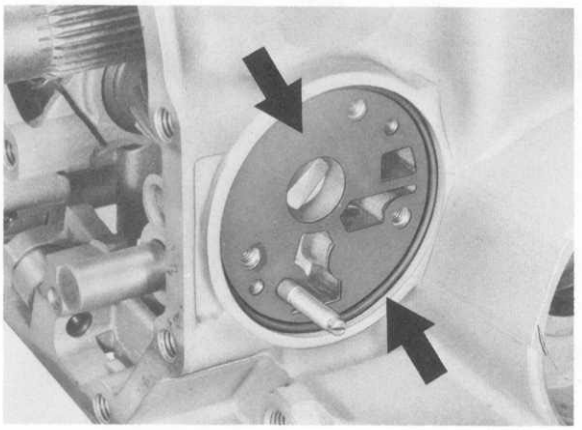
33. Swing axial holder over to centrifugal-force controller so that holder engages groove of controller shaft.



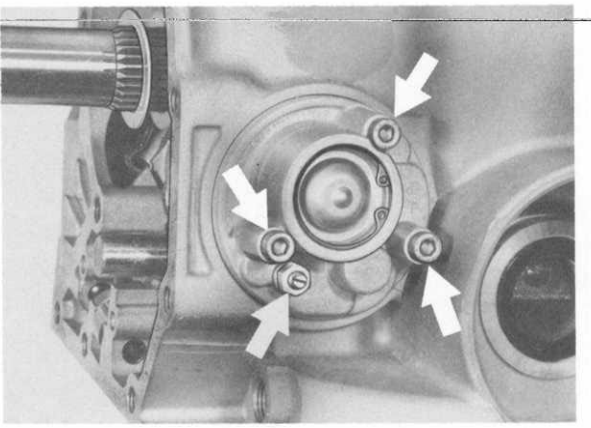
34. Insert cover and install circlip. Then pull cover out so that it makes contact with circlip around entire circumference.



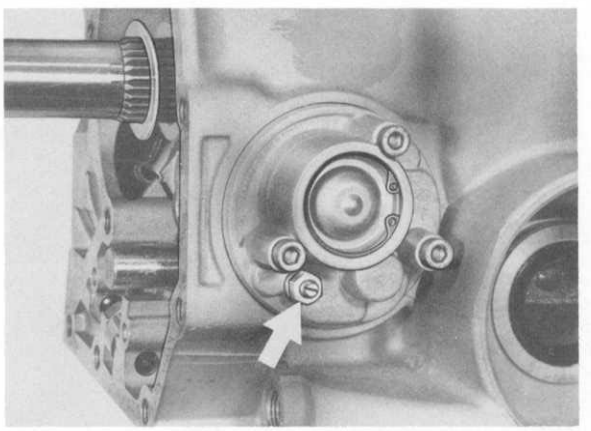
35. Install backer and insert O-ring.



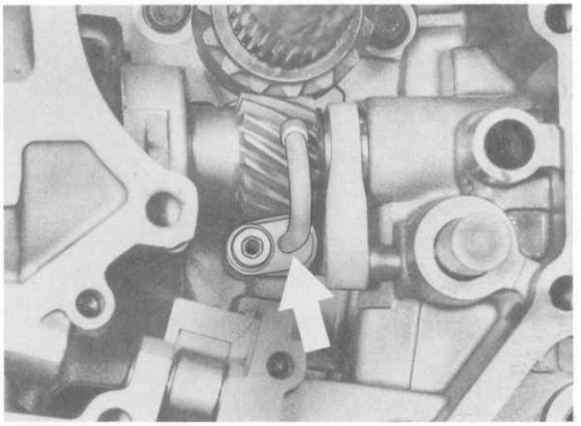
36. Place secondary pump in position and tighten hex bolts. Tightening torque: 8 Nm (5.9 ftlb).



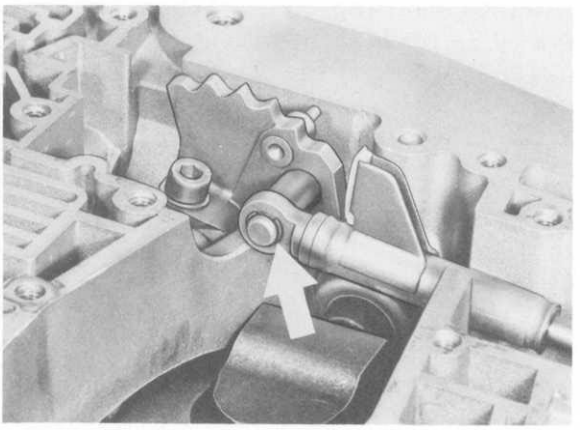
37. Recheck seating of axial holder and tighten new nut. Tightening torque: 6 Nm (4.4 ftlb).



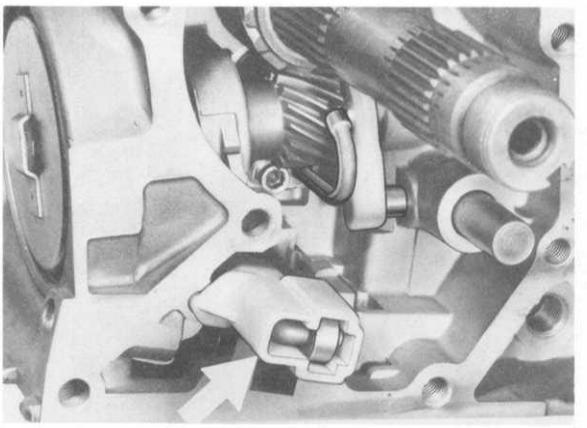
38. Insert oil tube (arrowed) and tighten socket-head bolt. Tightening torque: 8 Nm (5.9 ftlb).
The oil tube is discontinued as of '87 models.



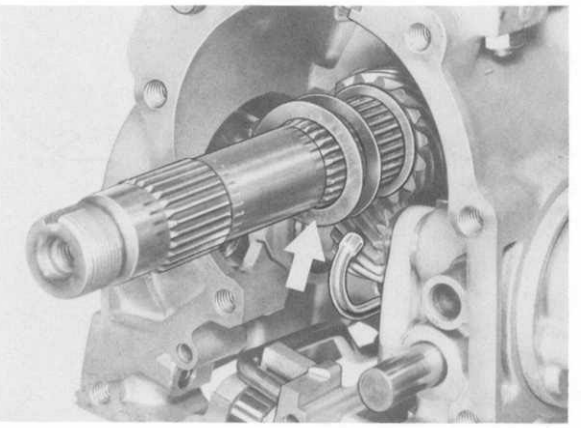
39. Insert detente plate with shaft, screw in socket-head bolt and tighten. Tightening torque: 8 Nm (5.9 ftlb). Push sprung linkage onto detente plate and install circlip (arrowed).
The circlip is discontinued as of '87 models. Linkage is staked to detente plate.



40. Push roller onto sprung linkage, place plastic guide in position and push into positioning holes.

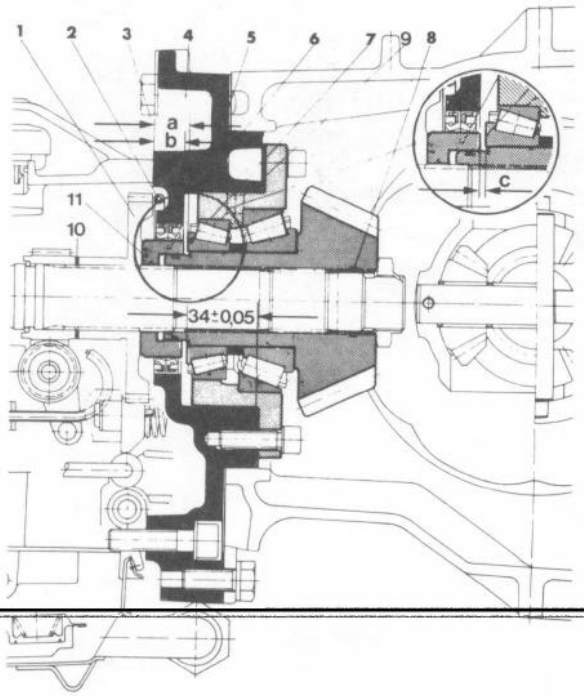


41. Place correct number of shims on helical gear.



42. Install parking lock pawl, expander spring and parking lock gear.

43. Measure axial play "C" of output shaft (clutch K 2) and correct.



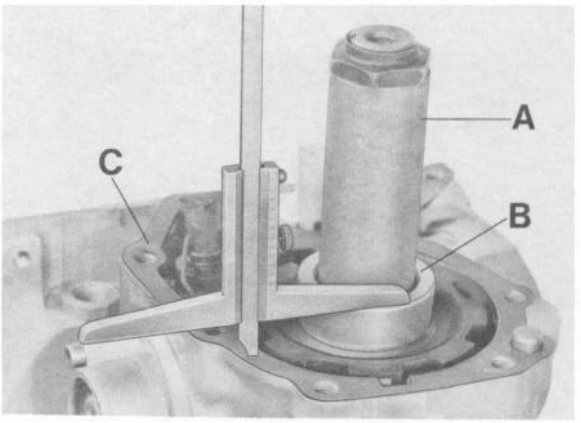
7 = Taper roller bearing - inner race
9 = Shim for bearing assembly
10 = Shim for axial play "C"
11 = Rotation ring
C = Axial play

Measure distance "b":

Push Special Tool 9312 onto output shaft and tighten collar nut. Tightening torque 380 Nm (280 ftlb). To do so, engage parking lock pawl.

Place seal in position.

Use a depth gage to measure from rotation ring to seal (e.g. 15.3 mm).

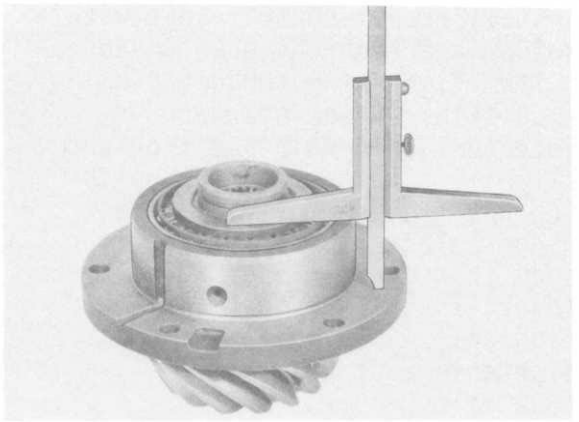


A = Special Tool 9312
B = Rotation ring
C = Seal

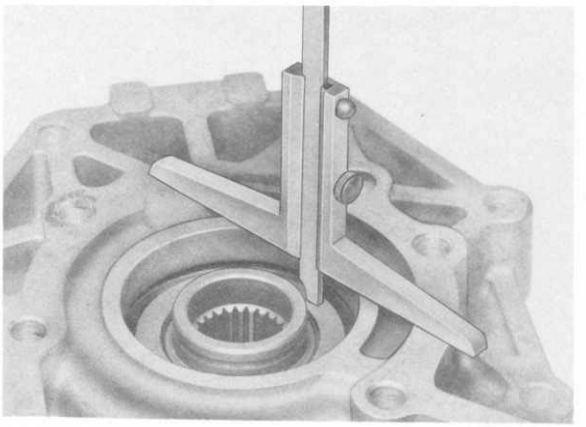
Measure distance "a":

Calculate thickness of shims for bearing assembly:

Use a depth gage to measure from bearing surface of taper roller bearing to bearing face of bearing assembly (e.g 34.55 mm). However, because the specified distance may not exceed 34 ± 0.05 mm, 0.55 mm must be made up in shims.



Use a depth gage to measure from case bearing face to inner race of cylindrical roller bearing (e.g 15.9 mm).



Example:

	34.55 mm	As-is (measured on bearing assembly)
-	34.00 mm	Specified (design distance)
	0.55 mm	Thickness of shims

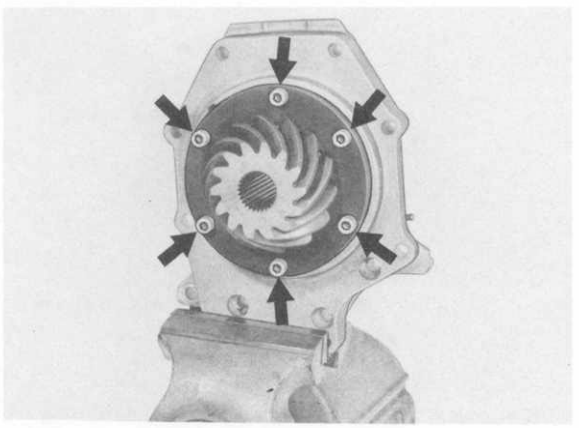
Distance "b" minus distance "a" equals distance "C".

Example:

Distance "a"	15.9 mm
Distance "b"	- 15.3 mm
Distance "C"	0.6 mm

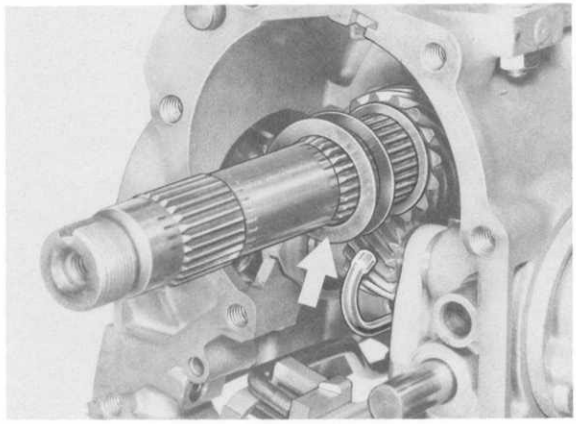
Install bearing assembly with shims as calculated in case and tighten all mounting bolts. Tightening torque: 33 Nm (24 ftlb).

Correct axial play "C" to 0.4 + 0.1 mm by inserting or removing shims beneath parking lock gear.



Note:

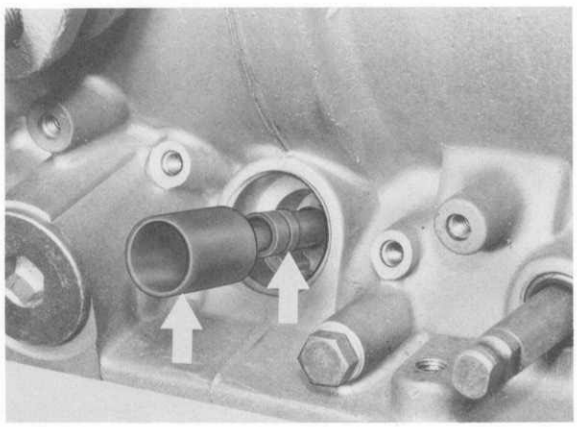
Remove bearing assembly from case and do not reinstall finally until case is fully assembled (see page 37 - 131).



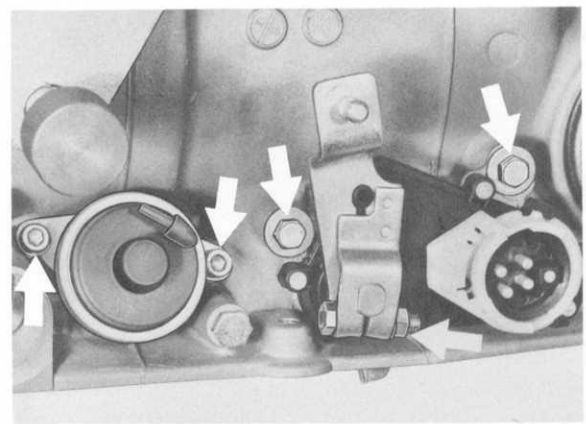
44. Insert injector tube.
Discontinued as of '87 models.

45. Screw in kickdown solenoid valve and tighten. Tightening torque: 20 Nm (15 ftlb).

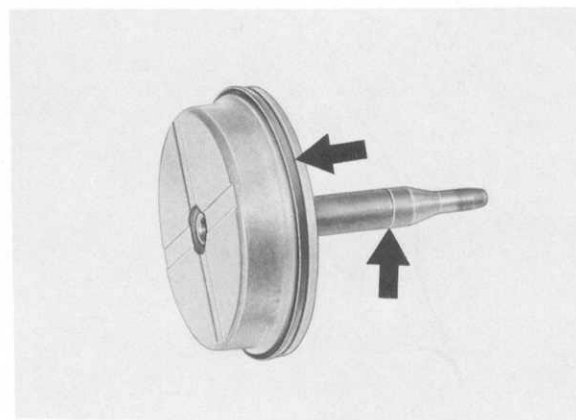
46. Insert modulating pressure control valve and pressure pin.



47. Install vacuum-control unit with holder and tighten socket-head bolts. Tightening torque: 8 Nm (5.9 ftlb). Place starter interlock switch in position and slightly tighten mounting bolts (do not tighten fully). Place range selector lever in position such that carrier is fixed in lever. Insert hex bolt and tighten.
Tightening torque: 8 Nm (5.9 ftlb).



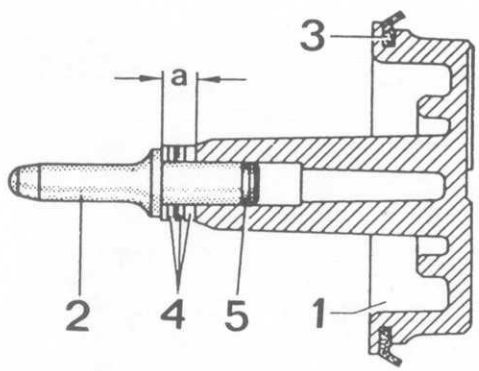
48. Insert sealing ring with lip in brake band piston B 1 such that sealing lip is pointing in the direction arrowed.



Note:

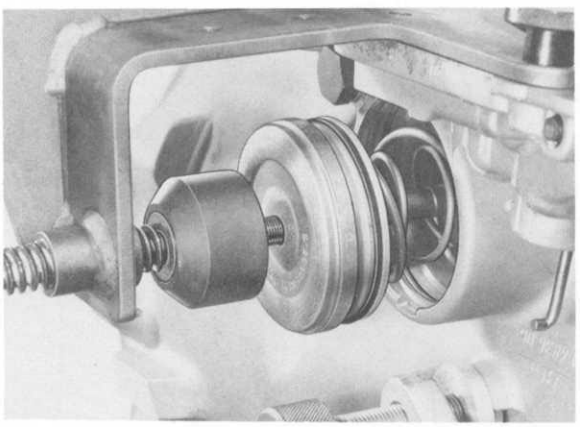
Brake-band pistons with five different pressure pins marked with grooves (arrowed) are available to correct play at brake band B 1. The brake band piston with the shortest pressure pin has no identification groove, the brake band piston with the longest pressure pin has four identification grooves.

Brake band pistons with removable pressure pins were installed as of transmission No. 788 606. To correct play, use shims available in three thicknesses 0.5 mm, 1.0 mm and 1.5 mm.



1 = Brake band piston B 1
2 = Pressure pin
3 = Sealing ring with lip
4 = Shims
5 = O-ring
d = Max. 6.5 mm

49. Bolt Special Tool 9316 to transmission case and insert brake band piston B 1 with compression springs and Special Tool 9320. Screw spindle down while ensuring that piston pressure pin enters brake band (do not damage sealing ring with lip).

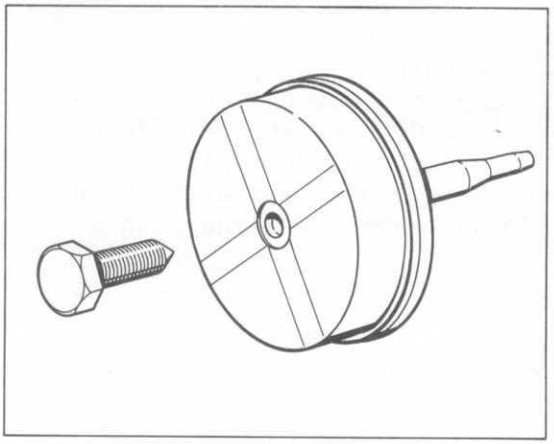


Note:

Play is set with either a flat or pointed adjuster screw for Special Tool 9320, depending on the design of brake band piston.

Piston with rivetted pressure pin = hex screw with point

Piston with removable pressure pin = flat hex screw M 10 x 1



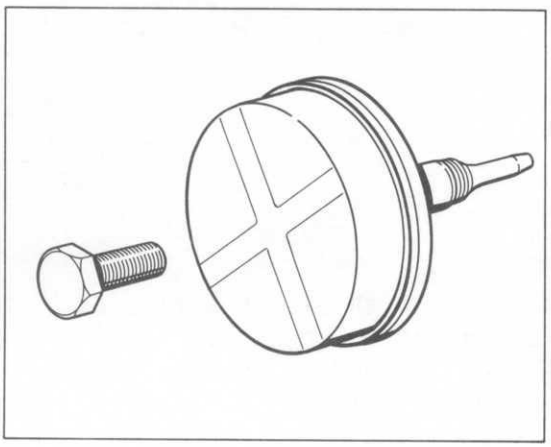
50. Insert circlip, relieve Special Tool 9316 and remove.

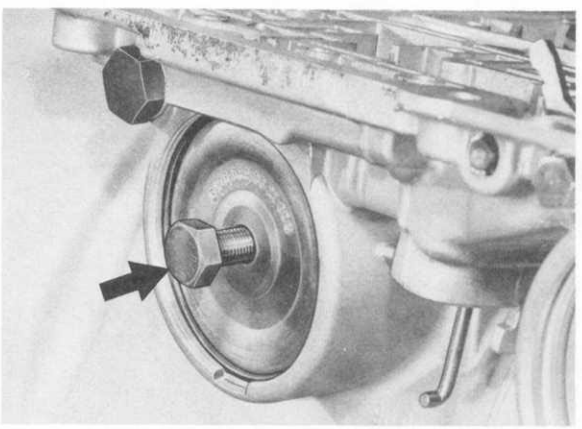
51. Measure and adjust play "L" of brake band.

Note:

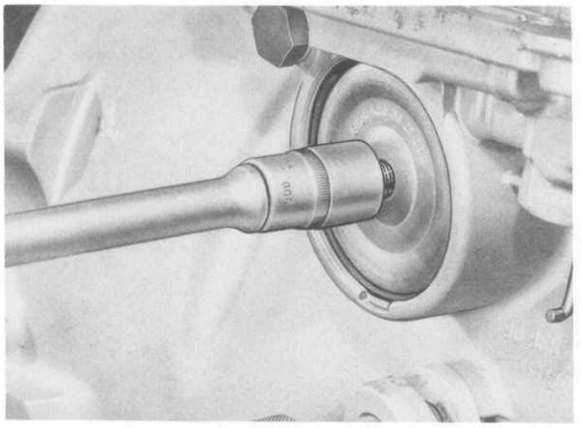
The thread of Special Tool 9320 has a 1 mm lead, which means that one full turn equals 1 mm travel.

Turn screw of Special Tool by hand until resistance is felt.





Tighten screw further with torque wrench, counting turns and tightening to 5 Nm (2.3 ftlb).

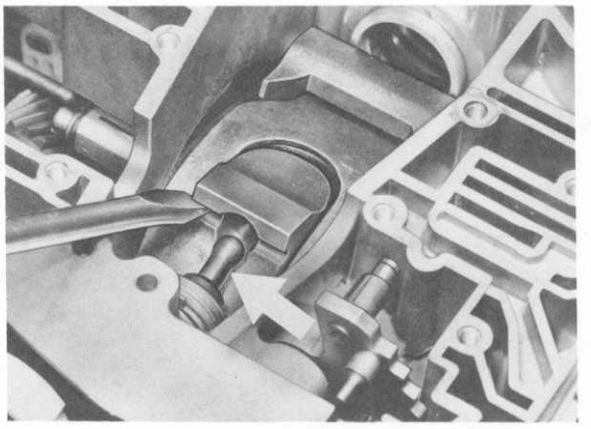


Travel at brake band must be 3...4 mm, in other words, the 5 Nm (2.3 ftlb) torque must be reached after 3...4 turns.

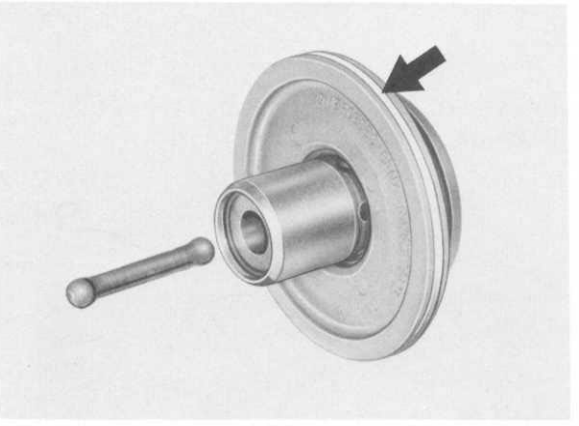
52. If travel is excessive, fit a brake band piston with a longer pressure pin; if travel is too short, fit a brake band piston with shorter pressure pin. As of transmission No. 788 606, use appropriate shims to correct travel.

53. Place Special Tool 9316 in position and bolt down. Remove brake band piston B 1 and install brake band piston cover instead of Special Tool 9320.

54. Install pressure pin with larger diameter toward brake band B 2.



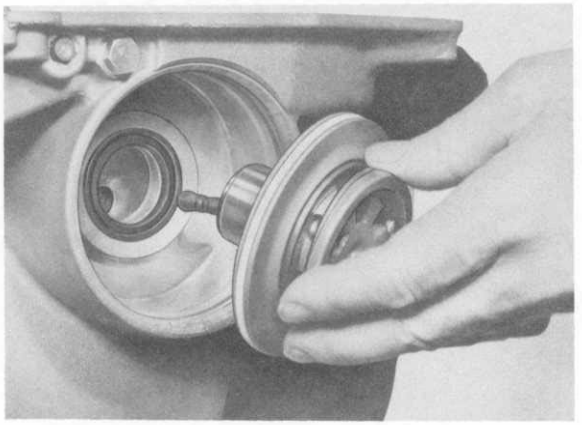
55. Insert teflon ring with grease in groove and insert pressure pin.



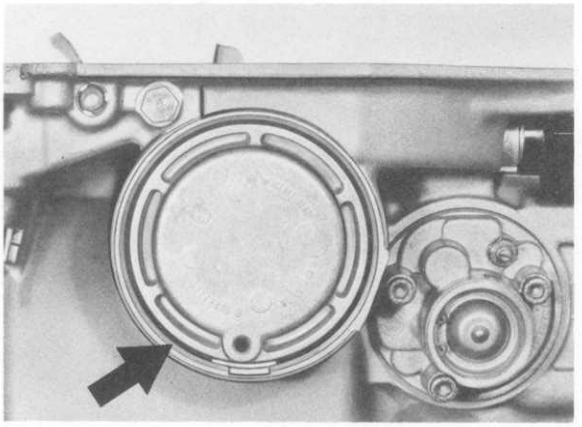
Note:

Pressure pins are available in 4 lengths for correcting travel at brake band B 2.

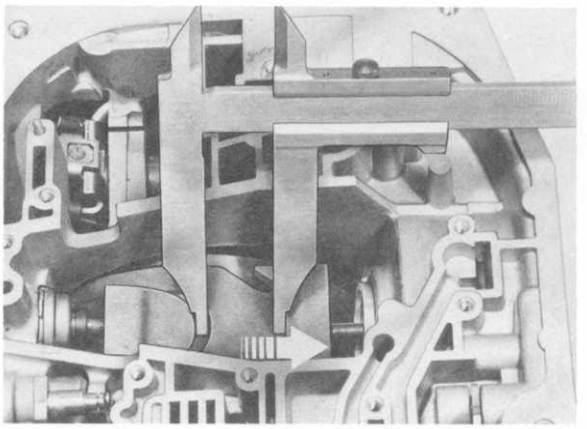
56. Insert brake band piston B 2, ensuring that pressure pin engages brake band.



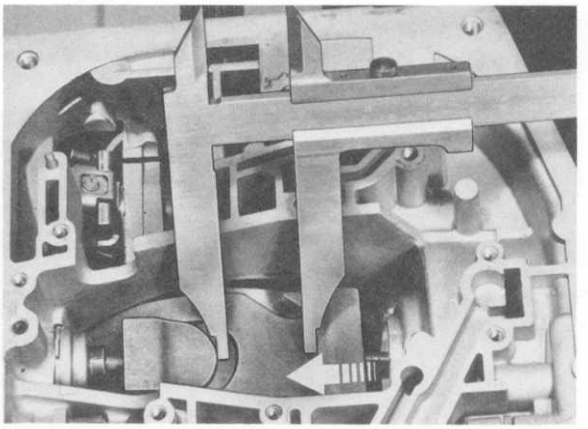
57. Press in brake band piston cover B 2 and insert circlip.



58. Measure play "L" at brake band B 2 and adjust:
press brake band B 2 toward brake band piston at support lug (as arrowed) so that brake band piston contacts brake band piston cover. Use a feeler gage to measure distance "a" at brake band.

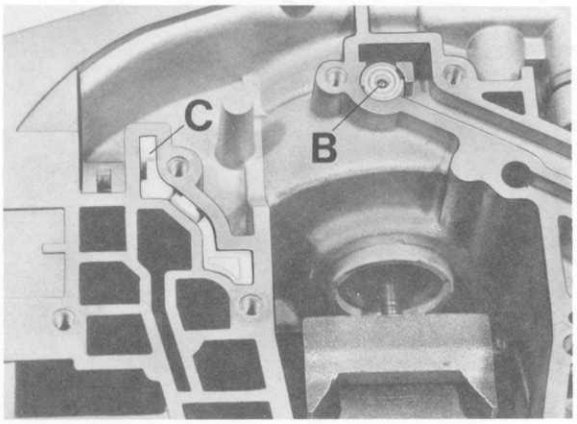


Again, press brake band B 2 toward pressure unit at support lug (as arrowed) and measure distance "a" again.

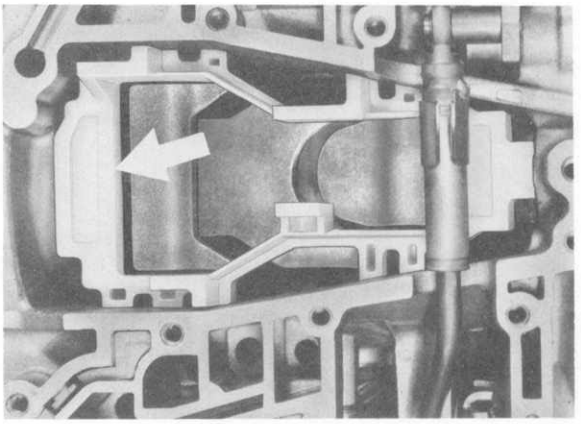


The difference between the two measurements is the play "L". Adjust play "L" to 6...7 mm by changing pressure pin in brake band piston B2.

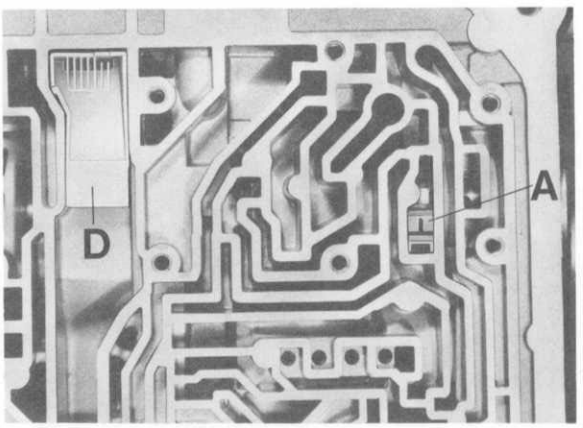
59. Insert one-way valve and filler.



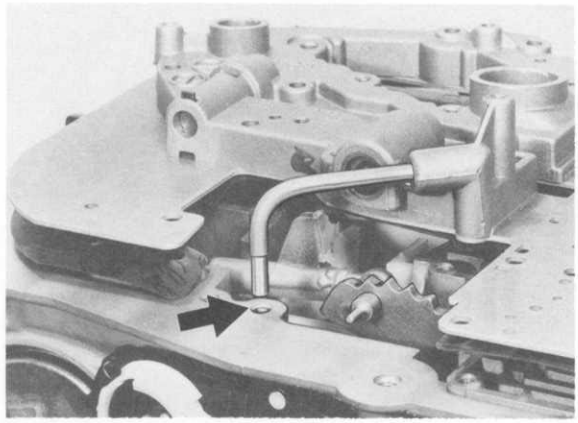
60. Insert brake band guide.



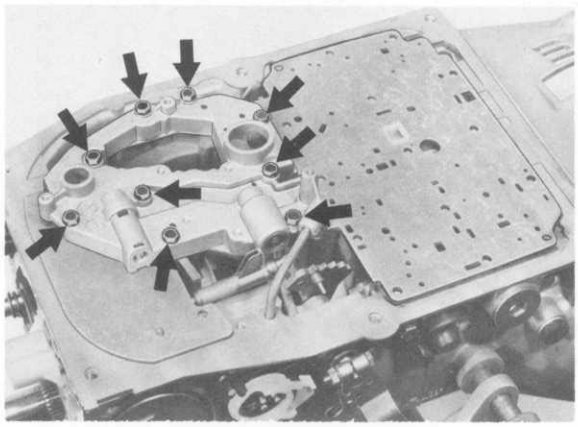
61. Insert temperature throttle and push into oil duct until throttle is flush with casing. Insert oil wiper.



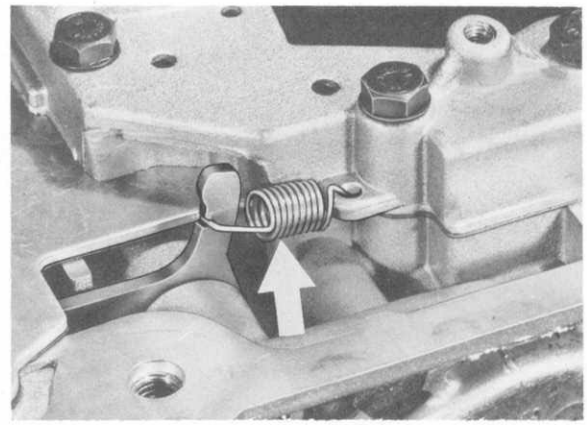
62. Install lower cover with back plate, in so doing, insert oil tube in casing bore.



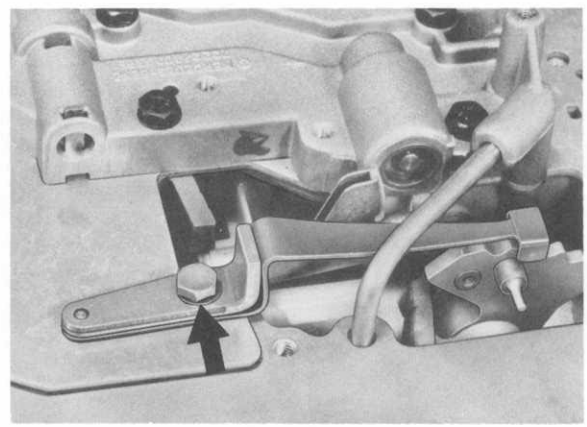
63. Insert combination bolts and tighten nuts slightly (do not tighten fully).



64. Engage return spring.

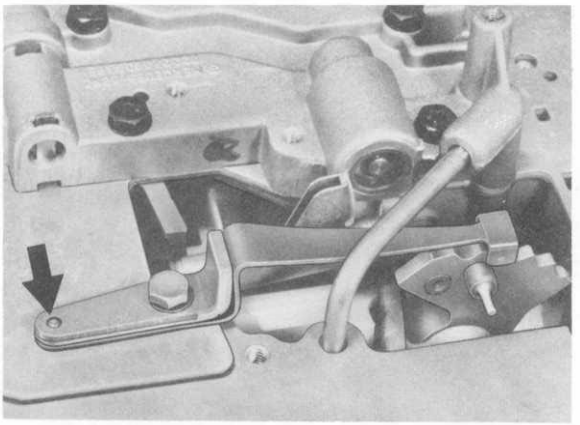


65. Place leaf spring with holder in position and tighten mounting bolts slightly (do not tighten fully).

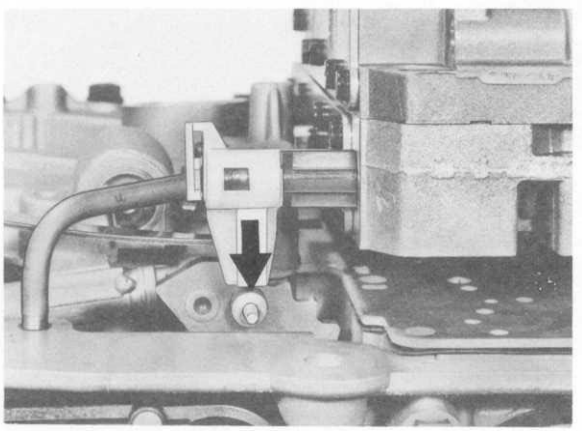


Note:

Holder must be properly pinned in place.



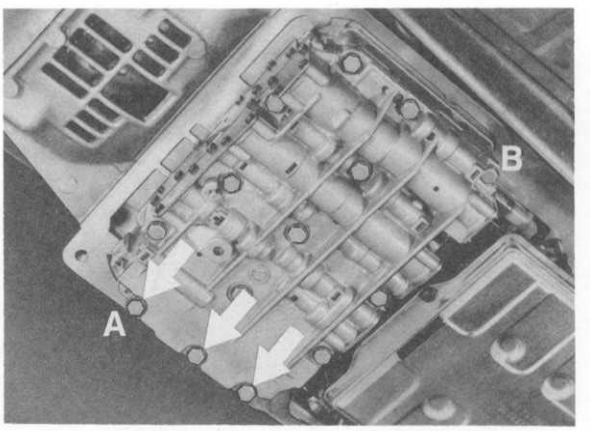
66. Install shift valve casing, range selector must engage carrier on detente plate (arrowed).



67. Insert combination bolts and tighten to 8 Nm (5.9 ftlb).

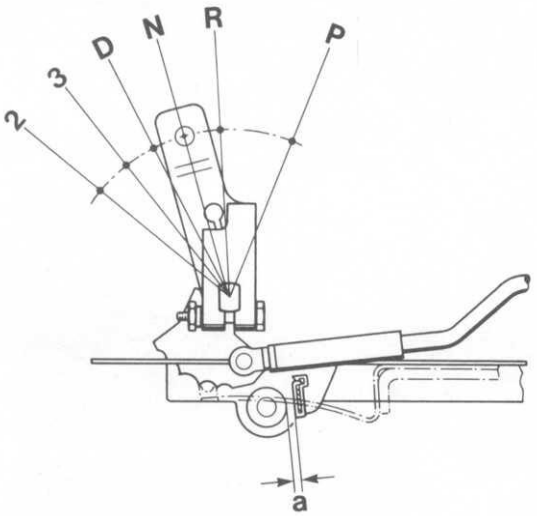
Note:

Note length of bolts. The three arrowed bolts are only 50 mm long, the remaining 12 bolts are 55 mm long.
Begin by tightening the two bolts A/B slightly to center the shift valve casing.

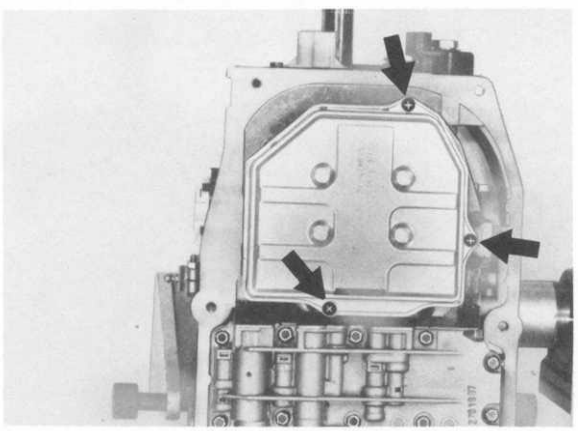


68. Tighten combination bolts for back plate and leaf spring holder to 8 Nm (5.9 ftlb)

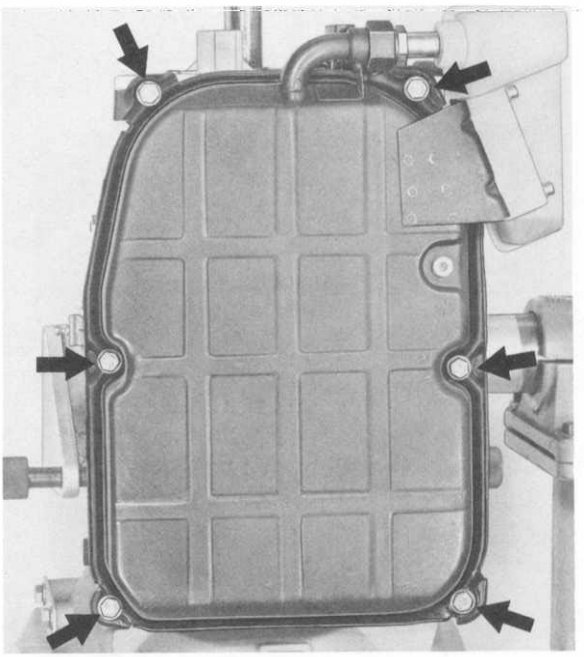
69. Check clearance "a" between locking piston and stop on sprung linkage, adjust if necessary. Use plastic clips to adjust play to 0.4...1.0 mm with selector in "N" position. Plastic clips are available in three thicknesses.



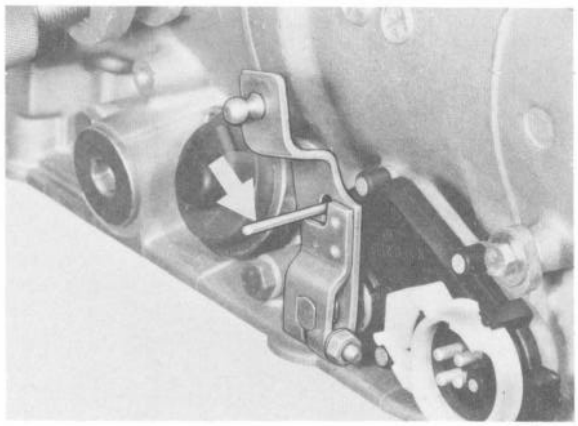
70. Place ATF filter in position, insert cross-recess head screws and tighten to 4 Nm (2.95 ftlb).



71. Install oil pan with gasket, screw down mounting bolts and tighten to 8 Nm (5.9 ftlb).



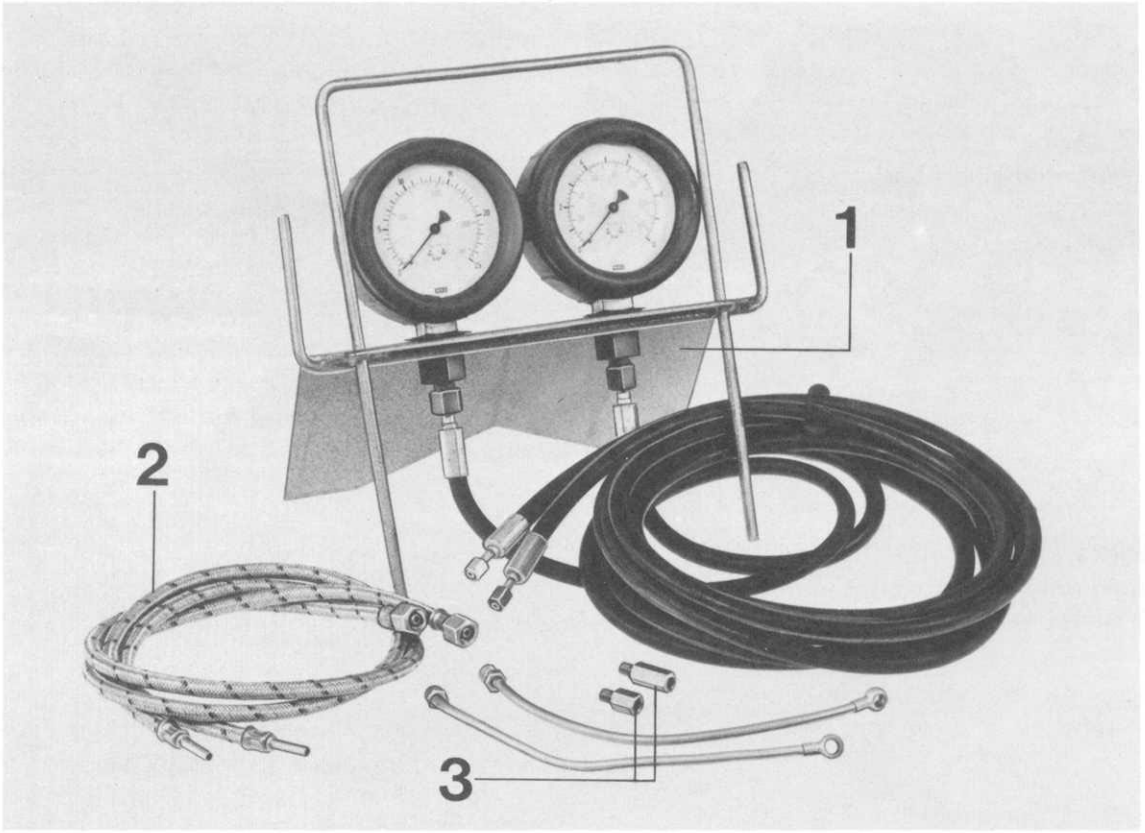
72. Set range selector to "N" position, insert a holding pin made of 4 mm welding wire (or 4 mm twist drill) through selector into hole in shift valve casing and tighten mounting bolts to 8 Nm (5.9 ftlb). Remove holding pin.



Note:

Once the transmission has been installed, check settings of cables for selector lever and control pressure and check modulating pressure, reset if necessary.

TOOLS



No.	Description	Special Tool	Remarks
1	Pressure tester	V 90	
2	Hoses	9170	
3	Adapters	9300/1	

CHECKING TRANSMISSION OPERATION

Prior to making repairs on an automatic transmission, troubleshoot transmission as instructed below and with help from the following tests.

A – General Checks

B – Transmission Fluid Level

C – Stall Speed

D – Test Drive

E – Pressure Test

Caution!

All jobs, which require that engine runs, should only be carried out with selector lever in "N" or "P" and parking brake applied.

Exceptions are tests, which require briefly a different selector lever position.

A – General Checks

Following jobs must be performed prior to any testing of transmission, and if defects are found, they must be eliminated before continuing with other work on transmission.

1. Check engine tuning (ignition timing, idle and transition).

2. Check for external damage, e. g. leaks on transmission (ATF) or final drive (hypoid oil) and missing or loose mounting bolts.

B – Transmission Fluid Level

The specified fluid level is extremely important for proper operation of an automatic transmission, so that following test must be carried out with great care.

Check ATF Level

Also check appearance and odor of ATF. Burnt friction linings cause a burnt odor. Contaminated oil could cause failure in valve body.

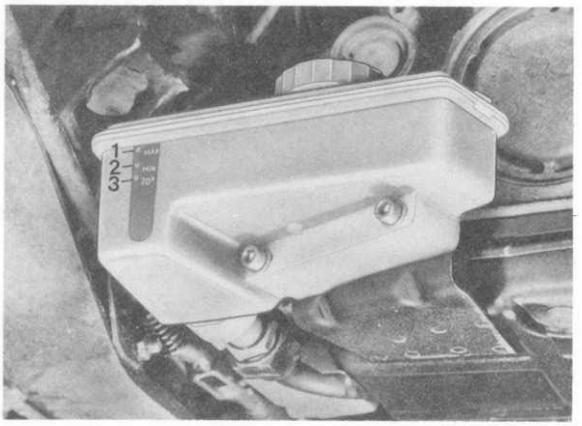
In this case transmission must be removed and repaired or replaced. ATF lines and cooler must also be flushed.

ATF level check is carried out at engine idle speed, parking brake applied and selector lever at "N". Car must be on level surface.

Let engine run at idle speed 1 to 2 minutes before checking fluid level, so that torque converter will be full.

ATF level can be checked on a cold or warm transmisstion. However, the level will be more accurate on a cold transmission (20 to 30°C/68 to 86°F ATF temperature) than on a warm transmission (80°C/176°F ATF temperature). ATF temperature of 80°C/176°F can only be estimated.

ATF level in transmission will change with fluid temperature. Max. and min. marks on transparent tank are in reference to an ATF temperature of 80 °C. When ATF temperature is 20 to 30 °C, the maximum ATF level will be below the minimum mark (see figure). The amount of ATF between min. and max. marks is 0.2 liters.



1 = max. at 80 °C ATF temperature
2 = min. at 80 °C ATF temperature
3 = max. at 20 to 30 °C ATF temperature

Add ATF to correct level. Cleanliness is essential!

If ATF level is too low, oil pump will draw in air, which can be heard. ATF will foam and cause incorrect readings when checking ATF level. Stop engine until ATF foam disappears (approx. 2 minutes). Add ATF and recheck ATF level.

Excessive ATF must be drained or drawn off, since otherwise transmission components would splash excessively and raise the temperature too much, until finally foamed oil is forced out through vent. This condition could damage transmission on a longterm basis.

After correcting ATF level to specifications, operate brake pedal, leave selector lever in each position (R–N–D–N–R) several seconds and then return it to "N", so that working pistons of power parts are filled with ATF. Recheck and, if necessary, correct ATF level.

C – Stall Speed Test

This check provides information on operation of engine, converter and transmission. It is applied, when top speed cannot be reached or acceleration is insufficient.

Note:

During this check all the engine power is converted into heat in the converter, which is why this test must not last longer than 5 seconds.

Rear wheels must not be permitted to turn for this check.

Also engine must be at operating temperature and develop its full power.

Extra equipment, e. g. compressor for air conditioner, must be turned off.

Check must not be made with car's tachometer.

1. Connect tachometer that it can be read from driver's seat.

2. Run engine at about 2,000 rpm approx. 2 minutes prior to testing.

3. Apply parking brake fully and depress brake pedal with left foot.

4. Set selector lever to "D", fully depress gas pedal, transmission must reach the specified stall speed (see Technical Data, page 30 - 0103).

N o t e :

If the stall speed drops some 400 to 700 rpm below the specified value, the torque converter freewheel is slipping.

If the measured stall speed exceeds the specification by more than 300 rpm, transmission slip is the cause of trouble.

If the engine does not reach its top speed despite a correct stall speed setting, the freewheel is blocking in both directions or is frozen. On the motorway, this fault usually shows itself as a leakage of ATF from the air bleeder.

The drop in engine power with every 1000 m of altitude above sea level reduces the stall speed by approx. 125 rpm.

The stall speed may also drop slightly beneath the lower value if outside temperatures are very high.

D - Test Drive

Take the vehicle for a test drive (only if transmission not obviously damaged). During test driving, it is important to pass through all the automatic transmission ranges and make careful note of transmission response. It is particularly important to note speed and shift characteristics of the shifting points for upshift and downshifts as well as the kickdown shifting points.

The transmission must shift gear quickly and without loss of pulling force. A careful check should be made to see whether the engine accelerates suddenly as the gears shift. Such acceleration indicates that a brake or clutch is slipping.

Experience in working with automatic transmissions is essential if the unit's method of operation is to be assessed and any faults identified. If this experience is not available, it is advisable to compare the transmission with a second unit of the same rating and in verifiably sound condition.

After the test drive, check the transmission for leaks.

Checking Operation

Shifting points in km/h

	Transmission Type A 28.01/04/07/12		Transmission Type A 28.02/05/08	
Gas pedal position	km/h	km/h	km/h	km/h
Selector lever position	⇑	⇓	⇑	⇓
Idle "D" 1-2-1	58...64	28...24	54...59	26...22
Idle "D" 2-3-2	109...125	54...47	102...117	50...44
Idle "D" 3-4-3	190...211	131...115	177...197	122...107
Idle "2" 1-2	58...64	–	env. 63	–
Kick-down "D" 1-2-1	62...68	45...39	58...63	42...36
Kick-down "D" 2-3-2	126...143	122...106	118...133	144...99
Kick-down "D" 3-4-3	207...216	203...183	193...213	189...171
Kick-down "2" 1-2	69...75	–	env. 68	–

	Transmission Type A 28.03/06/09/11/14		Transmission Type A 28/16		Transmission Type A 28.18	
Gas pedal position	km/h	km/h	km/h	km/h	km/h	km/h
Selector lever position	⇑	⇓	⇑	⇓	⇑	⇓
Idle "D" 1-2-1	50...55	24...21	41...50	30...23	41...50	30...24
Idle "D" 2-3-2	95...109	47...41	102...117	49...43	102...117	49...43
Idle "D" 3-4-3	165...183	114...100	169...188	144...128	169...188	144...128
Idle "2" 1-2	50...55	–	53...58	–	53...58	–
Kick-down "D" 1-2-1	54...59	39...34	59...61	48...43	57...58	47...42
Kick-down "D" 2-3-2	109...112	106...92	123...125	120...105	119...121	115...99
Kick-down "D" 3-4-3	180...188	176...159	192...195	186...167	180...189	180...162
Kick-down "2" 1-2	60...65	–	59...61	–	56...75	–

Note: All speeds stated are approximations

Key to symbols: ⇑ Upshift

⇓ Downshift

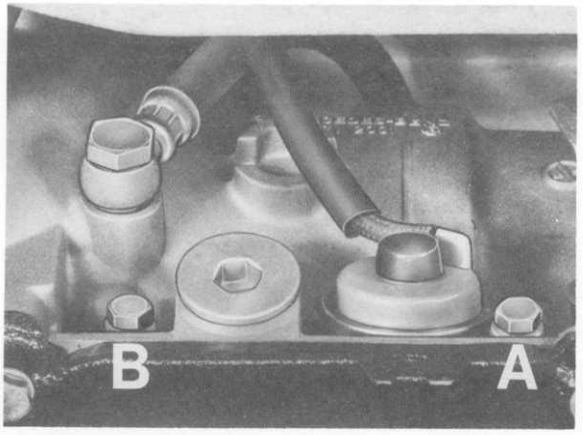
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E – Pressure Test

This pressure test will indicate any defects in the hydraulic control system.

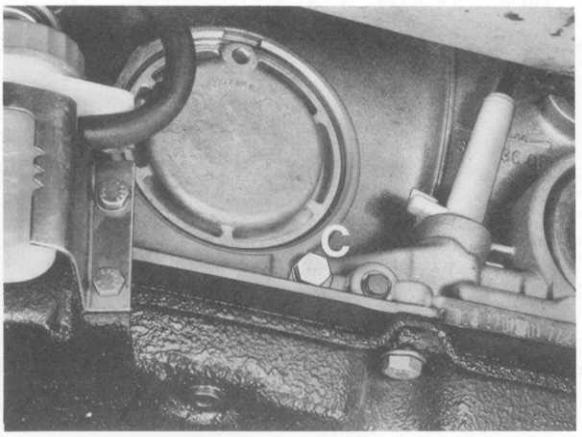
MEASURING NOMINAL PRESSURES

Automatic transmission is fitted with three measuring connections, so that the three most important pressures (modulating pressure, operating pressure, governor pressure) can be measured with help of a tester.



A – Modulating pressure

B – Governor pressure



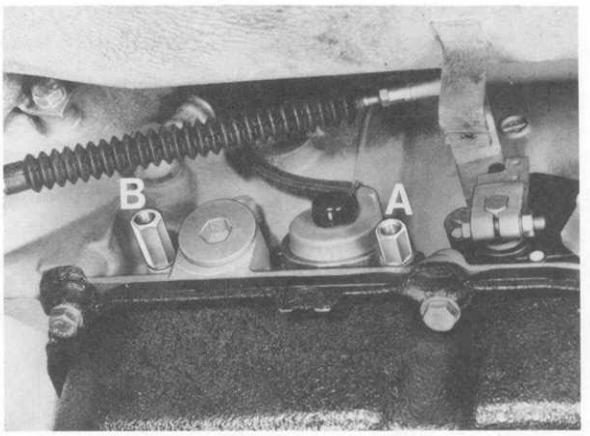
C – Operating pressure

A pressure tester with up to 25 bar pressure range is required for measuring the operating pressure. The 10 bar pressure tester is applied for modulating and governor pressure tests.

Pressure gauges are best connected, that they can be read by driver during a test drive (if a dynamometer is not available).

Tester is set up in footwell in front of front passenger's seat. Pressure gauges are connected to their measuring points by way of hoses, which are guided through window of right door. This requires disconnecting and pushing shield for rear muffler aside.

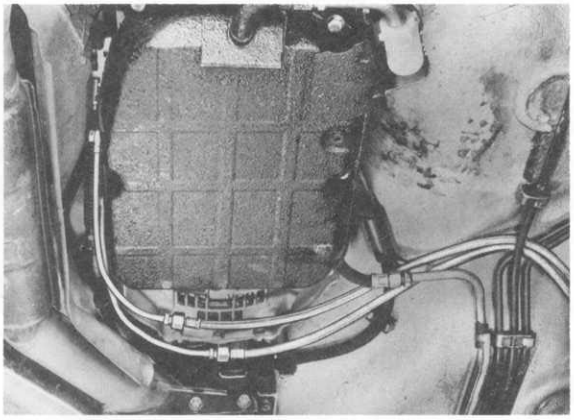
Screw in adapters for modulating pressure and governor pressure connections.



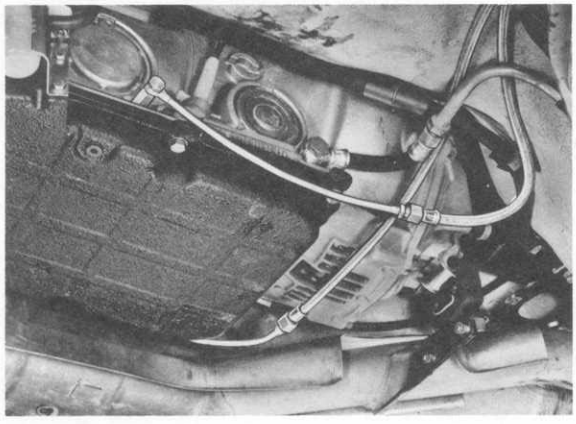
A – Short adapter for modulating pressure

B – Long adapter for governor pressure

Connections for modulating and governor pressures.



Connection for operating pressure.



Note:

Do not let hoses hang through too much or rest on the exhaust system.

Modulating pressure, measuring

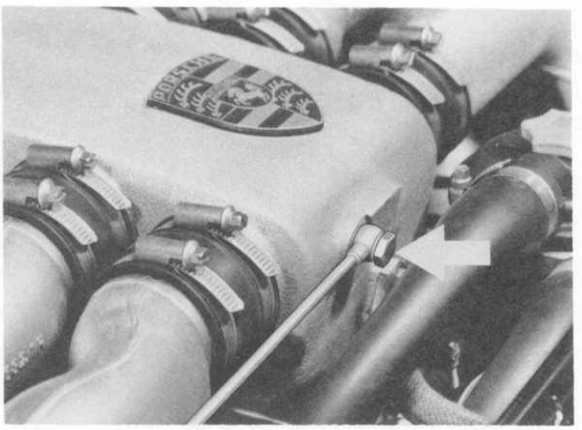
Note:

It is essential to measure the modulating pressure and reset if necessary, before testing any other pressures. When the modulating pressure is correctly set, the working pressure is produced of its own accord.

On the dynamometer or on the road, accelerate to approx. 140 km/h with the selector lever at "D" and check the reading on the pressure gauge (with vacuum line interrupted).

Note:

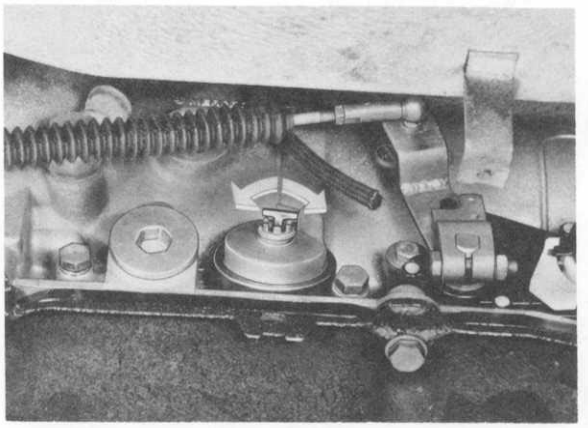
When working on K-Jetronic engines, disconnect the vacuum line from the intake manifold and plug socket with a suitable bolt (e.g. plug for test connection on transmission).



Modulating pressure, adjusting

1. Remove rubber cover from vacuum-control unit.

2. Pull the retainer out slightly and adjust the setting screw in the vacuum-control unit with the retainer.



Note:

One full turn of the setting screw changes the pressure by approx. 0.4 bar.

Clockwise:

Pressure is increased

Anti-clockwise:

Pressure is reduced

3. Lockplate must be pressed into nearest locking slot again after finishing adjustment.

4. Recheck after finishing adjustment.

Reference Information for Adjustments:

One turn of adjusting screw changes pressure by 0.4 bar.

Checking Operating Pressure

Not adjustable; modulating pressure automatically affects operating pressure.

Checking Governor Pressure

Note:

Always disconnect vacuum line to check governor pressure.

Governor pressure is part of operating pressure and is brought to the necessary value by the centrifugal governor.

Measuring Governor Pressure

Since governor pressure is derived from operating pressure, operating pressure must be checked simultaneously or previously.

Drive car on dynamometer or road and compare governor pressure with values specified in table.

If no or deviating governor pressure is measured, the governor must be disassembled, cleaned and repaired.

Control Pressure

Control pressure is part of modulating pressure. It is regulated mechanically depending on position of accelerator pedal.

If modulating pressure is adjusted correctly, the control pressure will automatically be correct.

SPECIFIED PRESSURES IN BAR UP TO '86 MODELS

Test pressure	Transmission type A 28.01/04/07	Transmission type A 28.02/03/ 05/06/08/09/11	Testing Conditions	
Modulating pressure*	4.4 ± 0.05	4.0 ± 0.05	ATF temperature approx. 80°C, selector lever at "D", speed approx. 140 km/h vacuum line disconnected from modulating pressure sensor	
Working pressure	16.9 ± 1	15.3 ± 1	ATF temperature approx. 80°C, selector lever at "D", engine idling, vacuum line disconnected from modulating pressure sensor	
Controller pressure	approx. 0.2 approx. 1.1 approx. 2.0 approx. 2.7	approx. 0.2 approx. 1.1 approx. 2.0 approx. 1.7	at 20 km/h at 50 km/h at 100 km/h at 150 km/h,	Selector lever at "D" car moving in partial-load range vacuum line disconnected from modulating pressure sensor

*Note.

If local conditions do not permit a test at approx. 140 km/h, measurements may also be taken at approx. 50 km/h.

Checking functioning

Nominal pressures in bar as from Model '87

Test pressure	Gearbox type A 28.12/14/16	A 28.18	Measuring conditions
Modulation pressure*	4.2 ± 0.05	4.4 ± 0.05	ATF temperature approx. 80°C, Selector lever in position D, driving speed approx. 140 km/h, Vacuum line disconnected at the modulating pressure cell
Working pressure	16.0 ± 1	15.8 ± 1	ATF temperature approx. 80 ° C, selector lever in position D, engine speed 1400 rpm, hand brake applied and servicebrake actuated, Test no longer than 5 seconds. Vacuum line disconnected at the modulating pressure cell

Controller pressure	A 28.14/16	A 28.12	A 28.18		
	approx. 0.2	0.17	0.45	at 20 km/h	Selector level in position D
	approx. 1.1	0.96	1.40	at 50 km/h	Vehicle moving in partial-load range
	approx. 2.0	1.74	2.15	at 100 km/h	Vacuum line disconnected at the
	approx. 2.7	2.35	3.10	at 150 km/h,	modulating prssure cell

*** Note**

If the local conditions do not permit testing at approx. 140 km/h, measurements are still possible at approx. 50 km/h.

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TROUBLESHOOTING AUTOMATIC TRANSMISSION

Note: If transmission oil is black and smells burnt or there is an unusual large amount of metal particles in oil pan, either repair or replace transmission.

Condition:

Transmission slips in all selector lever positions.

Cause/Correction:

1. Check modulating pressure, adjusting if necessary. If not adjustable, check movement of modulating pressure control valve.

2. Check whether vacuum line from intake branch to vacuum box is plugged. If yes, replace.

3. Check operating pressure. If too low or not available:

   a) Disassemble and clean shift valve housing and service valve. Replace shift valve housing if necessary.

   b) Remove and inspect primary pump, replacing if necessary.

Condition:

2nd gear slips or transmission shifts from 1st to 3rd gear.

Cause/Correction:

1. Check movement of control valve B 1, replacing shift valve housing if necessary.

2. Remove and install brake band B 1 piston and check seal, replacing if necessary.

3. Replace brake band B 1 and pressure element for B 1.

Condition:

Transmission slips when moving off in 1st and 2nd gear, or moving off not possible in forward gear. Reverse gear is still good.

Cause/Correction:

1. Service shift valve B 2, replacing shift valve housing if necessary.
2. Replace brake band B 2 piston.
3. Adjust brake band B 2 by installing a longer thrust pin. Replace brake band in case or excessive wear or broken brake band.

Condition:

Transmission slips during 2nd/3rd shift, or slips at first and then grabs hard.

Cause/Correction:

1. Check modulating pressure, adjusting if necessary.
2. Check whether temperature orifice is installed (see removing and installing lower cover on page 38 - 131).
3. Replace shift valve housing.
4. Replace inner plates of clutch K 1. Repair clutch depending on findings.

Condition:

Transmission slips during 3rd/4th shift.

Cause/Correction:

1. Check modulating pressure, adjusting if necessary.
2. Replace shift valve housing.
3. Replace inner plates of clutch K 2. Repair clutch depending on findings.

Condition:

After installation, transmission has no power flow or fails after a brief time of operation.

Cause/Correction:

Torque converter not installed according to instructions.
Drive dogs do not engage accurately in drive gear of primary pump.

Follow-up damage: Torque converter drive dogs and primary pump will be destroyed.

Replace primary pump and, if necessary, torque converter.

Condition:

No power flow in all selector lever positions for a brief period immediately after starting engine (especially when car had not been used for a while).

Cause/Correction:

Torque converter drains partially via leaky or defective lubricating ring on drive shaft or via leaky lubricating valve in shift valve housing.

1. Check lubricating ring on drive shaft, replacing if necessary.

2. Check and clean lubricating valve in shift valve housing.

Condition:

No power flow in reverse gear.

Cause/Correction:

1. Check lined plates and seals on piston of brake band 3, replacing if necessary.

2. Replace one-way clutch in gear set.

Condition:

Strong jolt when engaging selector lever in "D" and "R".

Cause/Correction:

1. Adjust idle speed and CO level to specifications.
2. Check modulating pressure, correcting if necessary.
3. Check whether spring is installed underneath valve ball (5) in shift valve housing (see page 38 - 126).
4. Check vacuum line and connections for leaks.
5. Check whether pressure acceptance piston in shift valve housing moves easily and is in correct installed position, replacing shift valve housing if necessary.

Note: If there is a hard engagement jolt when quickly shifting back and forth between "N" and "D" several times, there is no fault. The pressure pick-up requires a running time of approx. 2 seconds. If this time is given, the engagement jolt will also be correct.

Condition:

Strong jolts when changing gears.

Cause/Correction:

1. Check modulating pressure, adjusting if necessary.
2. Check vacuum line and connections for leaks.

Condition:

Strong jolt in downshift from 4th to 3rd gear.

Cause/Correction:

1. Replace seal on release end of B 2.
2. Replace brake band piston B 2.
3. Pressure element of B 2 has turned; replace pressure element.

Condition:

Jolts when shifting in partial load range.

Cause/Correction:

1. Check adjustment of control pressure cable.
2. Check modulating pressure, adjusting if necessary.
3. Check vacuum line and connections for leaks.

Condition:

Shaking during upshifts.

Cause/Correction:

Check whether screen restrictor with spring is installed (see page 38 - 126).

Condition:

No upshifts.

Cause/Correction:

1. Check governor pressure. If there is no governor pressure reading, continue with point 2. If governor pressure is correct, continue with point 3.

2. Clean and service centrifugal governor.

3. Disassemble and clean shift valve housing, replacing if necessary.

Condition:

Upshifts only in upper speed range of gears.

Cause/Correction:

1. Check and adjust control pressure cable.

2. Check governor pressure and replace centrifugal governor, if governor pressure is too low.

3. Service control pressure valve.

Condition:

Upshifts only in lower speed range of gears.

Cause/Correction:

1. Check whether control pressure cable is disconnected or torn, and then adjust accurately.

2. Check full throttle stop. Move accelerator pedal from full throttle and check whether throttle is against full throttle stop, adjusting if necessary.

3. Check governor pressure and replace centrifugal governor, if governor pressure is too high.

Fault:

No kickdown from 3rd to 2nd
shifting points in partial load range too low

Cause/remedy
check gas and control pressure cable settings

Fault:

No kickdown downshifts

Cause/remedy:

1.Check fuse for power supply to solenoid valve.

2.Remove solenoid valve. With valve removed, connect to power supply and check operation. Fit replacement if necessary.

3.Check that control pressure cable is not disconnected, broken or maladjusted.

4.Check that kickdown control slide moves freely in housing, install replacement housing if necessary.

Fault:

No brake shifts (4-3 and 3-2)

Cause/remedy:

1.Adjust control pressure cable.

2.Check vacuum lines and connections for leaks.

3.Release brake shift plunger, if necessary separate shift slider housing.

Condition:

Automatic, unwanted downshifts outside of partial throttle downshift range, without operation of kickdown switch.

Cause/Correction:

1. Remove kickdown solenoid valve.
   Check O-ring on solenoid valve for damage.

2. Check whether kickdown switch sticks in pressed position, replacing if necessary.

3. Check whether solenoid valve sticks in open position, replacing if necessary.

Condition:

Poor acceleration when moving off.

Cause/Correction:

1. Check stall speed.

2. If stall speed drops below specified value by approx. 400 to 700 rpm, one-way clutch in converter is slipping. Replace torque converter.

Condition:

Selector lever cannot be engaged in "R" and "P".

Cause/Correction:

a) With engine running
b) With engine stopped

1. a) Clean and service centrifugal governor.

2. b) Service blocking piston in lower cover.

Condition:

Engine cannot be started with selector lever in "P" and "N".

Cause/Correction:

1. Adjust selector lever cable and starter interlock switch.

2. Replace starter interlock switch.

Condition:

1st and reverse gears too loud.

Cause/Correction:

1. Replace front gear set depending on findings.

Note:
First and reverse gears are louder than the other gears because of the ratio. A different car should be used for comparison.

Condition:

3rd gear too loud.

Cause/Correction:

1. Replace rear planet gear set.

Condition:

Whining noise only when changing gears with full load.

Cause/Correction:

1. Replace oil filter.

Condition:

Whining noise, which increases in loudness as engine speed rises.

Cause/Correction:

1. Check primary pump, replacing if necessary.

Condition:

Invisible oil loss (leak cannot be seen on outside) in conjunction with smoke in exhaust.

Cause/Correction:

Diaphragm in vacuum box is defective. ATF drawn in by engine via vacuum line.

1. Replace vacuum box.

Condition:

Oil lost between torque converter and primary pump (oil escaping through vent grid).

Cause/Correction:

1. Install oil drain plug on torque converter with a new seal as well as Hylomar on threads, and tighten. If still leaking, continue with point 2.

2. Replace radial oil seal and O-ring of primary pump, inspecting O-ring groove in primary pump for porous spots. Replace primary pump, if necessary.

Condition:

Rattling noise at engine speed of 1500 rpm in all selector lever positions, except "R".

Cause/Correction:

Plates of reverse gear brake swinging in transmission case.

1. Replace inner plates of reverse gear brake B 3;
   adjust play to smallest value.

Condition:

Light grinding noise in selector lever positions "P" and "N".

Cause/Correction:

This noise concerns a normal rolling noise from the front gear set, which cannot be eliminated.

Condition:

Chattering noise when driving in reverse gear.

Cause/Correction:

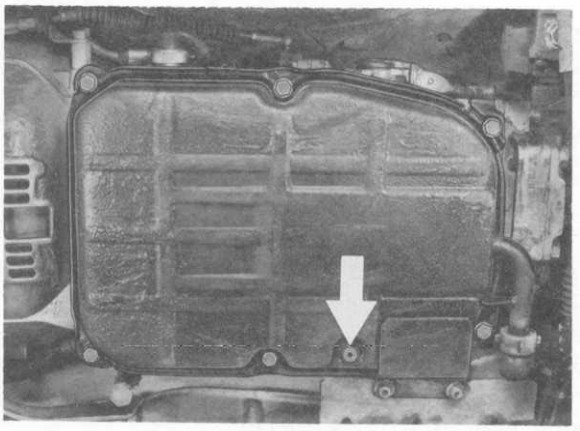
Play of plate brake B 2 excessive. Outer plate carrier of K 1 scraping on piston of B 3.

1. Adjust play to specified value (1.5 to 2 mm).

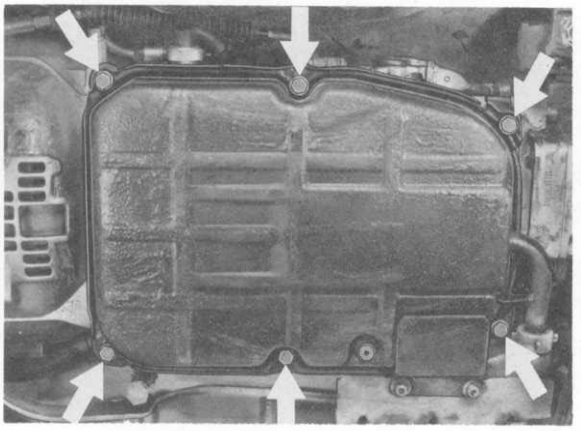
REMOVING AND INSTALLING SHIFT VALVE CASING

Removing

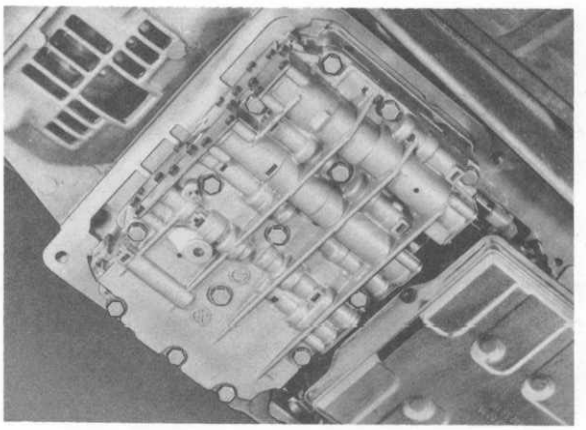
1.Remove drain plug and drain ATF.



2.Remove ATF pan by disconnecting breather holes for ATF reservoir and removing mounting bolts.

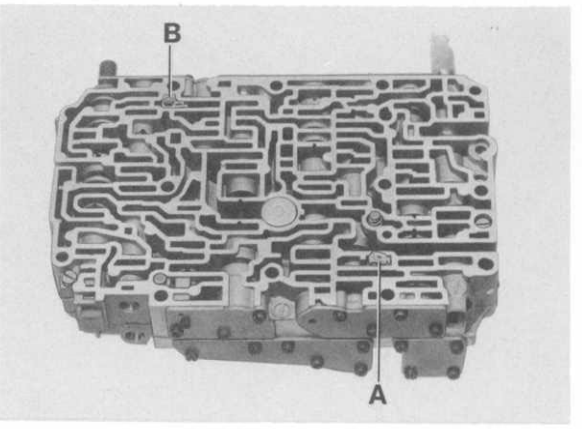


3.Unscrew mounting bolts and remove shift valve casing.



Installing

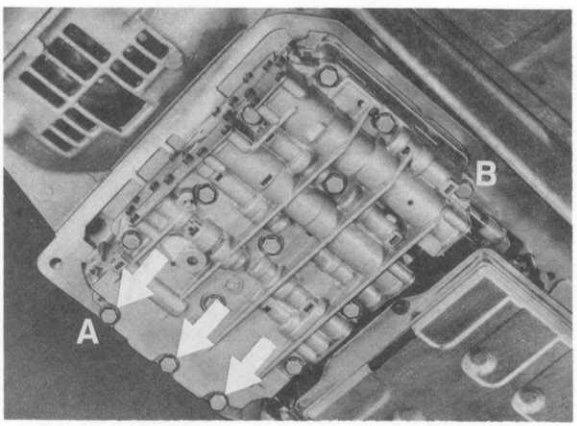
1.Ensure that plastic poppet valve and chip screen for shift valve B 2 are correctly seated.



A - Plastic valve
B - Chip screen (use in series production as of Nov. '85, transmission No. 729 001)

2.Place shift valve casing in position, range selector valve must engage carrier.

3.Insert mounting bolts and tighten. Tightening torque: 8 Nm (5.9 ftlb).



Note:

Center shift valve casing by first tightening the two bolts A/B slightly.

The three bolts marked with arrows are 50 mm in length, the remainder are 55 mm long.

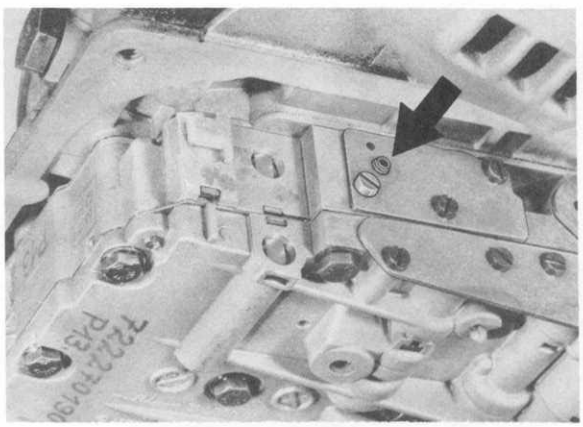
4.Install ATF pan with gasket and tighten mounting bolts. Tightening torque: 8 Nm (5.9 ftlb).

5.Screw in drain plug with new sealing ring and tighten. Tightening torque 14 Nm (8 ftlb)

6.Top up ATF.

Note:

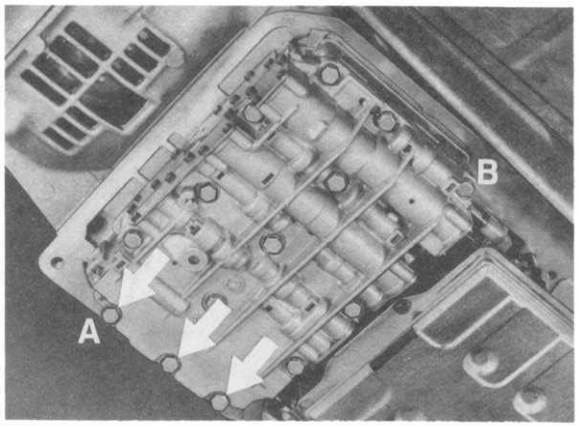
The full-throttle control pressure can be changed by turning the socket-head bolt (arrowed). Turning the bolt clockwise makes the full load or kick-down upshifts earlier. Turning the bolt anticlockwise makes the upshifts later.



7.Check setting of control-pressure cable and readjust if necessary.

2.Place shift valve casing in position, range selector valve must engage carrier.

3.Insert mounting bolts and tighten. Tightening torque: 8 Nm (5.9 ftlb).



Note:

Center shift valve casing by first tightening the two bolts A/B slightly.

The three bolts marked with arrows are 50 mm in length, the remainder are 55 mm long.

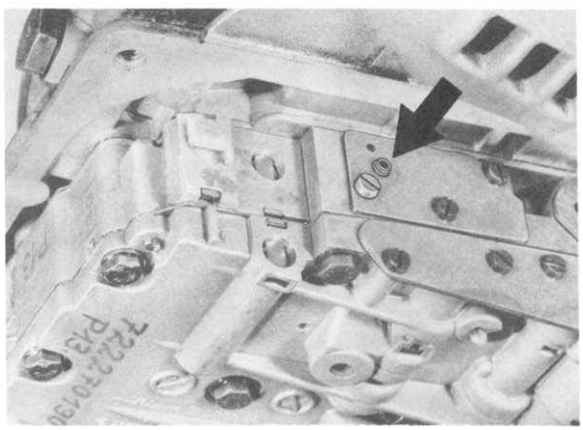
4.Install ATF pan with gasket and tighten mounting bolts. Tightening torque: 8 Nm (5.9 ftlb).

5.Screw in drain plug with new sealing ring and tighten. Tightening torque 14 Nm (8 ftlb)

6.Top up ATF.

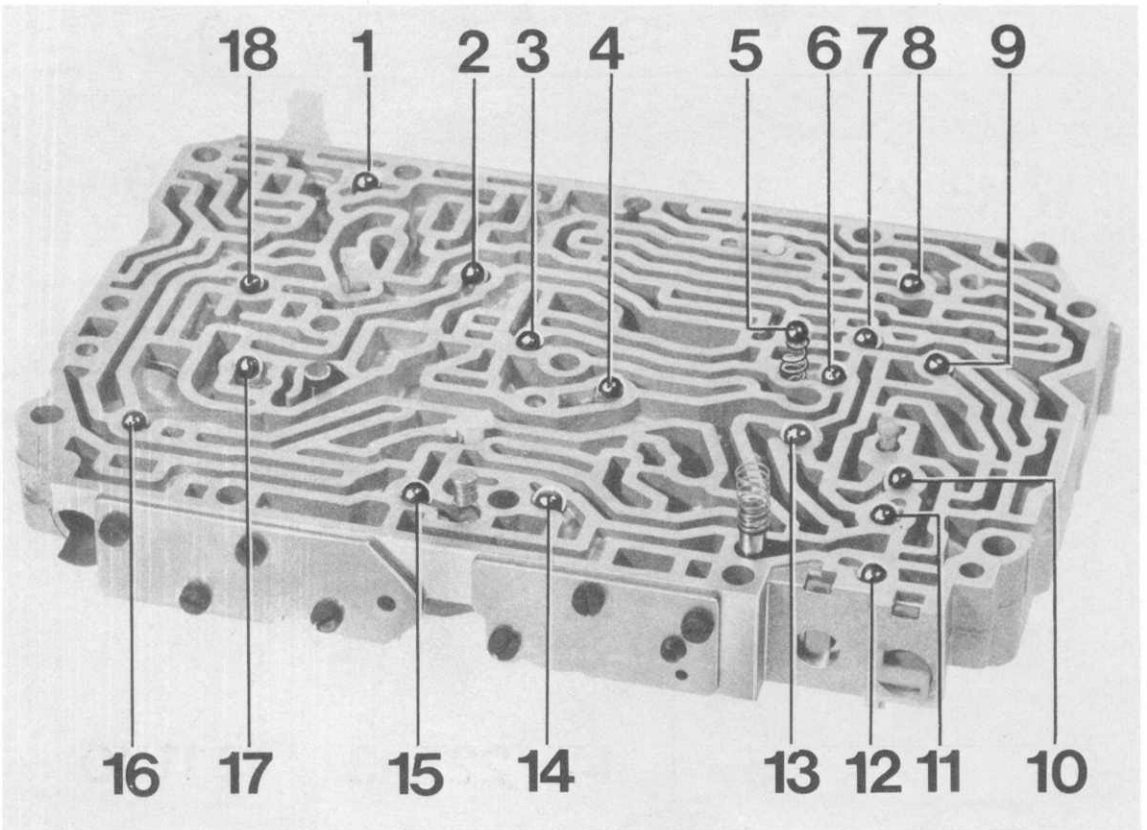
Note:

The full-throttle control pressure can be changed by turning the socket-head bolt (arrowed). Turning the bolt clockwise makes the full load or kick-down upshifts earlier. Turning the bolt anticlockwise makes the upshifts later.

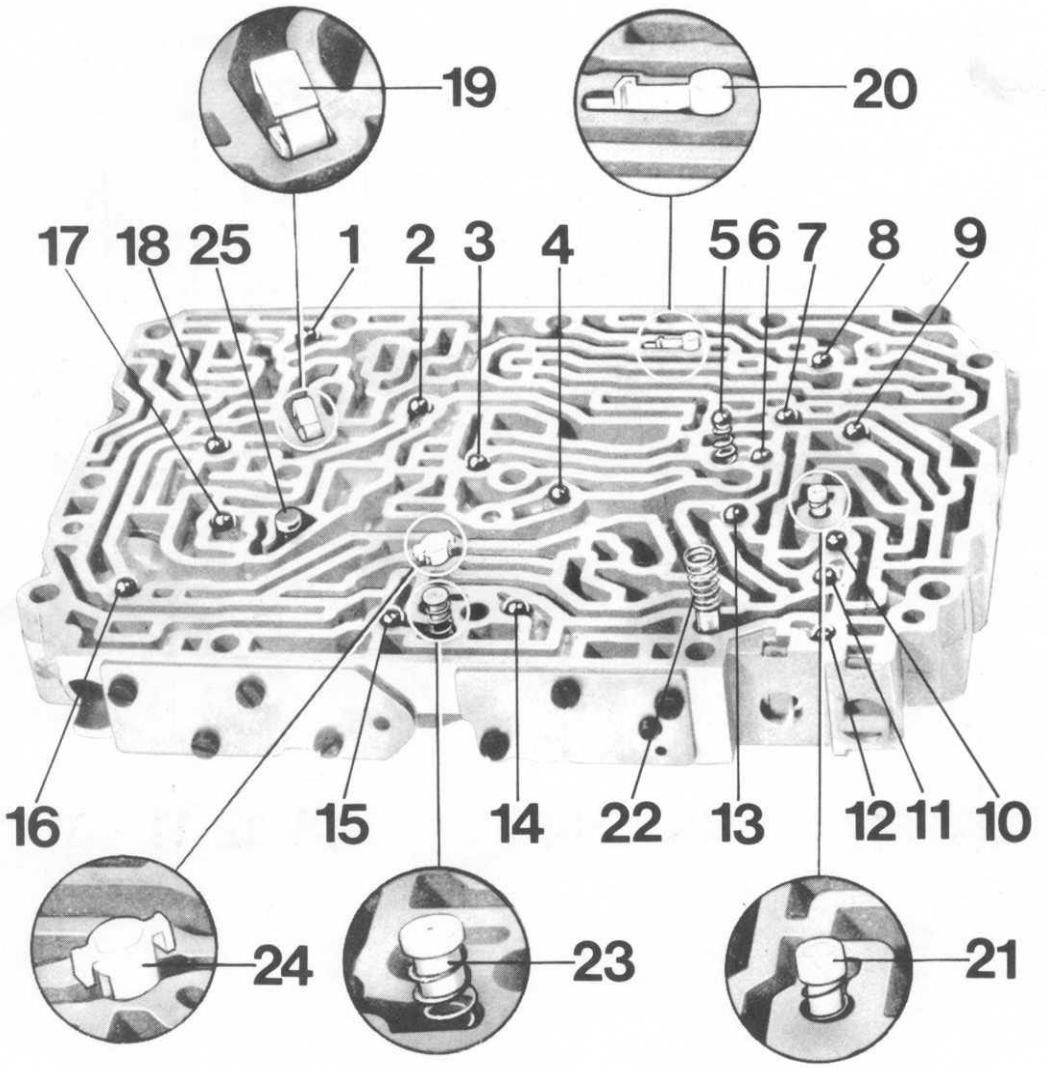


7.Check setting of control-pressure cable and readjust if necessary.

DISASSEMBLING AND ASSEMBLING SHIFT VALVE HOUSING



DISASSEMBLING AND ASSEMBLING SHIFT VALVE HOUSING



No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1–18	Valve ball (5.5 mm dia.)	18		Install conical spring with large diameter end facing down underneath ball no. 5	
19	Plastic valve (light without bore)	1		Install in correct position, do not mix up with valve without bore	
20	Throttle check valve	1			
21	Check valve	1		Install with spring	
22	Lubricating pressure operating pin	1		Install with spring	
23	Orifice	1		Install with spring	
24	Valve	1			
25	Operating pin	1	Unlosable		

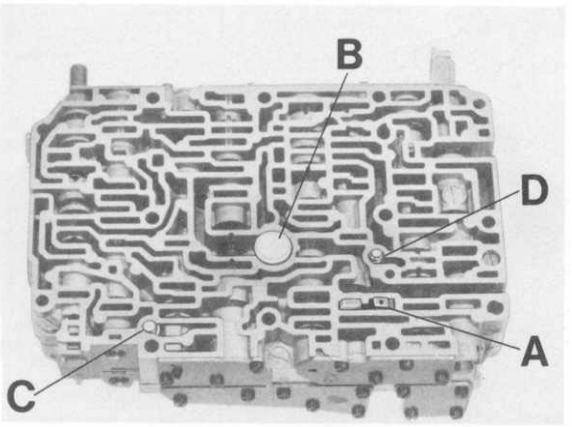
DISASSEMBLING AND ASSEMBLING SHIFT VALVE HOUSING

Disassembling

Note:

Absolute cleanliness is essential for any work on the shift valve housing. If at all possible work should be done on a plastic lined work-bench (leather sheets would be especially suitable). After disassembling all parts must be washed and dried with compressed air.

1. Remove plastic valve.



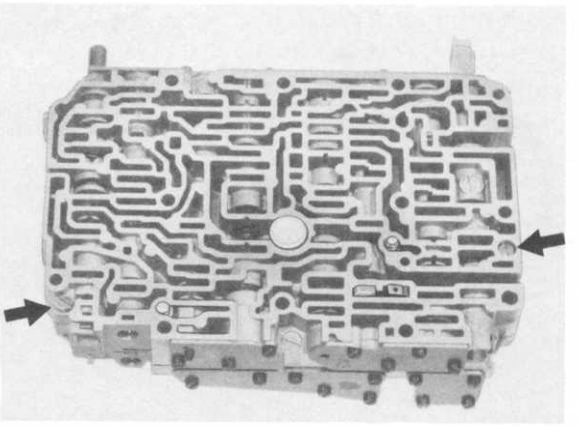
A = Plastic valve

B = Check valve

C = Operating pin

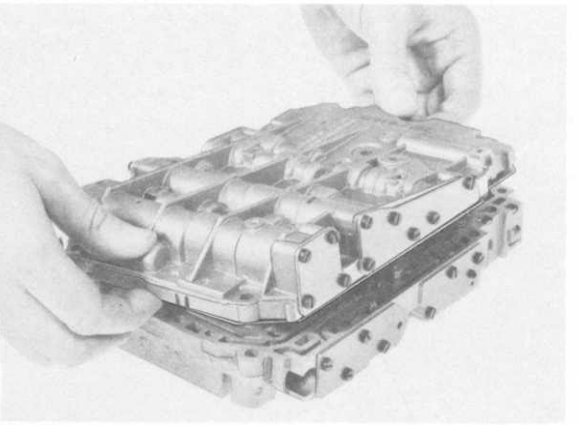
D = Blocking valve K 1

2. Remove both mounting bolts (arrow).



3. Hold and turn shift valve housing and pick-up housing around.

4. Lift off pick-up housing with transfer plate carefully.

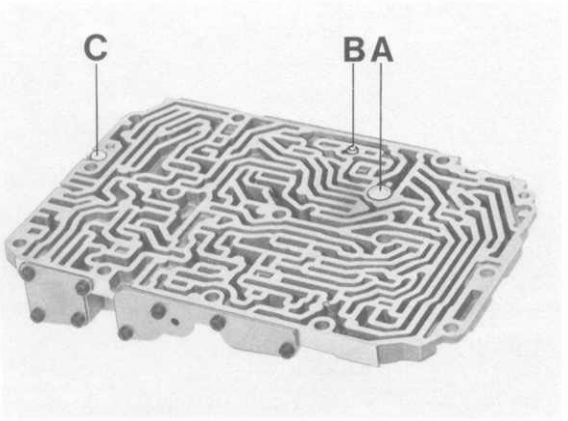


5. Take out all valves and balls.

Assembling

1. Place all balls and valves in shift valve housing (see layout drawing).

2. Install lubricating valve, modulating pressure valve and vent valve K 1 in pick-up housing.

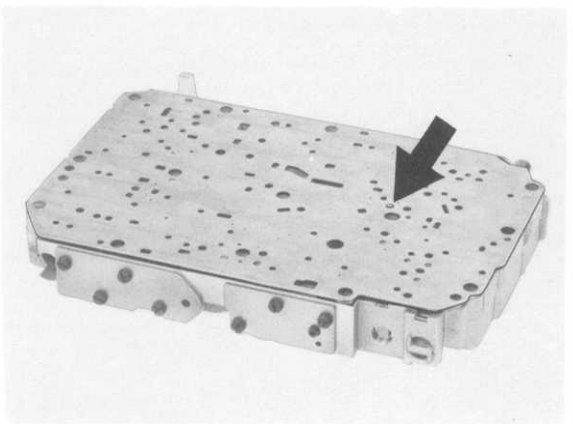


A = Lubricating valve (unlosable)

B = Modulating pressure valve (unlosable)

C = Vent valve (unlosable)

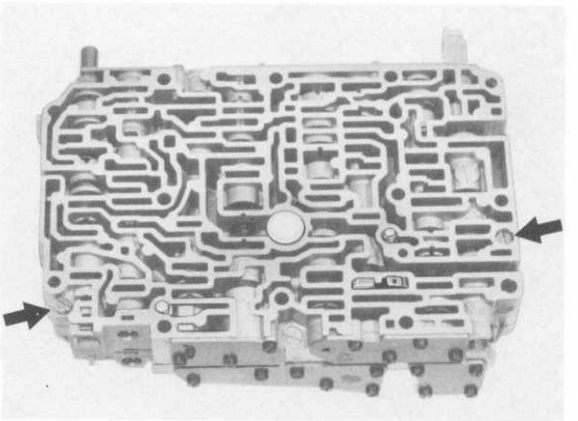
3. Place transfer plate on shift valve housing carefully and check whether valve ball (arrow) is in correct installed position.



4. Place pick-up housing on shift valve housing.

5. Hold shift valve housing and pick-up housing together and turn both around.

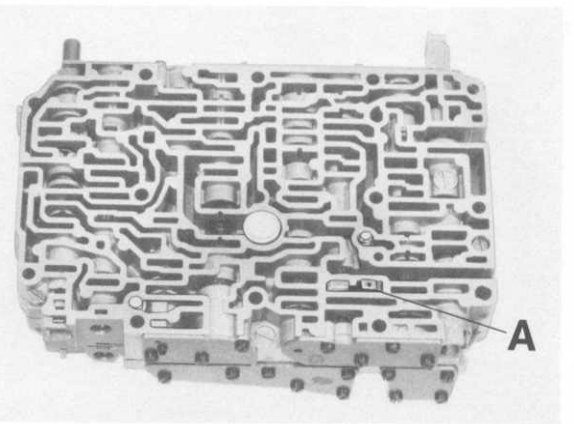
6. Screw in both bolts, but do not tighten.



Note:

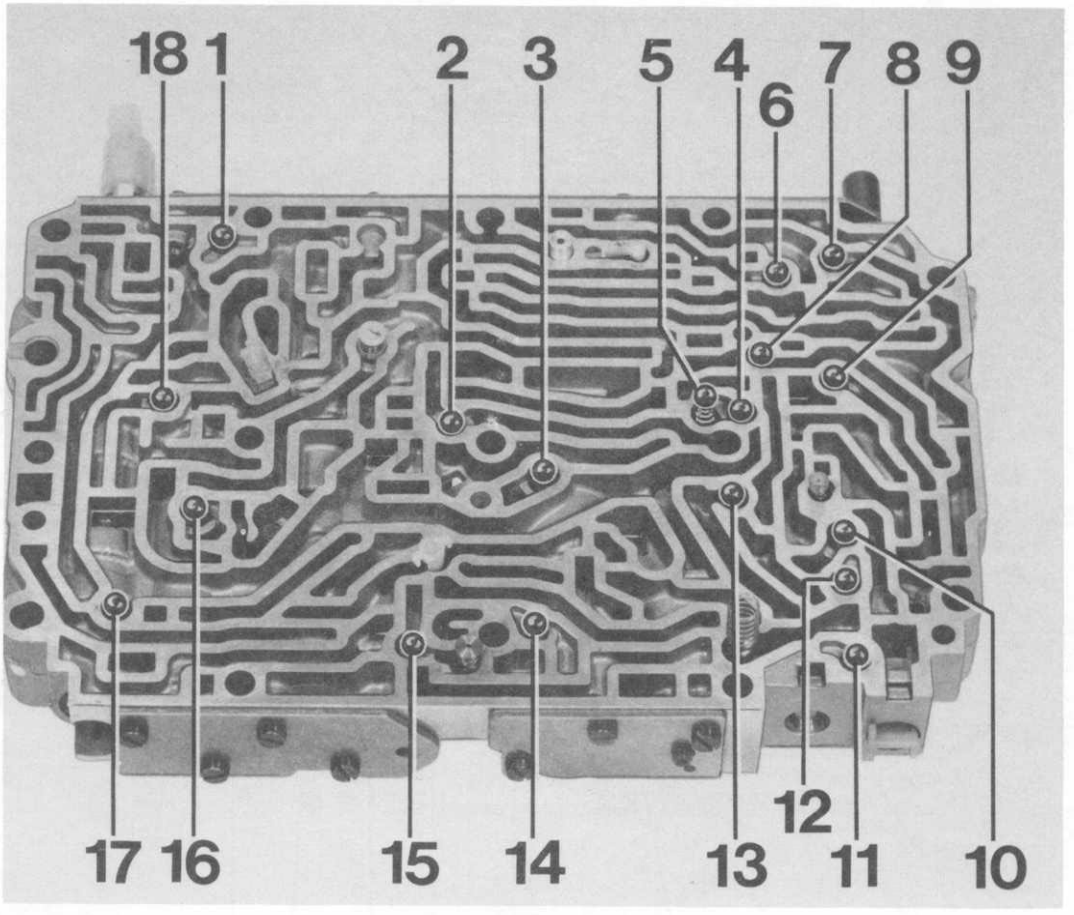
Tighten bolts only enough that both housings can still be moved to align them.

7. Install plastic valve (green) in housing that bore is in correct position.

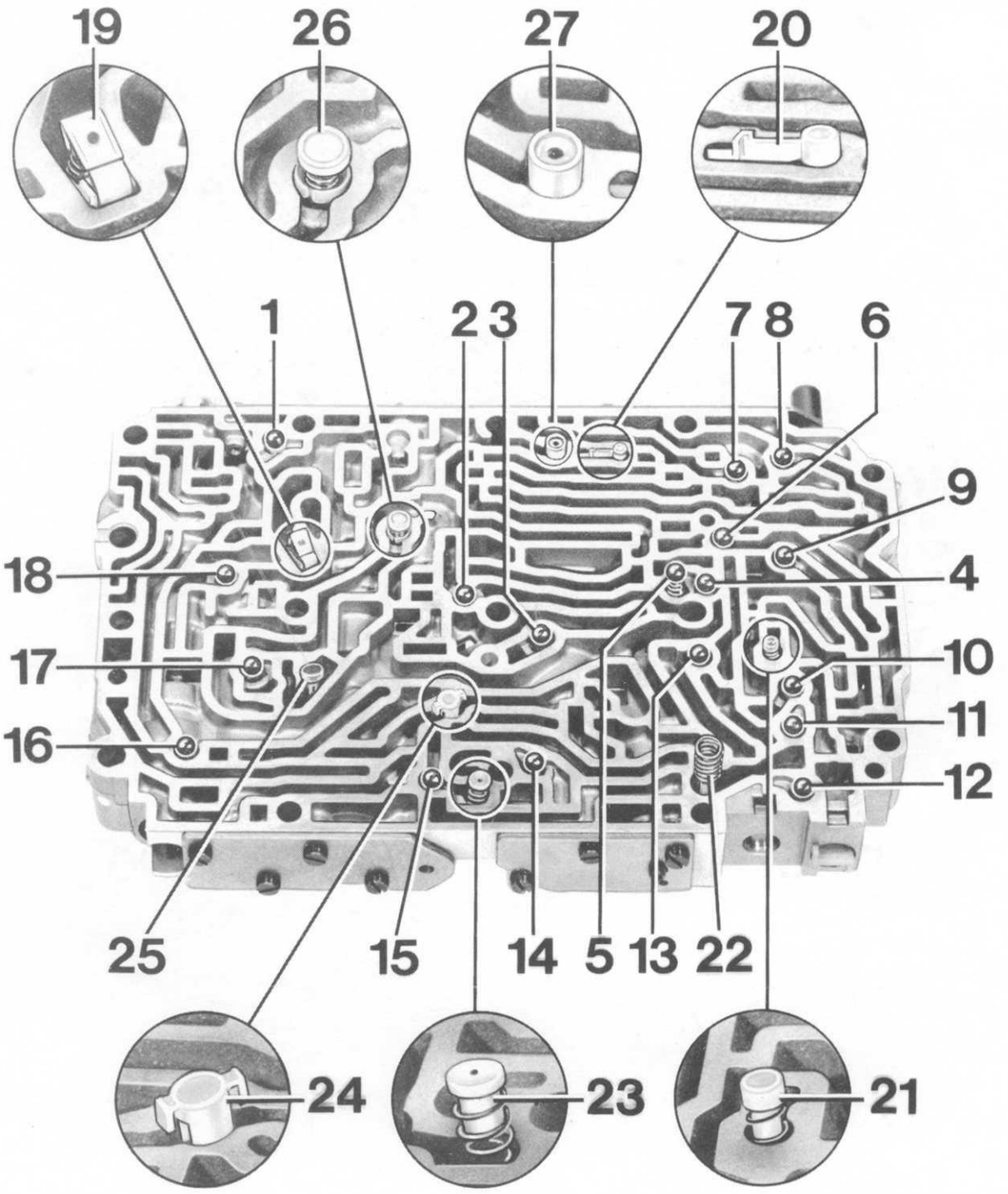


A = Plastic valve

DISASSEMBLING AND ASSEMBLING SHIFT VALVE CASING ('87 MODELS ONWARD)



DISASSEMBLING AND ASSEMBLING SHIFT VALVE CASING ('87 MODELS ONWARD)



No.	Designation	Qty.	Note When: Removing	Installing
1... 18	Valve ball (dia. 5.5 mm)	18		Insert taper spring with large diameter downward beneath ball No. 5.
19	Plastic valve (light, without bore)	1		Insert right way round, do not mix up with valve with bore
20	Throttle check valve	1		
21	Check valve	1		Install with spring
22	Shift pin, lubricating pressure	1		Install with spring
23	Throttle	1		Install with spring
24	Valve	1		
25	Shift pin	1	Captive	
26	Valve	1		
27	Throttle* (with spring)	1		Install with spring

* At the start of series production the throttle was installed in some cases and was later discontinued without replacement.

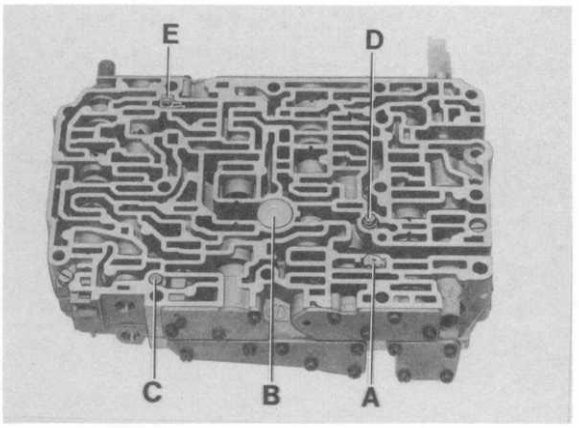
NOTES FOR DISASSEMBLY AND ASSEMBLY

Disassembling

Note:

It is essential to maintain absolute cleanliness during all work on the shift valve casing. If possible, spread a plastic sheet on the workbench beneath the parts (moleskin cloths are particularly suitable). After disassembly, wash all parts and blow through with compressed air.

1. Remove plastic valve and chip screen.



A - Plastic valve

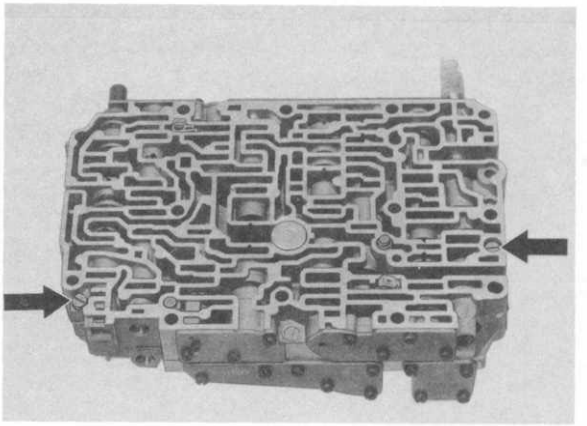
B - Check valve

C - Shift pin

D - Lock valve K 1

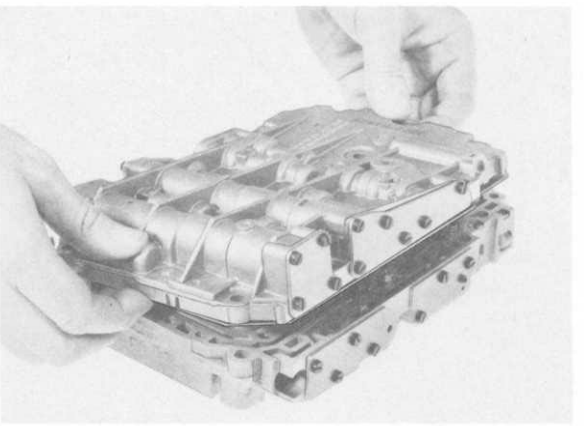
E - Chip screen

2. Remove both mounting screws (arrowed).



3. Hold shift valve casing and sensor housing together and turn over.

4. Carefully lift off sensor housing with back plate

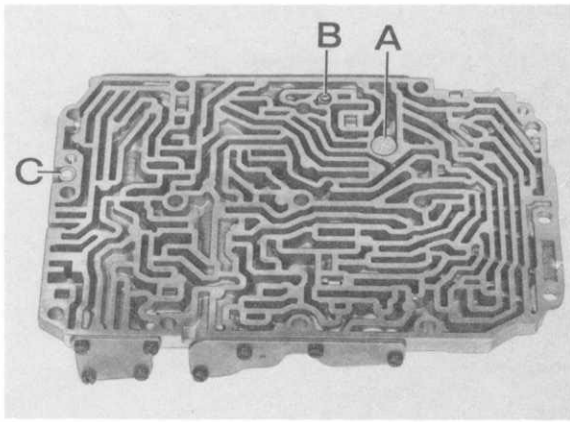


5. Remove all valves and balls.

Assembling

1. Place all valve balls and valves in shift valve casing (see exploded drawing).

2. Install lubricating-pressure valve, overpressure modulating valve and bleed valve K1 in sensor housing.

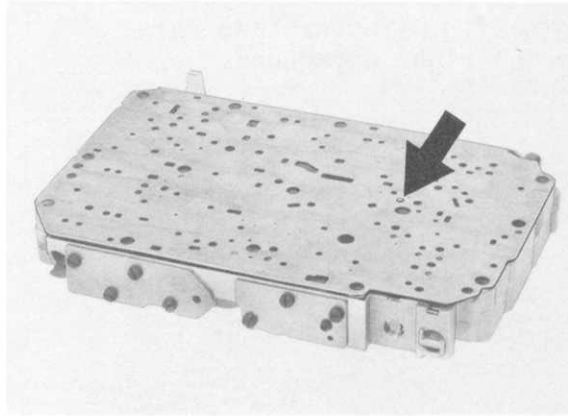


A = Lubricating pressure valve (captive)

B = Overpressure modulating valve (captive)

C = Bleed valve (captive)

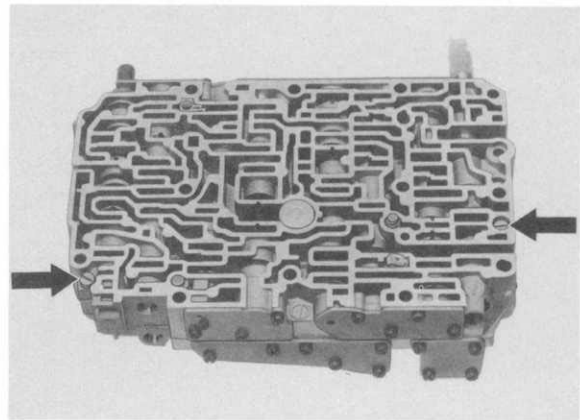
3. Carefully place back plate on shift valve casing and check that valve ball (arrowed) is in its installation position.



4. Place sensor housing on shift valve casing.

5. Hold shift valve casing and sensor housing together and turn over.

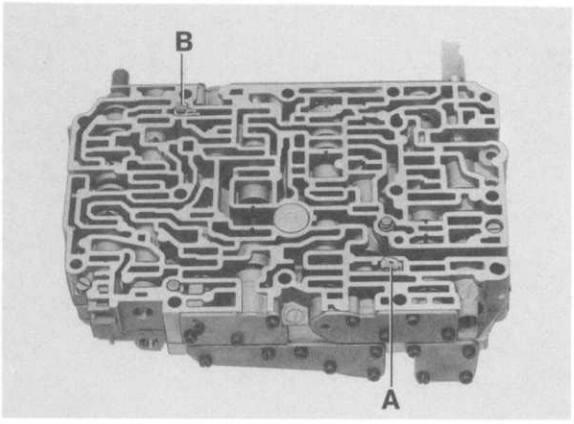
6. Insert both screws (do not tighten).



Note:

Tighten screws so that housing and casing can still be moved against each other.

7. Insert plastic valve (yellow) in casing with bore and chip screen right way round.



A = Plastic valve
B = Chip screen

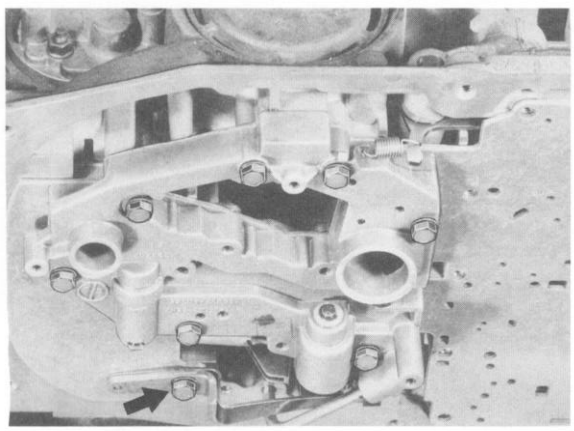
REMOVING AND INSTALLING LOWER COVER

Removing

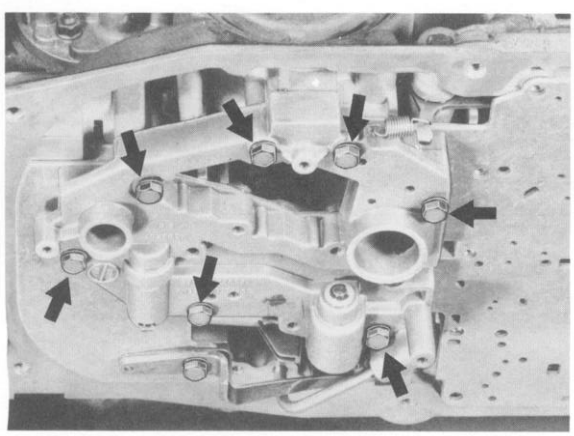
1. Remove shift valve housing.

2. Remove ATF filter.

3. Remove holder and leaf spring.

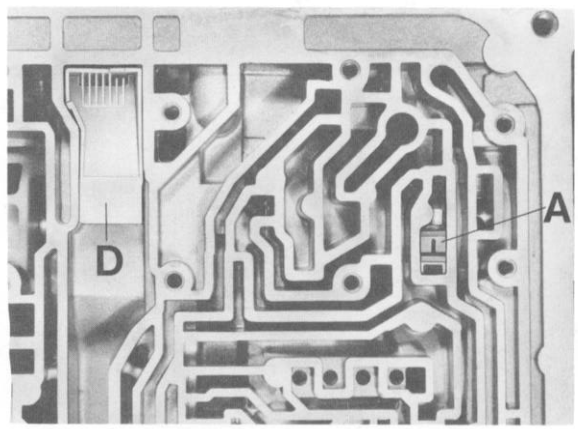


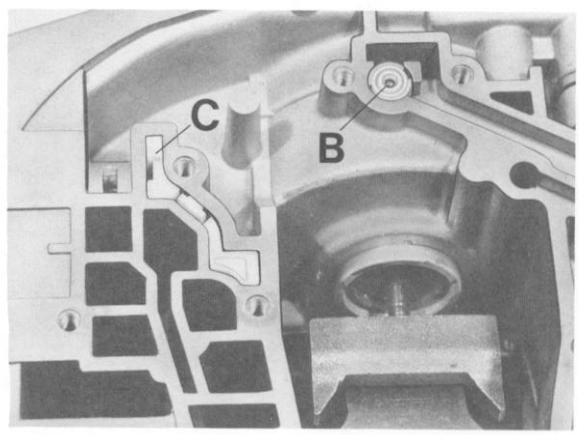
4. Remove combination bolts and take off cover with oil tube.



Installing

1. Check for proper seating of temperature orifice, plastic valve, filler and oil deflector.





A = Temperature orifice

B = Plastic valve

C = Filler

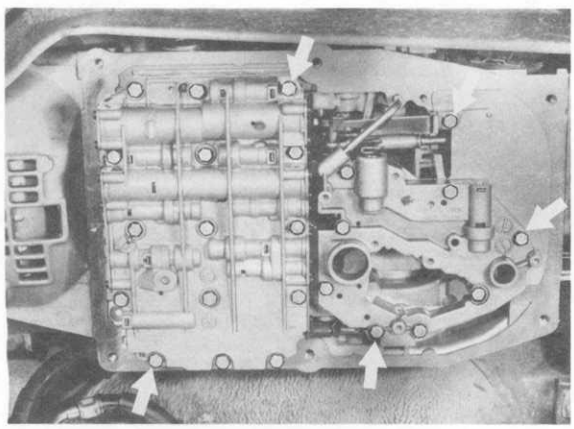
D = Oil deflector

2. Mount lower cover, guiding oil tube into bore.

3. Install combination bolts, but do not tighten (tighten bolts with 8 Nm/6 ftlb only after installing the shift valve housing).

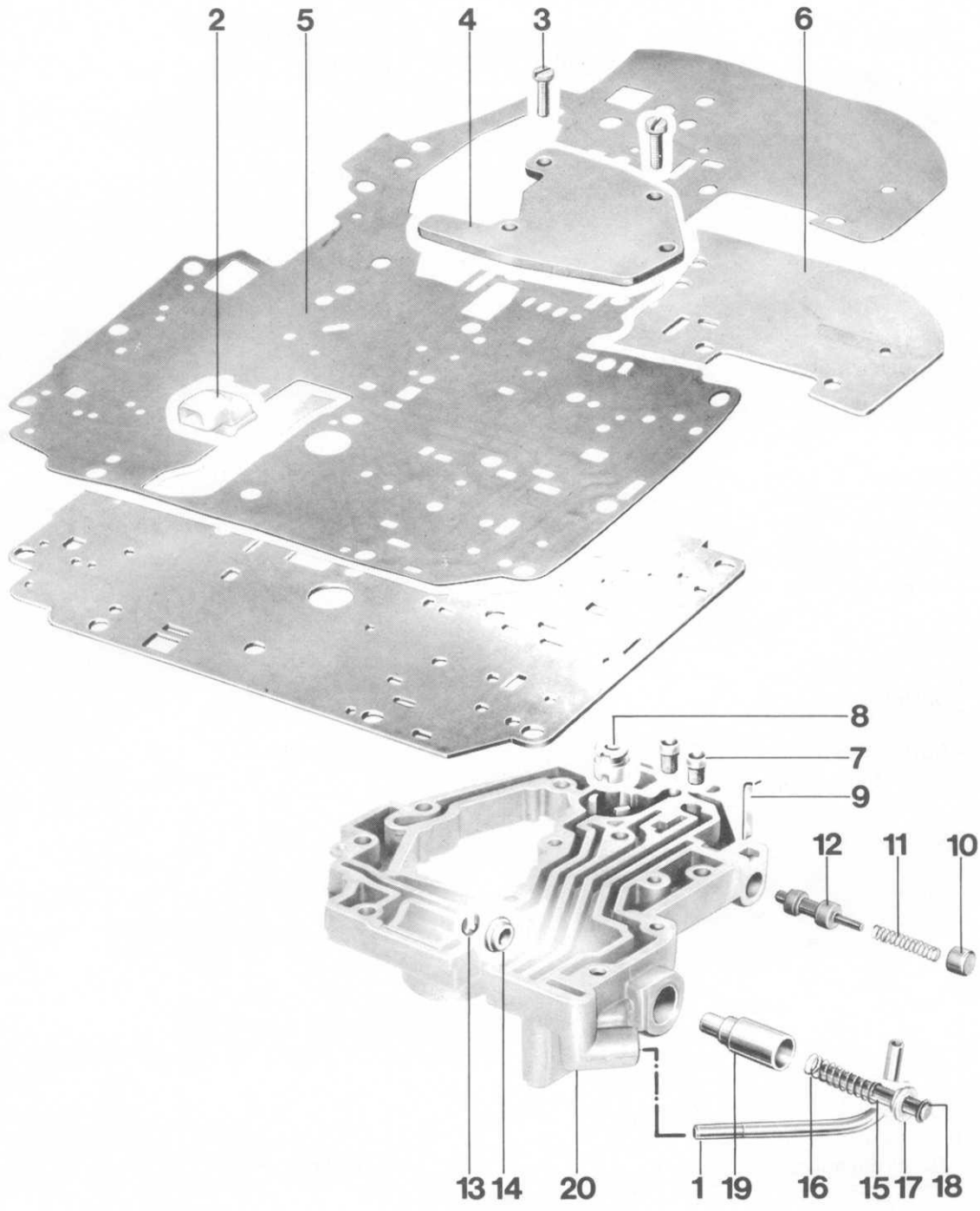
4. Mount leaf spring with holder and install bolt but do not tighten (tighten bolt with 8 Nm/6 ftlb only after installing the shift valve housing).

5. Install shift valve housing and tighten combination bolts with 8 Nm/6 ftlb (including bolts on lower cover).



6. Install ATF filter and tighten phillips screws with 4 Nm/3 ftlb.

DISASSEMBLING AND ASSEMBLING LOWER COVER



No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Oil tube	1			
2	Injector	1	Squeeze tabs together and remove	Install in correct position	
3	Bolt	4		Torque: 8 Nm/6 ftlb	
4	Cover	1			
5	Gasket	1		Replace, if necessary	
6	Transfer plate	1			
7	Filter screen	2			
8	Valve	1		Position correctly, check for tight fit	
9	Holder	1		Position correctly	
10	Plug	1			
11	Spring	1			
12	Shift valve secondary pump	1		Install with ATF	
13	Circlip	1			
14	Sleeve	1			
15	Shaft	1			
16	Spring	1			
17	Sleeve	1			
18	Circlip	1			
19	Blocking valve	1		Coat with ATF	
20	Housing	1			

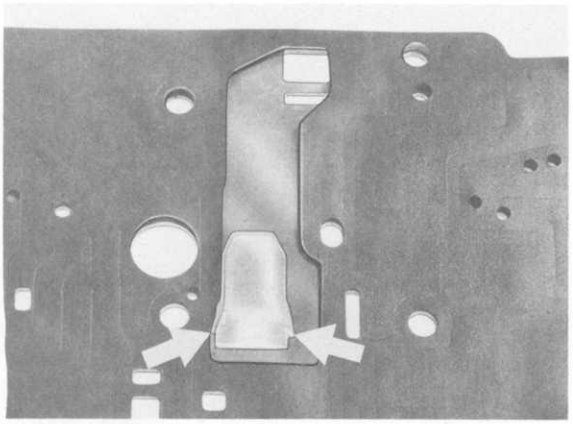
DISASSEMBLING AND ASSEMBLING LOWER COVER

Note:

Absolute cleanliness is essential for any work on shift valve housing and lower cover.
Work should be performed with a plastic liner on the workbench whenever possible. Never use cloths losing lint.

Disassembling

1. Squeeze both tabs together and remove injector.

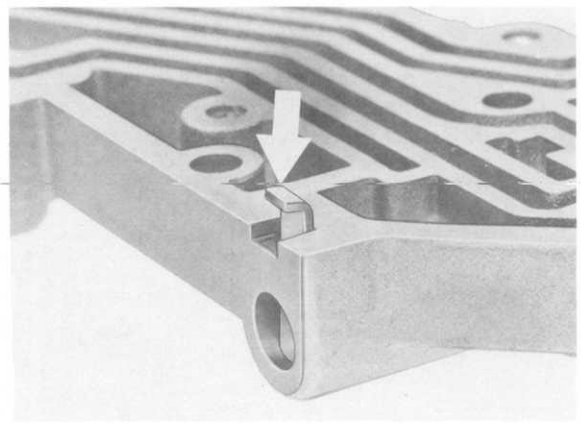


2. Remove filter screens and valve.

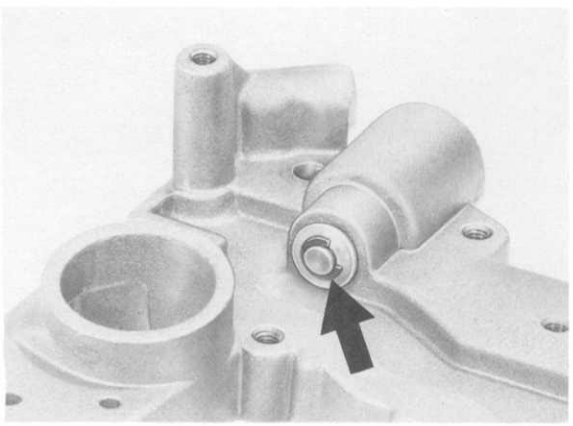
3. Take off circlip. Remove blocking valve with spring and shaft.

Assembling

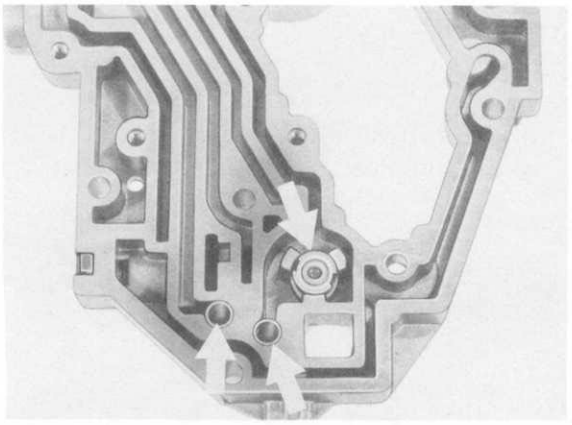
1. Install shift valve secondary pump with spring and plug, and secure with holder.



2. Insert blocking valve with spring and shaft, and install circlip.



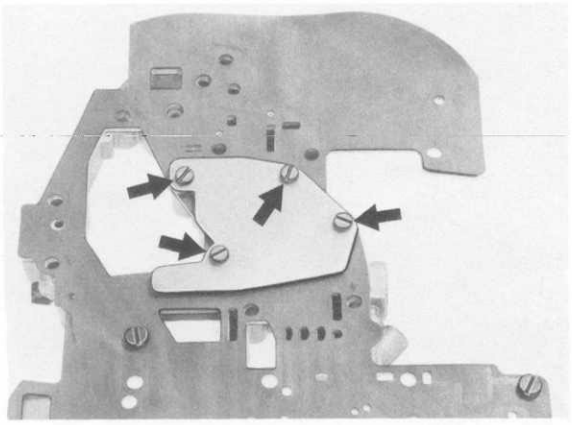
3. Install valve and filter screens in correct position.



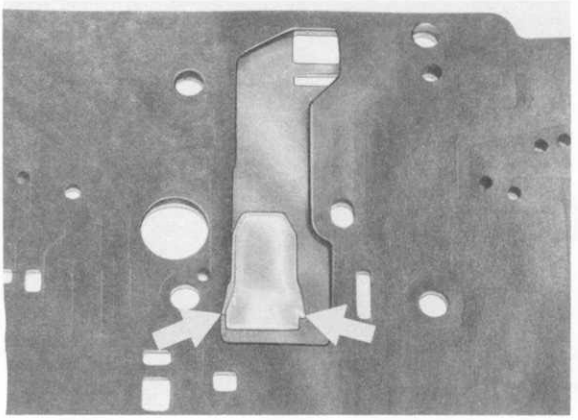
4. Place transfer plate and gasket on lower cover.

5. Align gasket with transfer plate by inserting two bolts.

6. Mount cover and tighten mounting bolts with 8 Nm/6 ftlb.



7. Insert injector in correct position until both tabs (arrows) engage.



TOOLS



No.	Description	Special Tool	Remarks
–	Filler	–	Commercially available, e. g. Dresser-Wayne Model 3009

AFT AND FILTER, CHANGING

F i l l i n g C a p a c i t i e s

After drainage approx. 8.0 l
After oil change approx. 6.0 l

T y p e s o f o i l :

ATF Dexron B - sperm-oil free

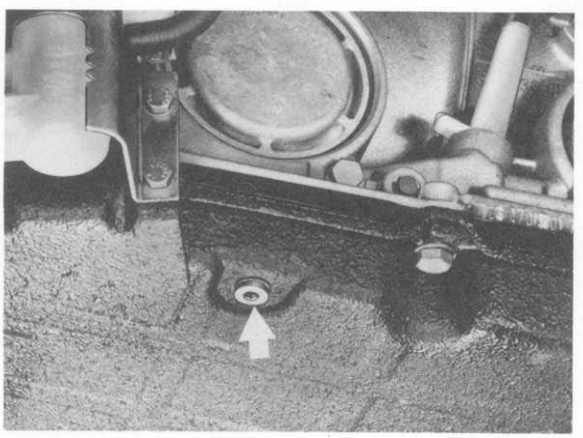
The ATF and the filer must be changed every 40,000 kilometers.

N o t e

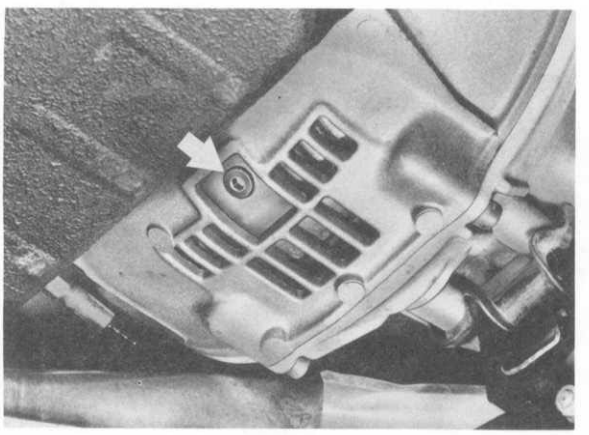
If a vehicle is subjected to particularly severe wear and tear (e.g. used for towing) the ATF should be changed every 20,000 km (without replacement filter)

If the ATF is to be changed, the vehicle must be standing on level ground, the transmission must be hot and the engine switched off.

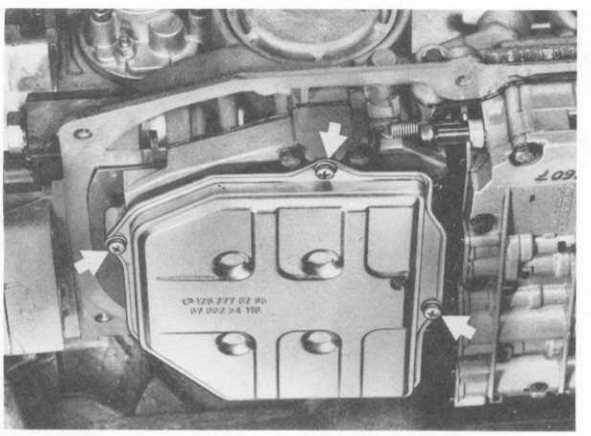
Unscrew drain plug from oil pan and drain the ATF into a suitable container.



Turn crankshaft until the converter drain plug is visible and can be removed.

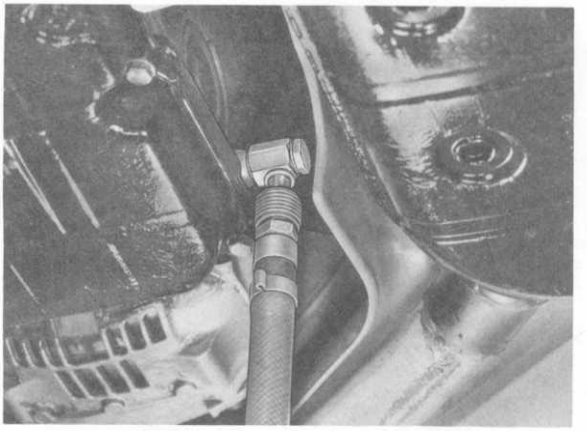


When ATF ceases to drain from the oil pan and torque converter, remove transmission oil pan and install replacement ATF filter.



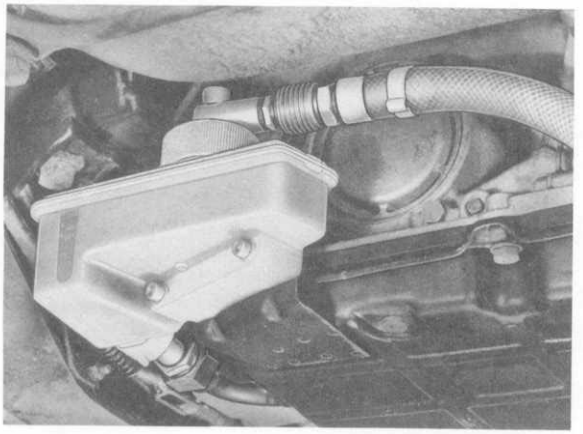
Install oil pan with gasket and torque retaining bolts with 8 Nm (8.7 ftlb).

Screw in plugs with new seals and tighten with 14 Nm (10.2 ftlb).



R e f i l l i n g w i t h ATF

Before starting the engine, use a filler to pump most of the ATF (approx. 5 l) into the oil pan. With the selector lever at "P" start the engine and allow to idle. Observe the ATF level in the reservoir and top up with the rest of the ATF without delay.



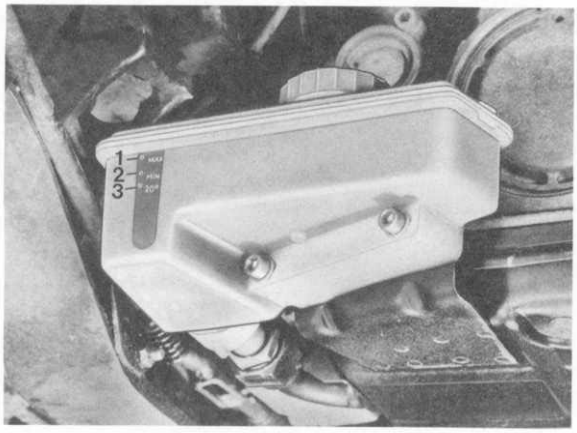
Up to 85 models

86 models onward

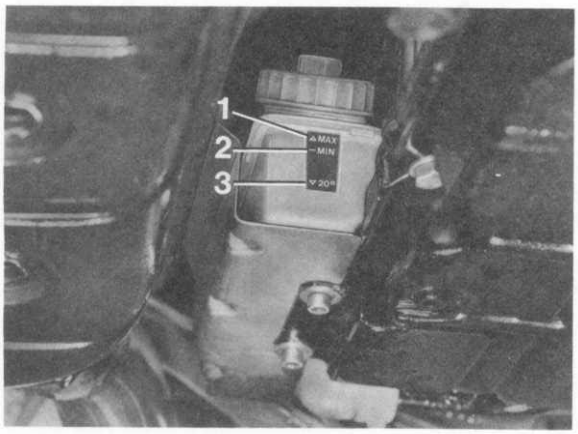
Operate service brake and set the selector lever to each position for a few seconds. Recheck ATF level.

N o t e

The level of ATF in the transmission varies with the temperature of the fluid. The marks (max. and min.) on the resevoir are indexed for an ATF temperature of 80° C. However, at temperatures between 20 and 30° C, the maximum ATF level is below the minimum mark (see fig.). This fact is of importance, as the ATF is usually changed at these temperatures.



Up to 85 models



86 models onward

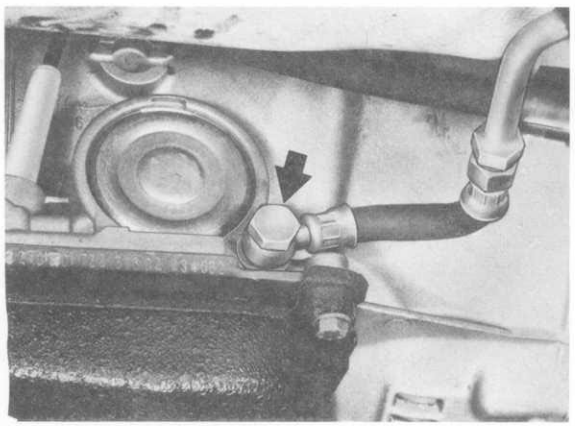
1 = max. at 80°C ATF temperature
2 = min. at 80°C ATF temperature
3 = max. at 20-30°C ATF temperature

FLUSHING ATF COOLER AND LINES

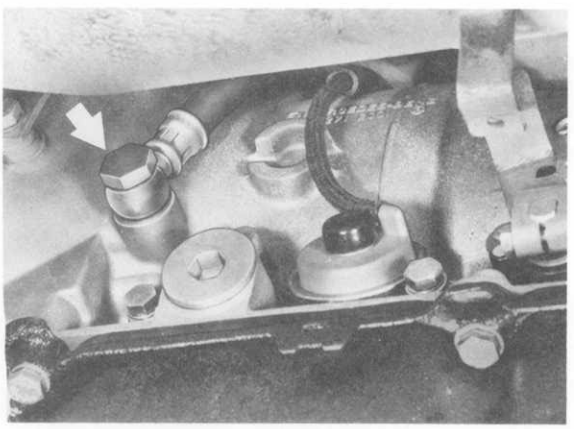
Note:

If ATF smells burnt and there are metal particles, sludge or liner abrasion in oil pan, it is not sufficient to only replace the valve body or transmission. The ATF cooler and lines will also have to be flushed with ATF.

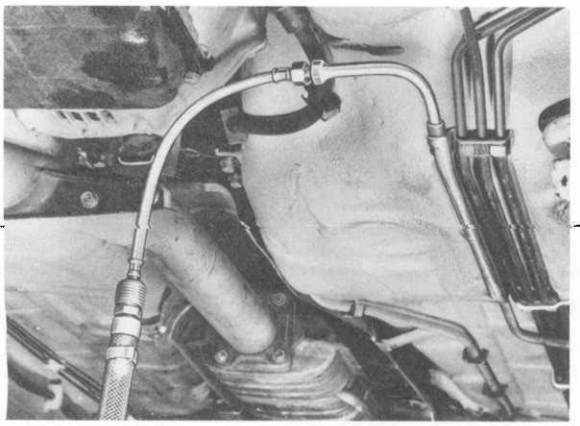
1. Disconnect return line on transmission case and take off short hose on return line.



2. Disconnect feed line on transmission case.



3. Attach extra hose from ATF charger (see Workshop Equipment Group of Special Tool Catalog) on return line and flush cooler as well as lines with the charger.



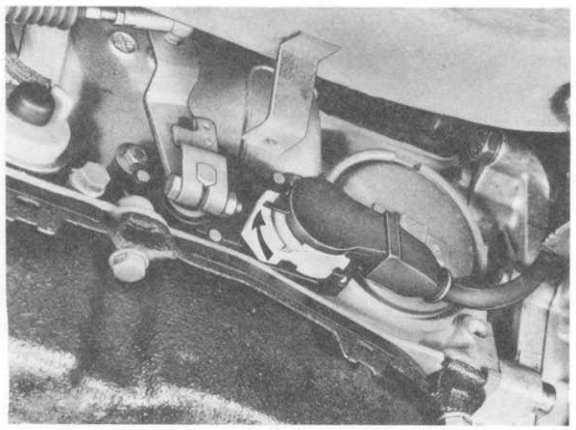
4. Catch ATF running out of feed line.

REMOVING AND INSTALLING GOVERNOR

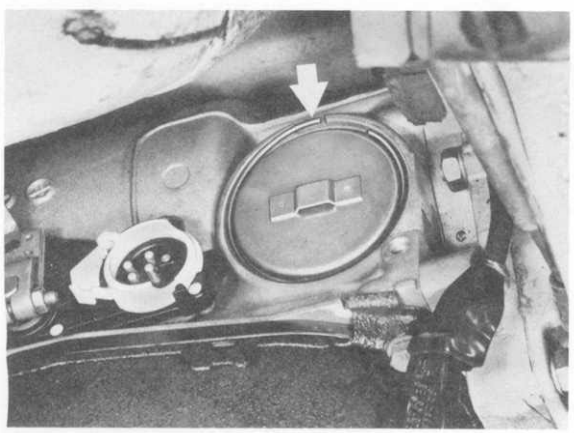
Removing

1. Loosen intermediate muffler shield and push aside as far as possible.

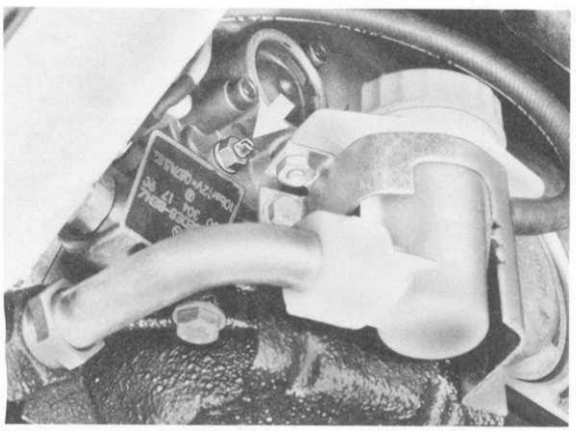
2. Unlock plug for starter locking and backup light switch by turning up white plastic ring in direction of arrow. Pry off plug carefully with two screw-drivers applied on both sides.



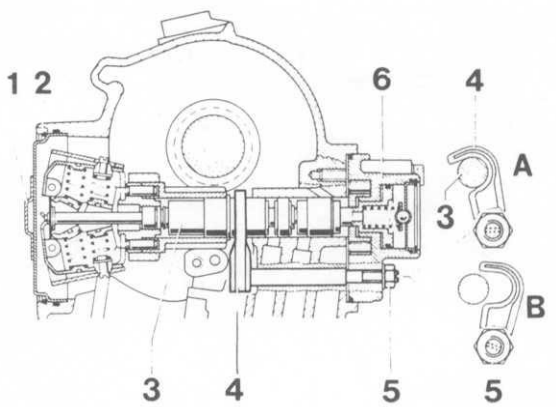
3. Press in cover and remove snap ring with cover.



4. Loosen nut for axial holder.

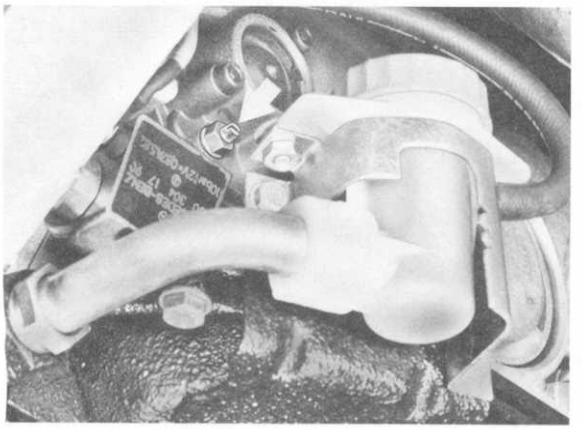


5. Turn axial holder counterclockwise with a screwdriver inserted in slot (corresponding with position "B" in sectional view).



1 = Cover
2 = Snap ring
3 = Governor
4 = Axial holder
5 = Axial holder nut
6 = Secondary pump

6. Pull out governor.



Installing

1. Guide in governor.

Note:

Absolute cleanliness is necessary for installation of governor. If necessary, cover area of governor installation with lint free cloths.

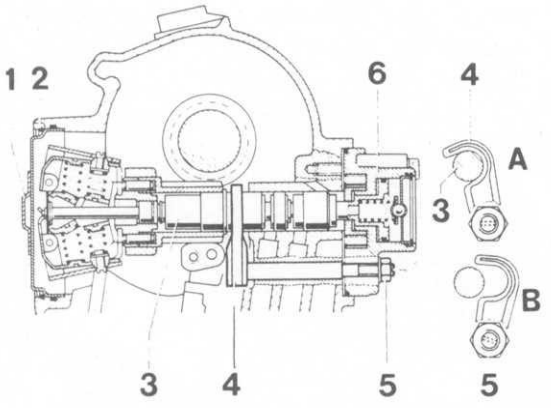
2. Move centrifugal governor lightly in and out while turning axial holder clockwise until governor engages firmly (position "A" in section drawing).

Note:

Axial holder has been installed correctly when slot is horizontal (position "A" in section drawing).

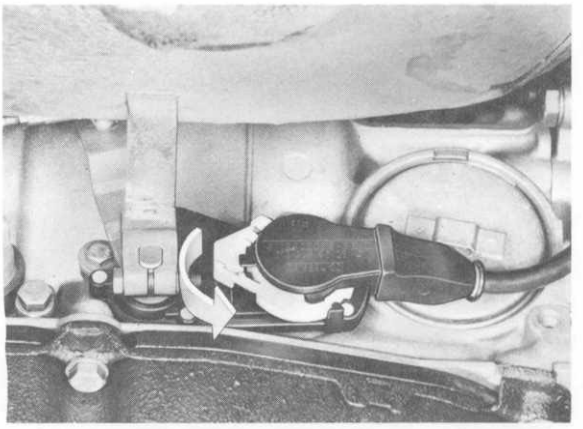
4. Press in cover and insert snap ring.

5. Press out cover again until it rests on snap ring.



1 = Cover
2 = Snap ring
3 = Governor
4 = Axial holder
5 = Axial holder nut
6 = Secondary pump

6. Press on plug for starter locking and backup light switch. Lock by turning white plastic ring down.

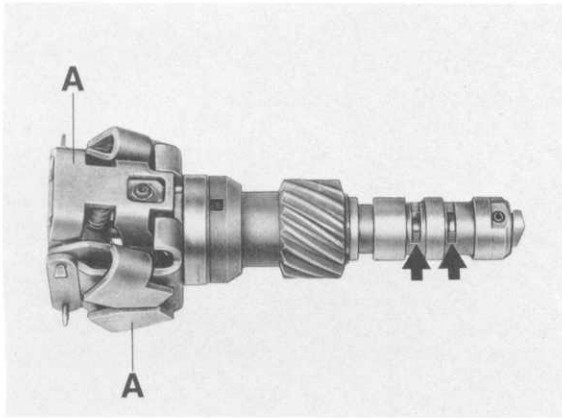


3. Tighten axial bearing nut to 8 Nm/6 ftlb.

7. Bolt shield.

Checking Governor

Move centrifugal weight "A" and at same time check movement of governor valve in openings (arrows).



Note:

It should be possible to move governor valve easily. If necessary, wash governor and dry thoroughly with compressed air.

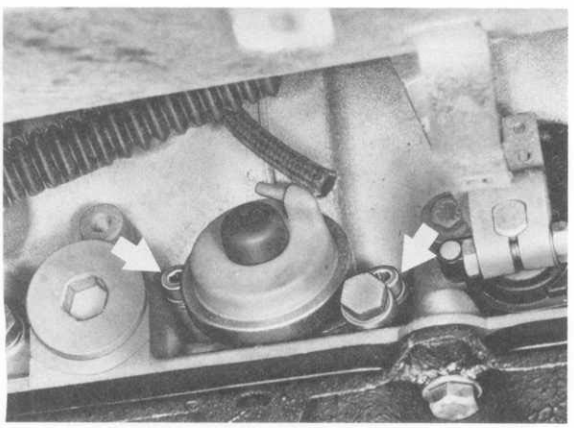
REMOVING AND INSTALLING VACUUM MODULATOR

Removing

1. Loosen intermediate muffler shield and push aside as far as possible.

2. Pull off vacuum hose on vacuum modulator.

3. Remove socket head screws and remove with holder.



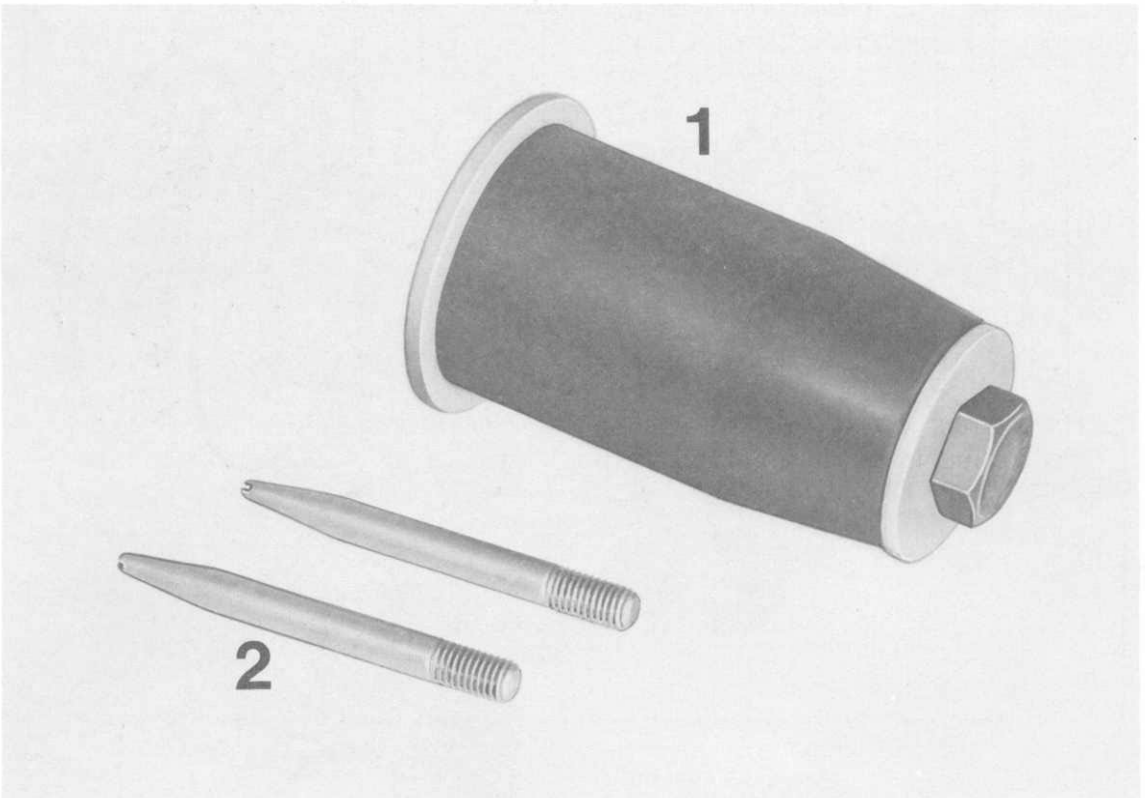
4. Pull out vacuum modulator.

Installing

1. Mount vacuum modulator with holder and tighten socket head screws to 8 Nm/6 ftlb.

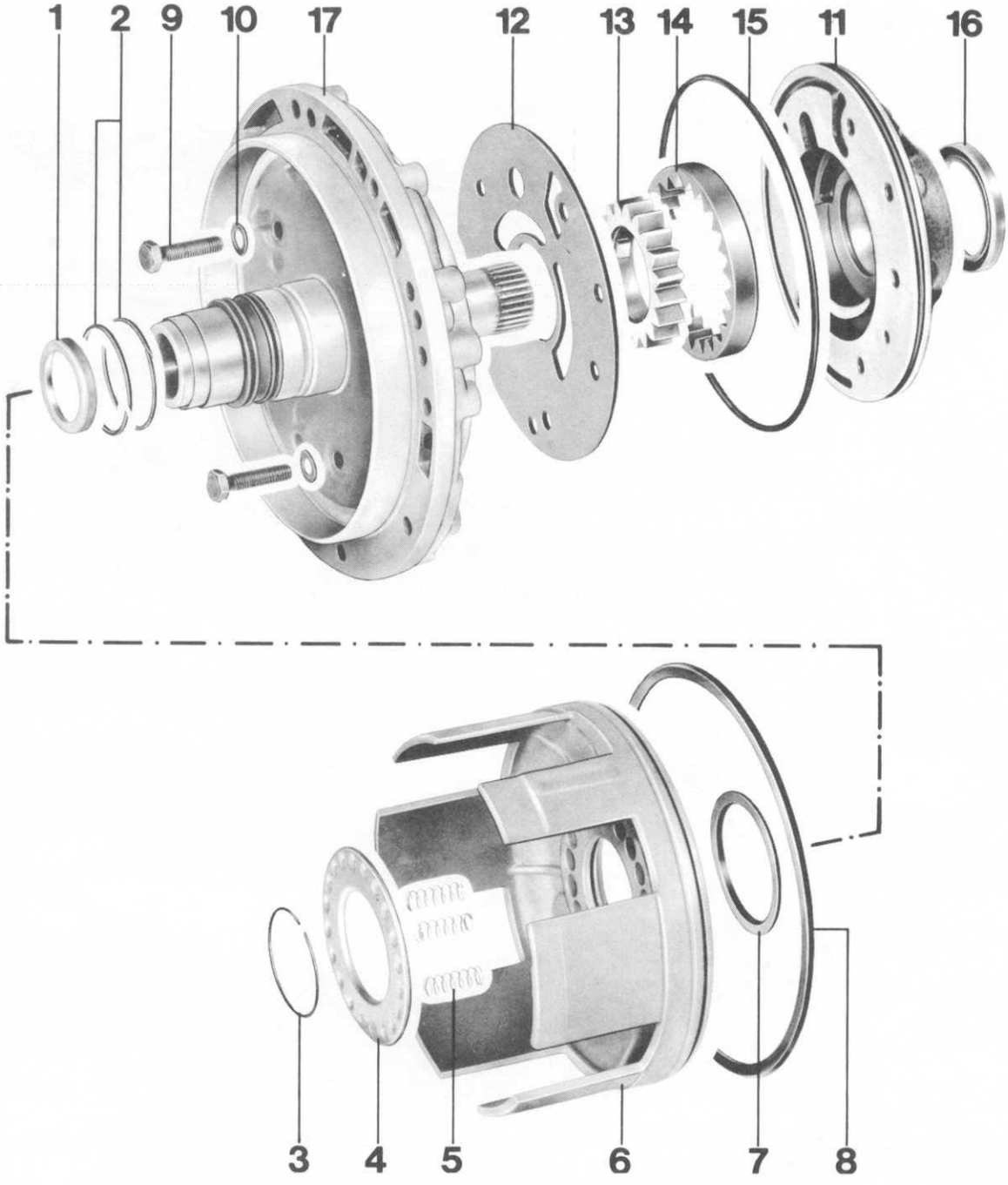
2. Adjust modulating pressure (see page 38 - 108).

TOOLS



No.	Description	Special Tool	Remarks
1	Guiding sleeve	9319	
2	Centering pins	9321	

REMOVING AND INSTALLING PRIMARY PUMP



No.	Description	Qty.	Note When: Removing	Installing
1	Thrust washer	1		
2	Teflon ring	2		Replace, install with grease.
3	Circlip	1		
4	Spring plate	1		Insert right way round
5	Compression spring	20		
6	Piston	1		Insert right way round
7	Sealing ring with lip	1		Sealing lip must face toward cover
8	Sealing ring with lip	1		
9	Hex bolt	1		Tightening torque: 20 Nm (15 ftlb)
10	Spring washer	6		
11	Pump casing	1		Check bearing sleeve for damage
12	Backer	1		Install right way round
13	Pump gear (driving)	1		
14	Pump gear (driven gear)	1		Bevel faces toward bearing sleeve
15	O-ring	1		Replace, coat with ATF
16	Sealing ring	1		Drive in with suitable pressure piece
17	Cover	1		

* As of transmission No. 472 213, the pin on the cover (No. 17) has been extended. The thrust washer is no longer installed.

NOTES FOR REMOVING AND INSTALLING

Removing

Note:

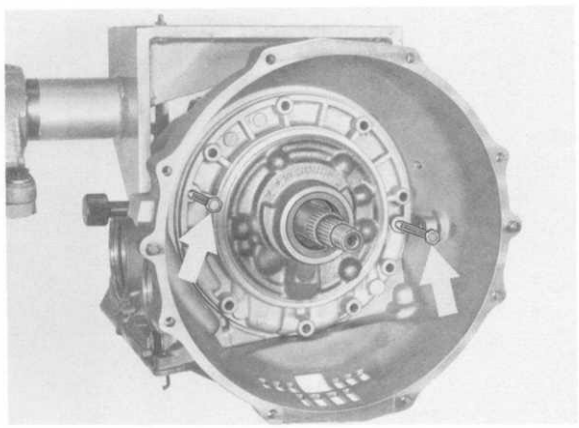
It is not necessary to disassemble the transmission to remove or install the primary pump.

1. Remove transmission.

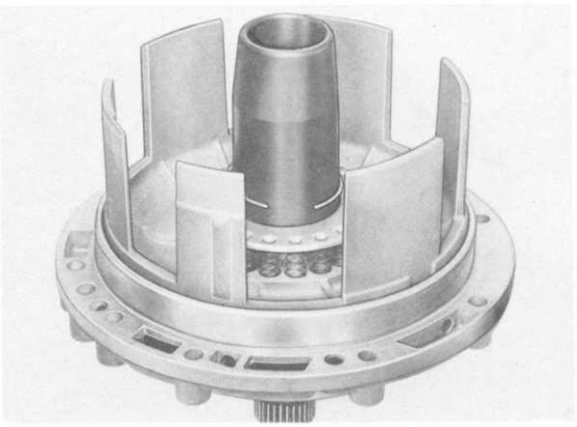
2. Remove front converter casing and converter.

3. Unscrew mounting bolts for front transmission cover.

4. Screw two bolts in threaded holes and pull bolts to withdraw cover.



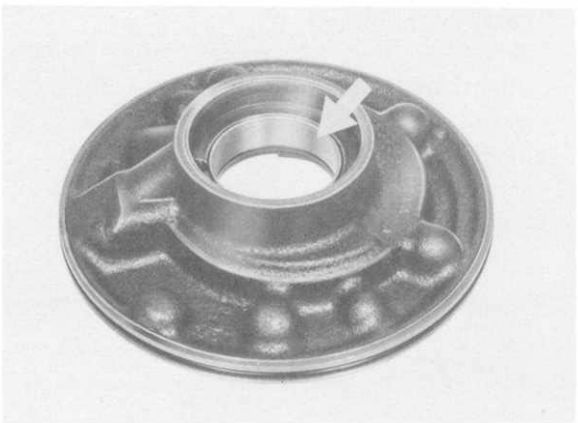
5. Press spring plate down and remove circlip.



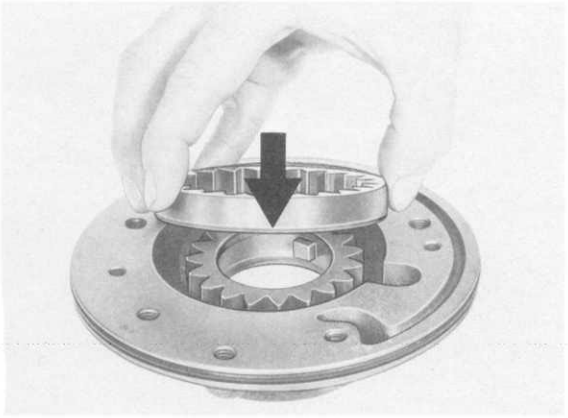
6. Unscrew mounting bolts and remove pump; screw two bolts in threaded holes and carefully drive out primary pump with light taps of a nylon-headed hammer.

Installing

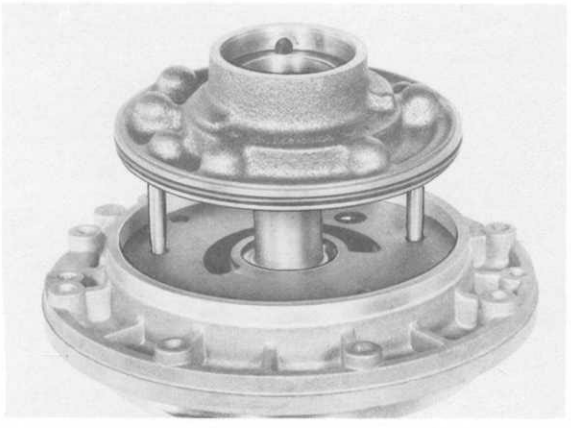
1. Check bearing sleeve for grooves or signs of damage. If damage is discovered, the primary pump must be replaced.



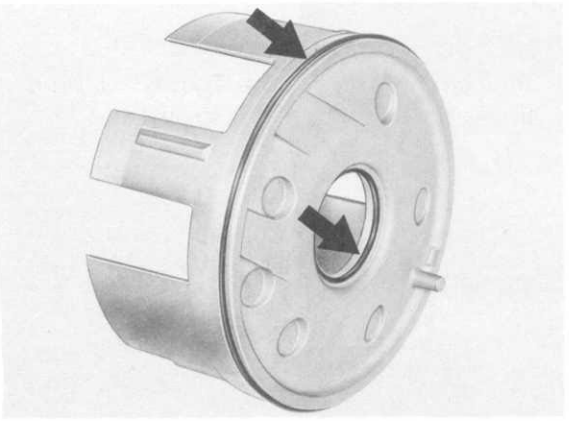
2. Lubricate both pump gears with ATF and install in pump body, whereby the large gear must be installed that the chamfer (arrow) faces bearing sleeve.



3. Screw Special Tools 9321 in pump body. Place transfer plate in correct position and install pump in front cover. Bearing sleeve must not be damaged by the stator shaft during this step. Tighten mounting bolts to 20 Nm/14 ftlb.



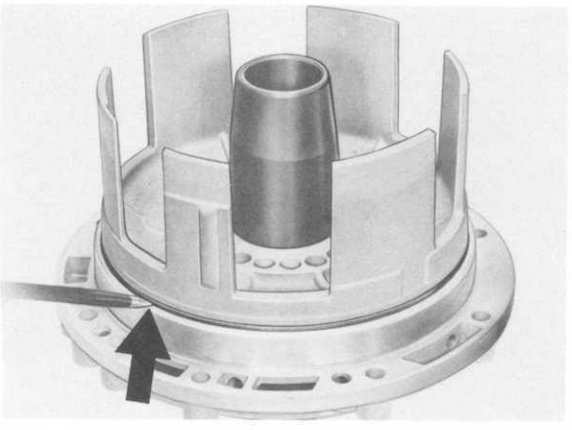
4. Install seals on piston that sealing lips face down (direction of arrow).



5. Apply Special Tool 9319 on front cover and coat sliding surfaces with ATF.

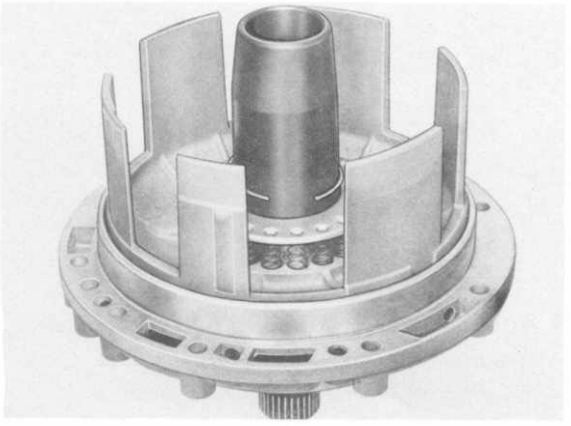
6. Coat seals on piston with ATF and install piston that journal (on piston) and bore in front cover are aligned.

7. Press in piston carefully and without canting, driving in with a suitable pin applied on outer seal (arrow) if necessary.



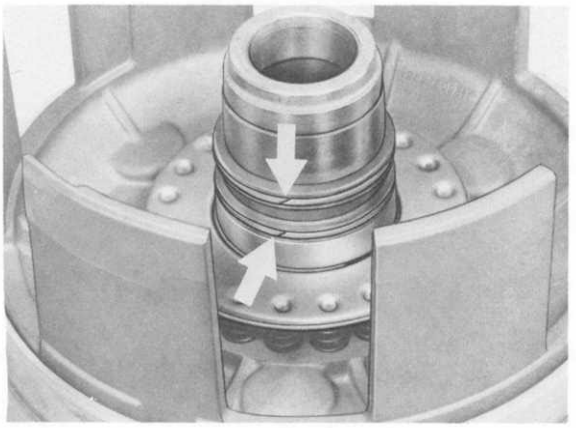
8. Install return springs and diaphragm spring.

9. Slide circlip over Special Tool 9319, hold circlip down and pull off special tool.

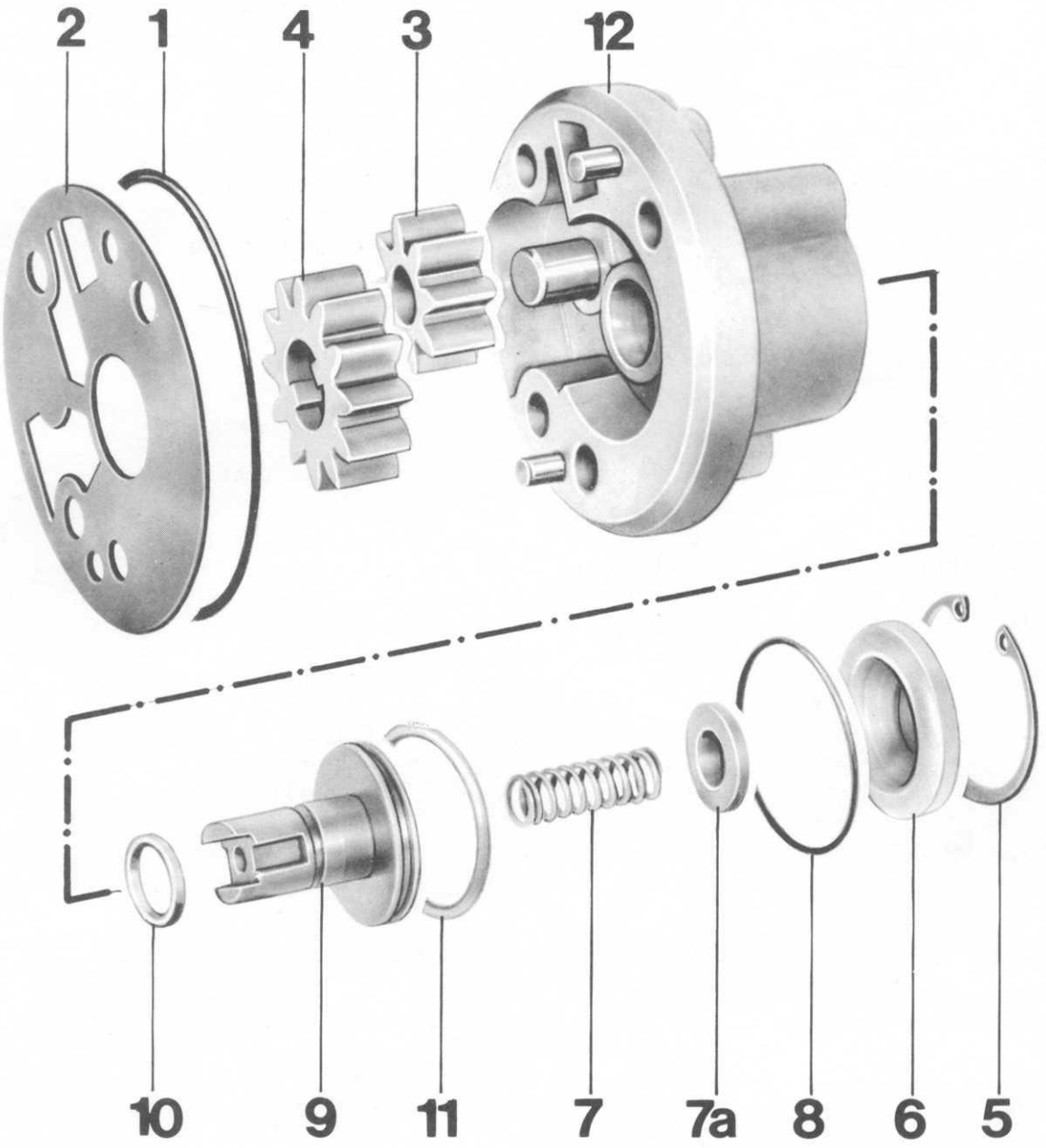


10. Push down on diaphragm spring with circlip until circlip engages in its groove.

11. Install teflon rings with grease, making sure gap of rings (arrow) remain together. If necessary, take off rings again and shape them carefully to a smaller diameter.

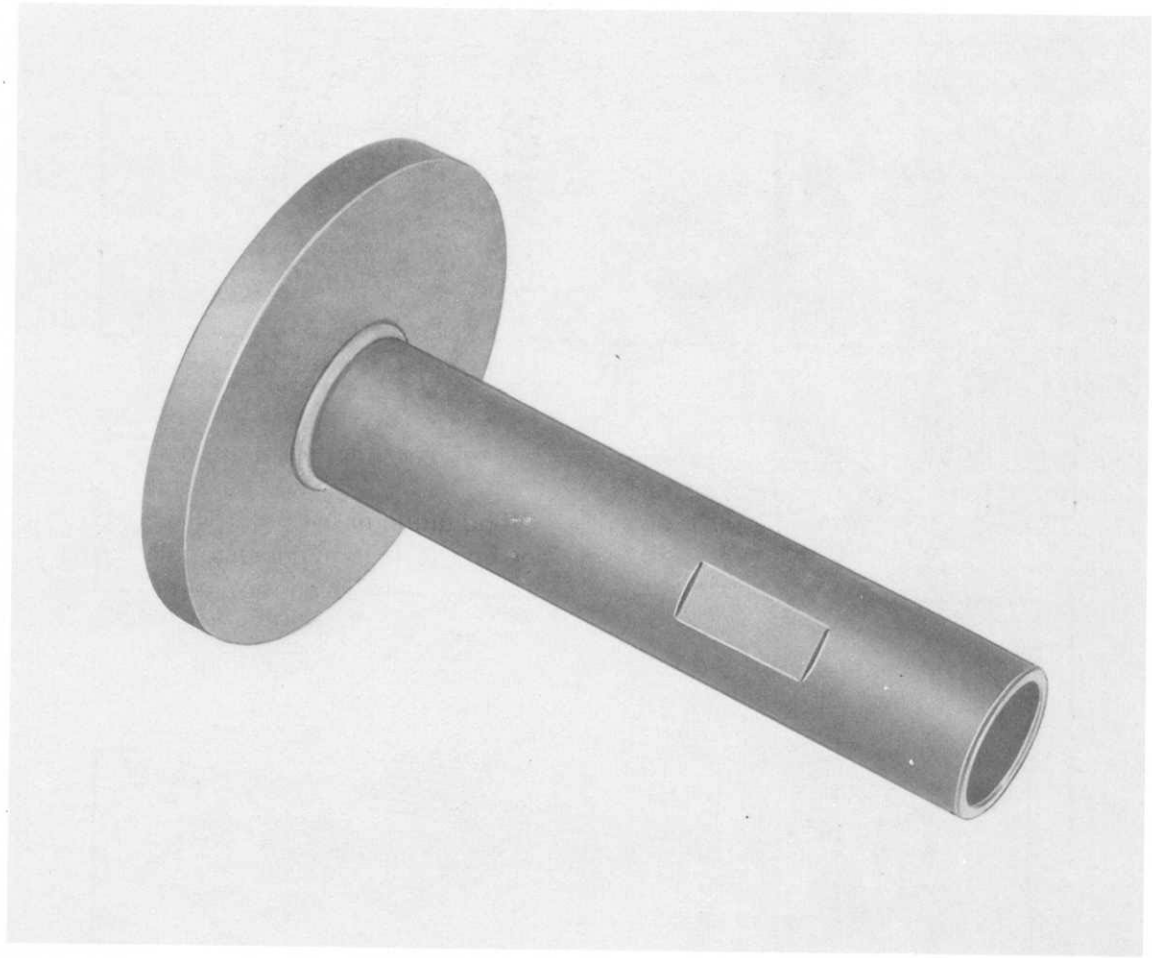


DISASSEMBLING AND ASSEMBLING SECONDARY PUMP



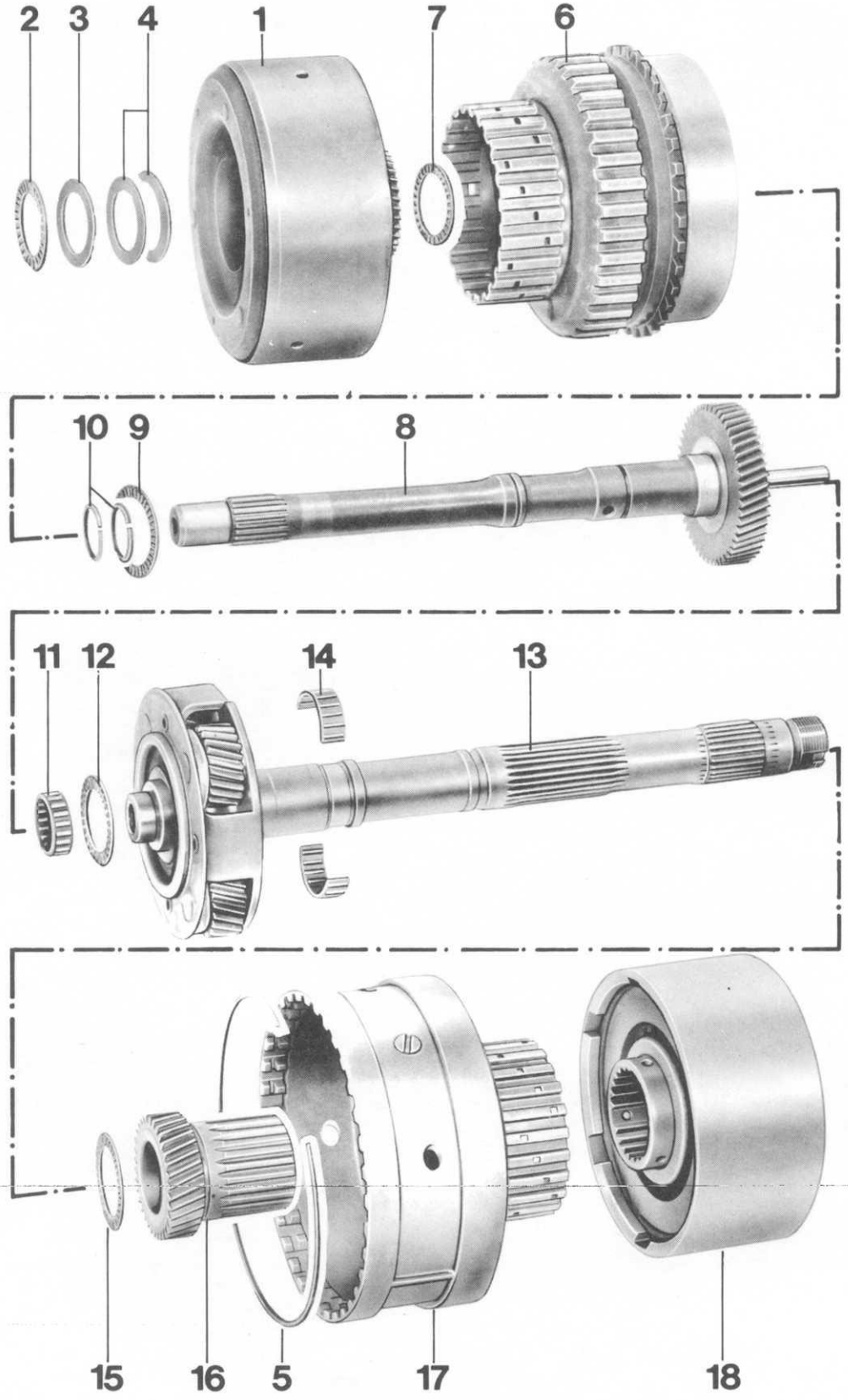
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	O-ring	1		Replace if necessary. Coat with ATF	
2	Transfer plate	1			
3	Gear (driven)	1		Coat with ATF	
4	Gear (driving)	1		Coat with ATF; drive dog must engage in groove	
5	Circlip	1			
6	Cover	1			
7	Spring	1			
8	O-ring	1		Replace, coat with ATF	
9	Piston	1			
10	Teflon ring	1		Replace, install in groove with grease	
11	Teflon ring	1		Replace, install in groove with ATF	
12	Body	1			

TOOLS



No.	Description	Special Tool	Remarks
	Assembly stand	9314	

DISASSEMBLING AND ASSEMBLING GEAR ASSEMBLY

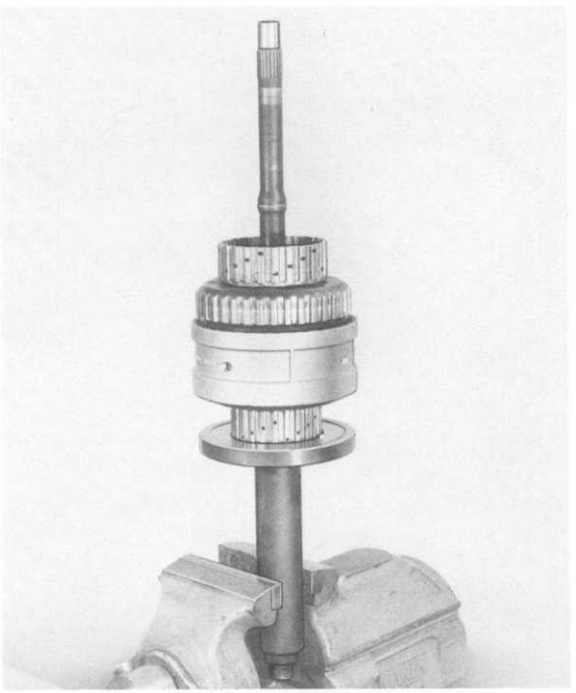


No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Clutch K 1	1		Install only after gear assembly is in case	
2	Axial bearing	1			
3	Thrust washer	1			
4	Shim	X	Note thickness for reinstallation	Redetermine thickness if necessary	
5	Snap ring	1	Remove with a suitable screwdriver	Check for correct fit	
6	Front gear set	1			
7	Axial bearing	1			
8	Drive shaft	1			
9	Axial bearing	1			
10	Lubricating ring	2		Replace, install with grease	
11	Radial bearing	1			
12	Axial bearing	1			
13	Drive shaft	1			
14	Radial bearing (split)	1		Install with grease	
15	Axial bearing	1			
16	Sun gear	1			
17	Inner plate carrier with one-way clutch	1			
18	Clutch K 2	1			

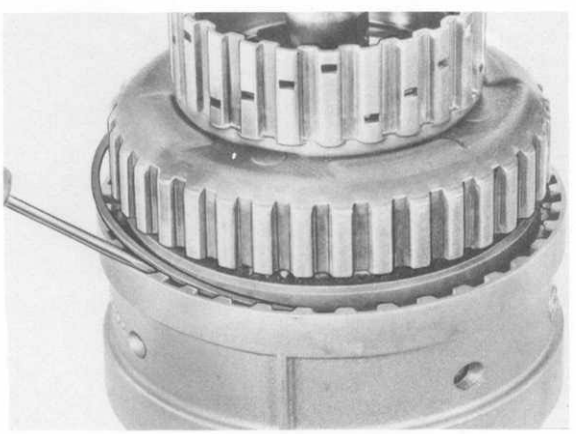
DISASSEMBLING AND ASSEMBLING GEAR ASSEMBLY

Disassembling

1. Clamp Special Tool 9314 in a vise on both surfaces with plate facing up and mount gear assembly with drive shaft facing up.

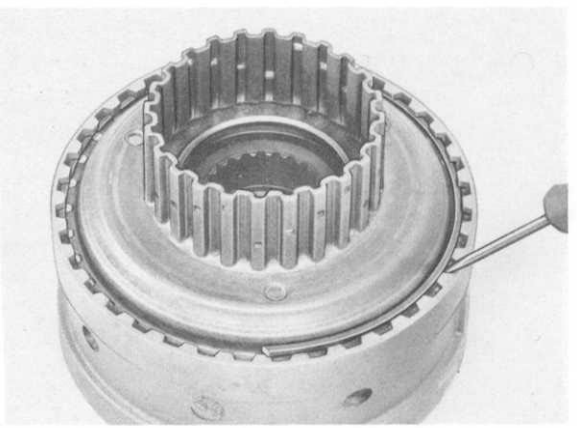


2. Remove snap ring.



3. Take off parts separately.

4. Remove snap ring and take inner plate carrier with one-way clutch out of connecting carrier



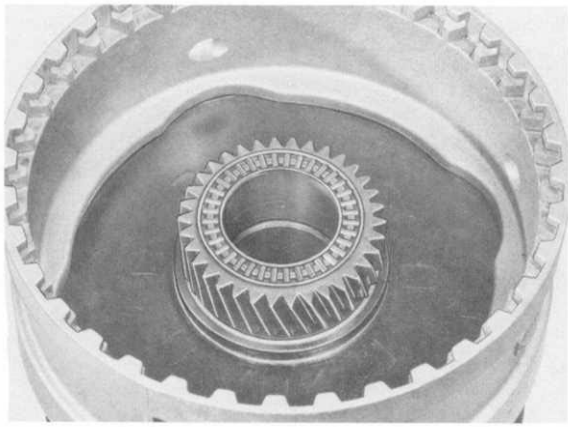
Assembling

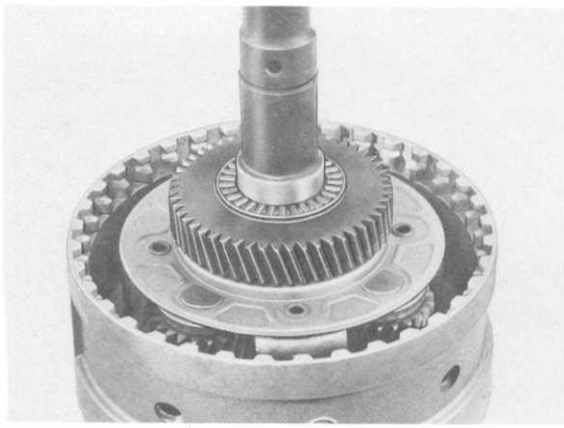
Note:

Coat all bearing surfaces and sliding surfaces with ATF when assembling.

1. Place one-way clutch with connecting carrier on Special Tool 9314.

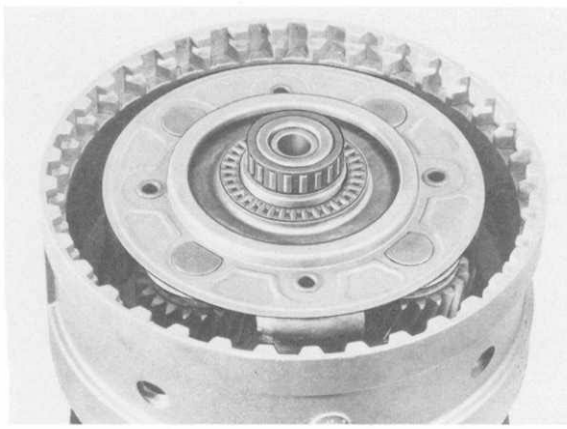
2. Mount sun gear and install axial bearing.





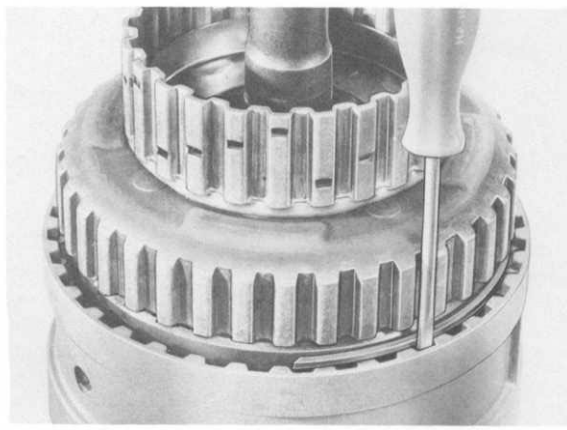
3. Install output shaft.

4. Install axial and radial bearings on output shaft.



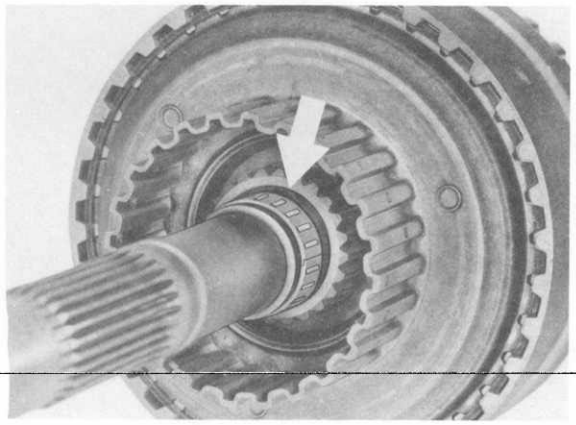
5. Install drive shaft and axial bearing.

6. Install front gear set and secure with snap ring. Press snap ring into groove with a screwdriver.

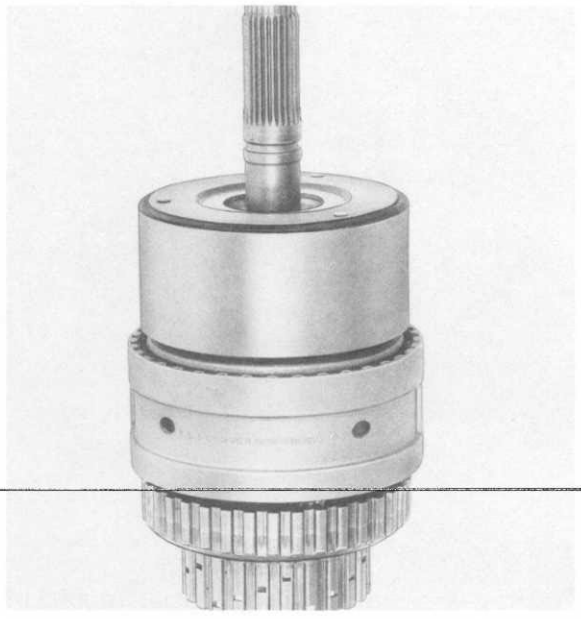


7. Lift gear assembly off of Special Tool 9314 and install again with drive shaft facing up.

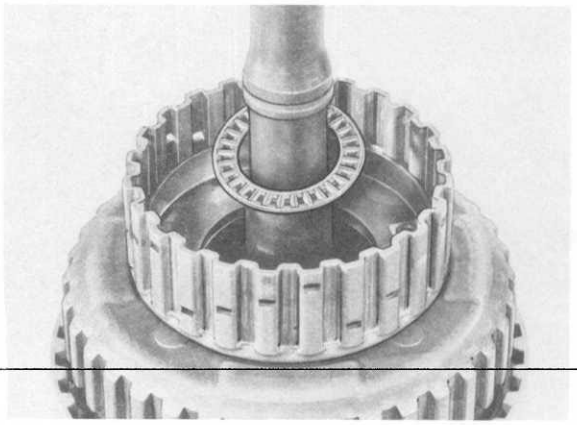
8. Install split radial bearing on output shaft with a small amount of grease.



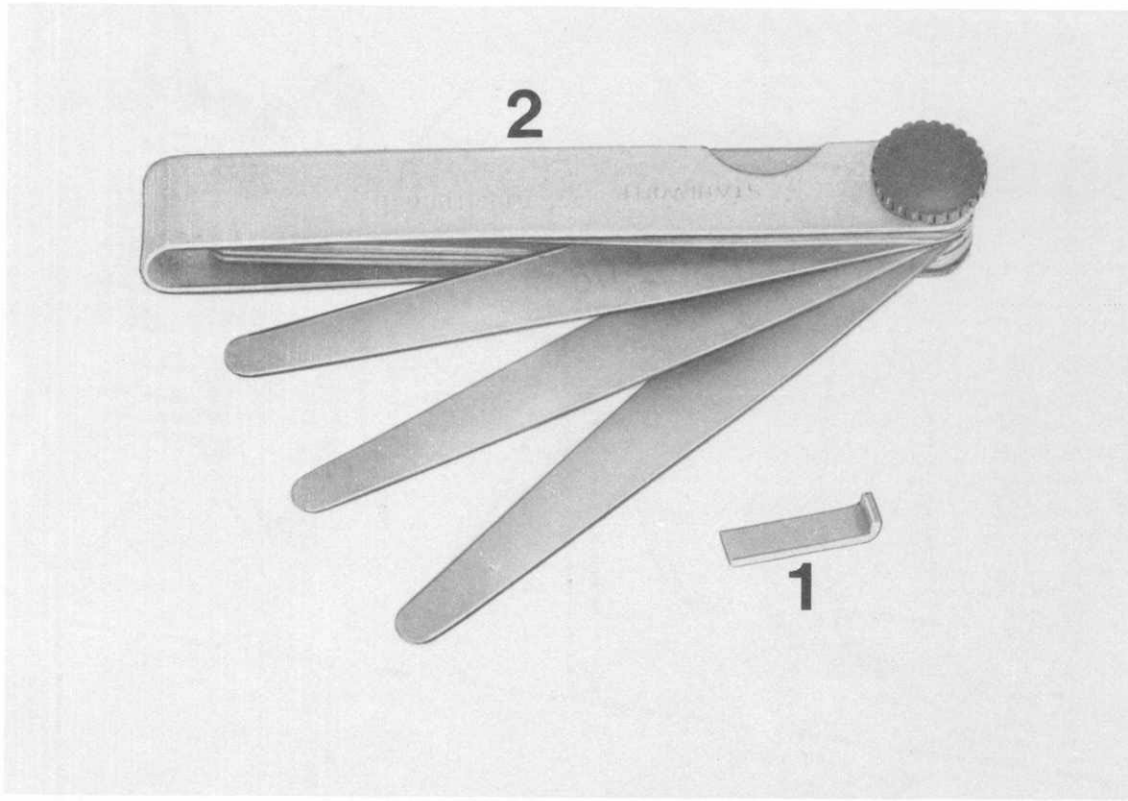
9. Install clutch K 2.



10. Take gear assembly off of Special Tool 9314 and install axial bearing on drive shaft with a small amount of grease.

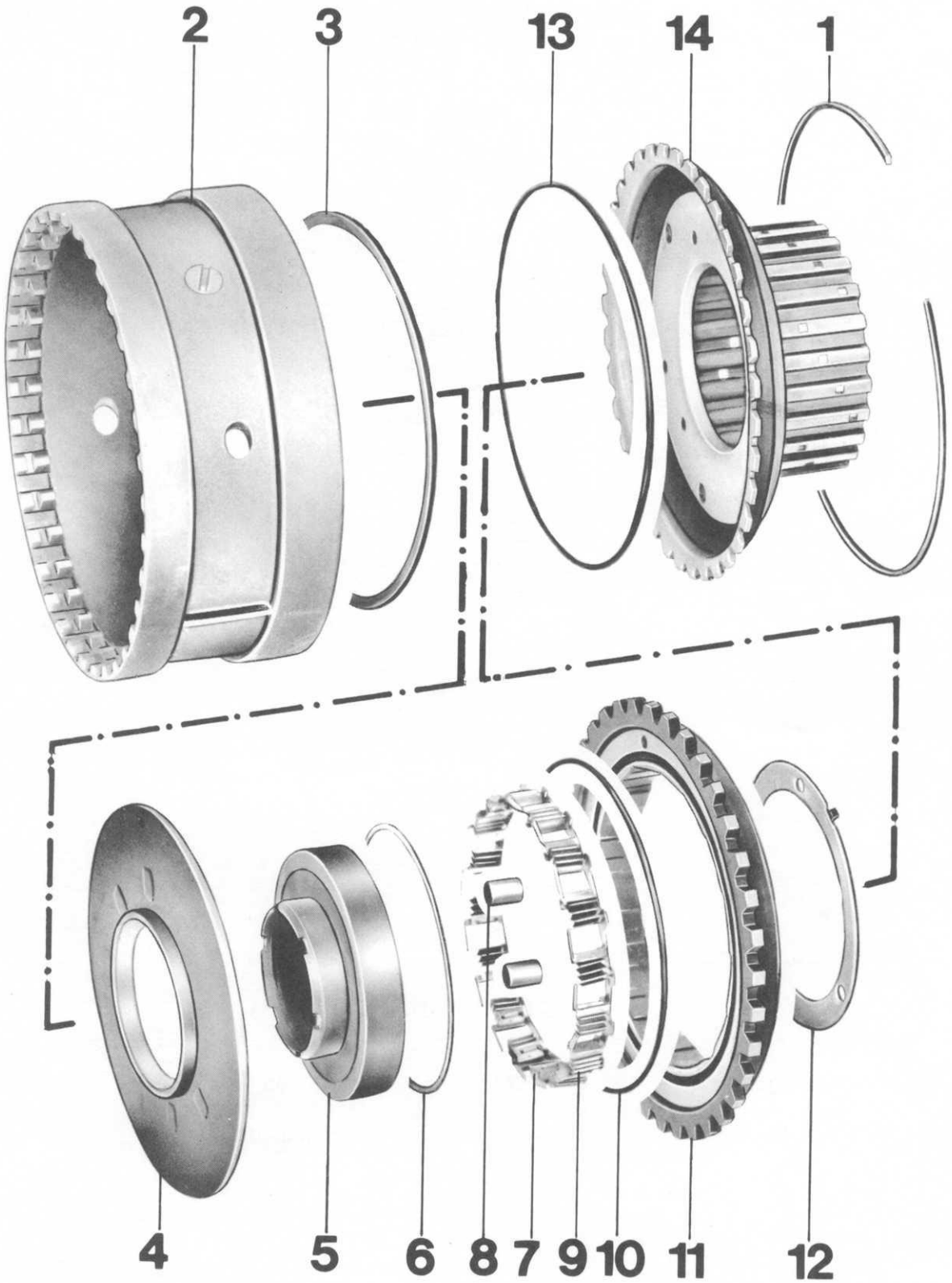


TOOLS



No.	Description	Special Tool	Remarks
1	Lockplate	9322	Sixteen (16)
2	Feeler blade gauge	–	Standard tool

DISASSEMBLING AND ASSEMBLING ONE-WAY CLUTCH

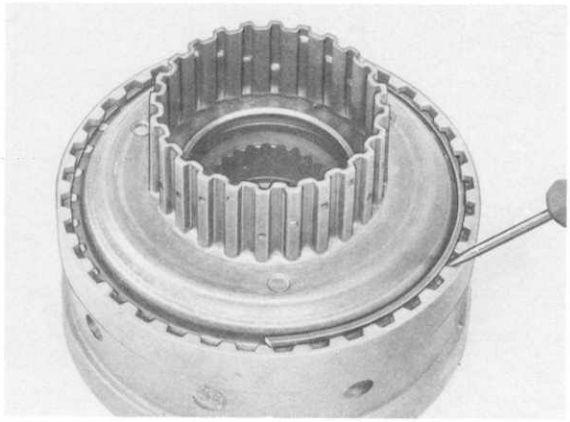


No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Snap ring	1		Check for correct fit	
2	Connecting carrier	1			
3	Shim	X		Redetermine thickness, if necessary	
4	Support	1		Position correctly	
5	One-way clutch inner race	1		Use Special Tool 9322	
6	Shim	1			
7	Roller cage	1			
8	Cyl. roller	16			
9	Spring	16			
10	O-ring	1		Replace, install after checking axial play	
11	One-way clutch outer race	1		Check for wear	
12	Thrust washer	1		Tabs engage in plate carrier	
13	O-ring	1		Replace	
14	Plate carrier	1			

DISASSEMBLING AND ASSEMBLING ONE-WAY CLUTCH

Disassembling

1. Remove snap ring and lift inner plate carrier K 2 with one-way clutch out of connecting carrier.



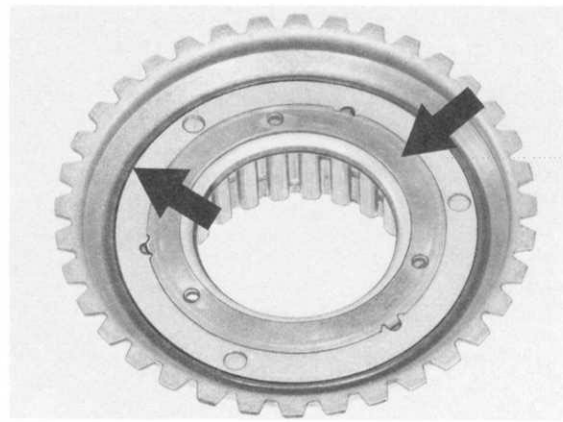
2. Turn inner race of one-way clutch counter-clockwise and pull out.

Assembling

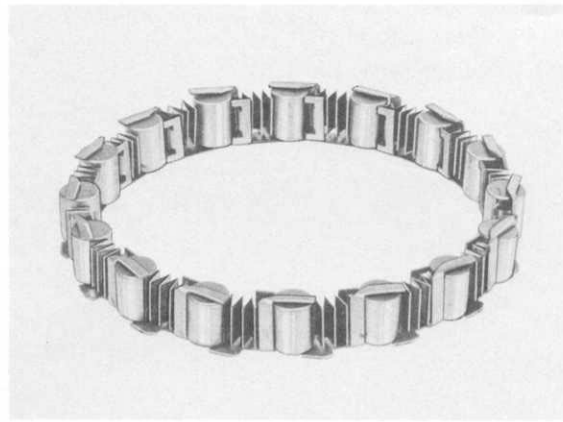
Note:

Check bearing surfaces and inner race of one-way clutch for wear.
If bearing surface of cylindrical rollers on inner race of one-way clutch shows strong scoring or notching, replace the entire one-way clutch.
Coat bearing surfaces and sliding surfaces with ATF.

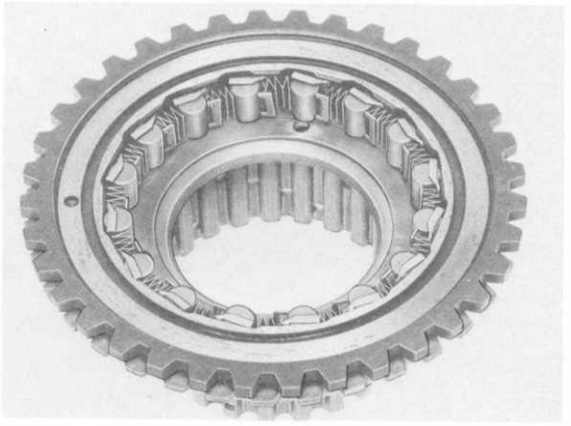
1. Place thrust washer and O-ring on inner plate carrier.



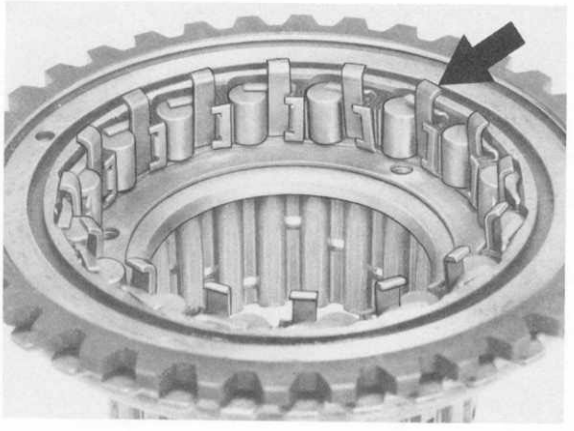
2. Install cylindrical rollers in roller cage.



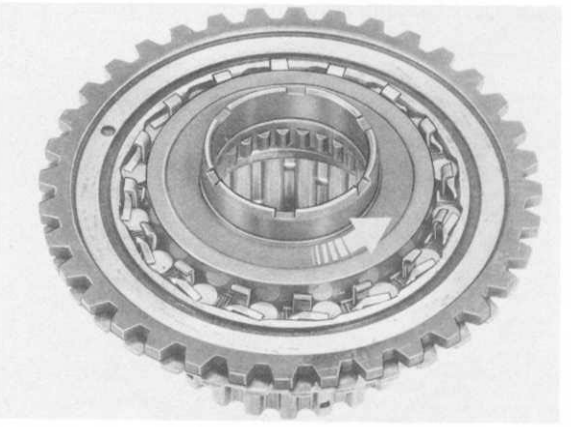
3. Place outer race of one-way clutch on inner plate carrier and install roller cage in correct position.



4. Push cylindrical rollers against springs and apply Special Tool 9322 with bend facing out.

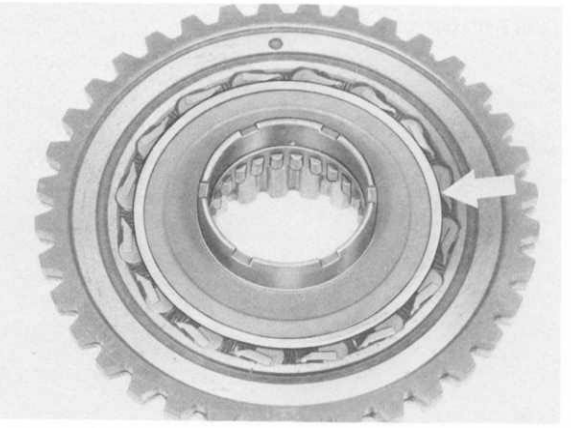


5. Install one-way clutch inner race while turning in direction of arrow.



6. Remove Special Tool 9322.

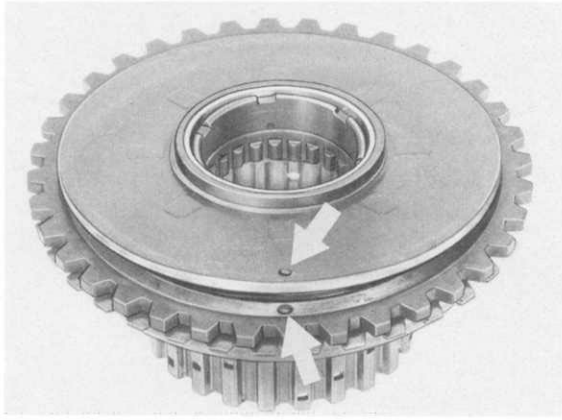
7. Install shim.



Note:

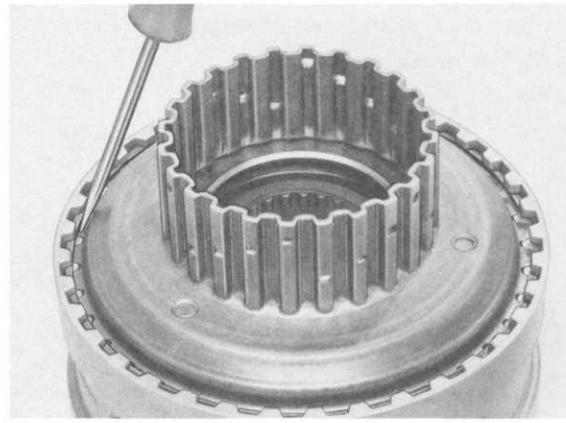
Install O-ring only after checking axial play of one-way clutch.

8. Install support that pin engages in bore (arrow) of one-way clutch outer race.



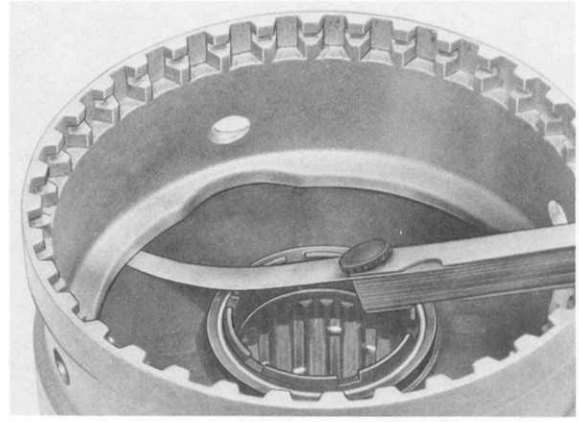
9. Place shims (if available) on outer race of one-way clutch and install connecting carrier on one-way clutch.

10. Install snap ring and press into groove with a screwdriver.



Checking and Adjusting One-way Clutch Axial Play:

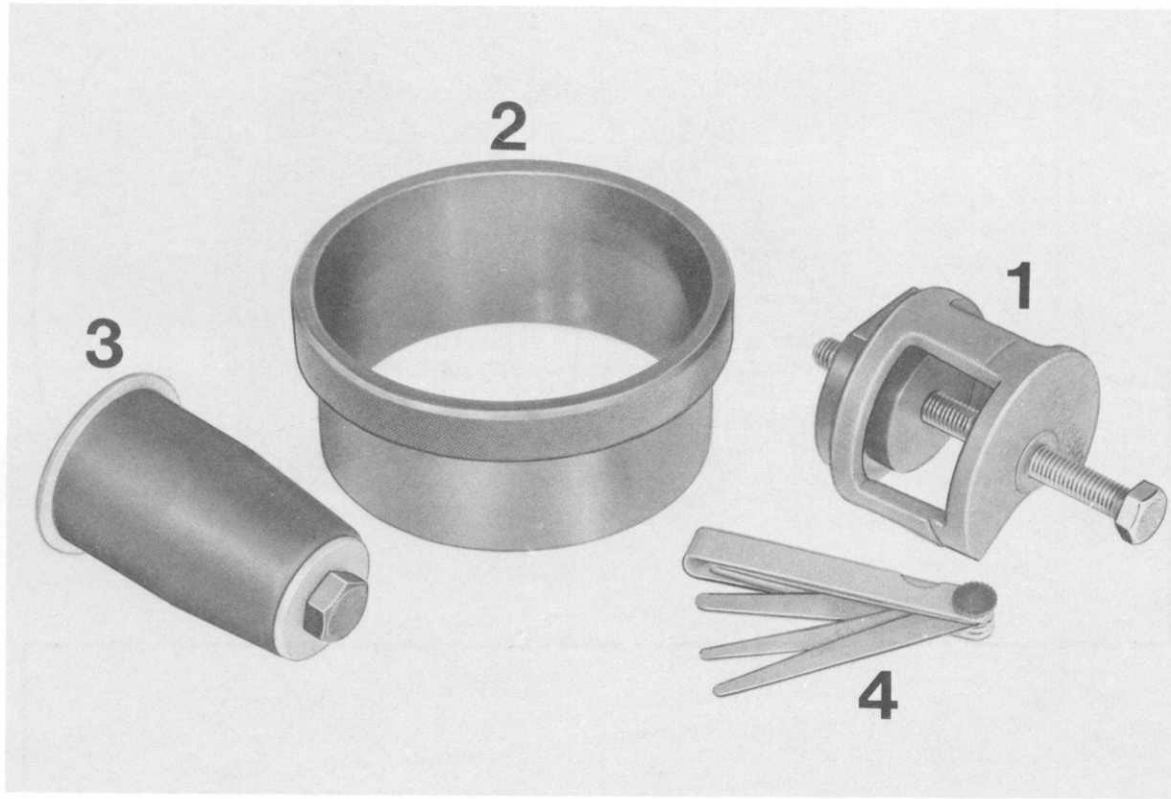
1. Check play between one-way clutch and connecting carrier with a feeler gauge.



2. Adjust play to 0.05 . . . 0.2 mm with shims.

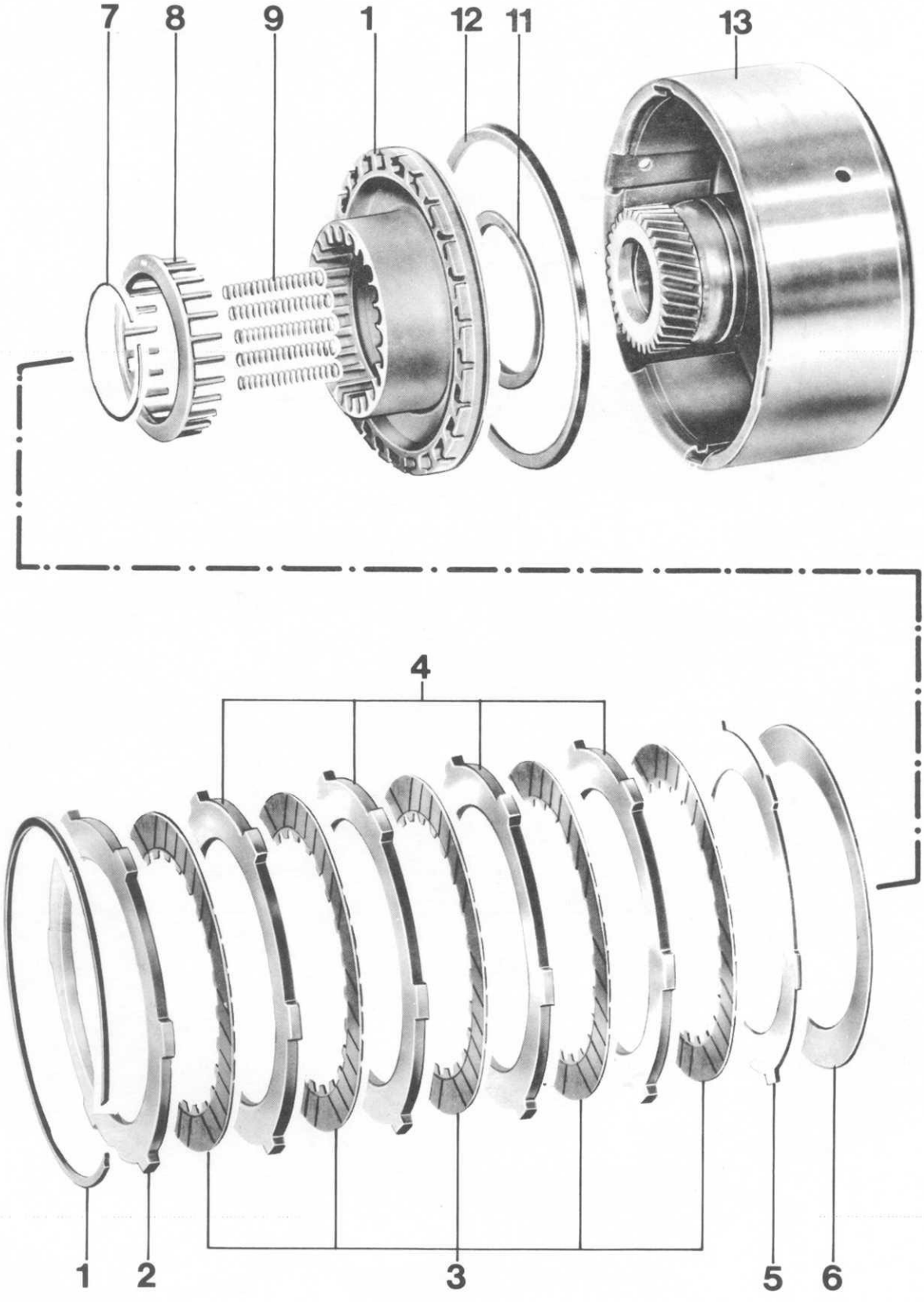
3. Install O-ring.

TOOLS



No.	Description	Special Tool	Remarks
1	Assembly tool	9315	
2	Assembly sleeve	9317	
3	Assembly sleeve	9318	
4	Feeler blade gauge	–	Standard tool

DISASSEMBLING AND ASSEMBLING CLUTCH K 1



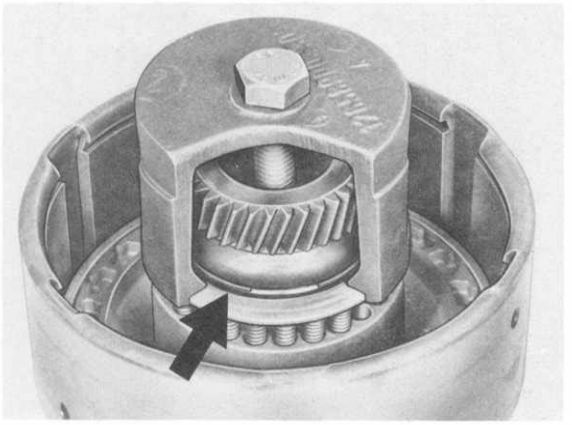
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Snap ring	X		Redetermine thickness, if necessary	
2	Outer plate	1		Check for burnt spots and bending	4.5 or 5.0 mm thick (optional to adjust play)
3	Inner plate (2.1 mm thick)	5		Check for burnt spots and wear. If less than 2 mm thick, replace. Place in ATF about 1 hour before installing	
4	Outer plate	4		Check for burnt spots and bending	3.0 or 3.5 mm thick (optional to adjust play)
5	Outer plate (2.0 mm thick)	1		Check for burnt spots and bending	
6	Diaphragm spring	1		Position correctly that curved surface faces piston	
7	Snap ring	1	Remove with Special Tool 9315	Install with Special Tool 9315, checking for correct fit	
8	Diaphragm spring	1			
9	Spring	X	Note quantity for reinstallation		

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
10	Piston	1		Install with Special Tools 9317 and 9318	
11	Seal	1		Position correctly, coat with ATF	
12	Seal	1		Position correctly, coat with ATF	
13	Plate carrier	1			

DISASSEMBLING AND ASSEMBLING CLUTCH K 1

Disassembling

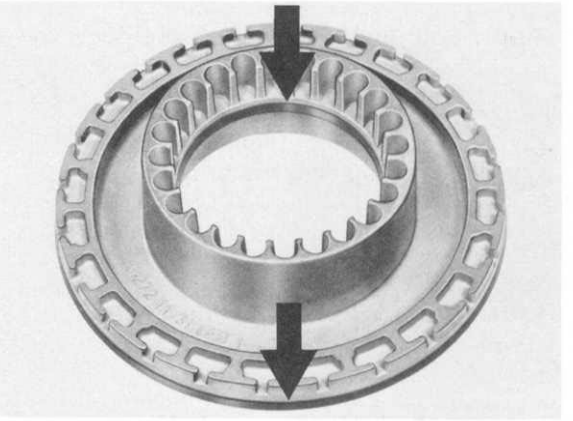
1. Apply Special Tool 9315 on diaphragm spring and tighten until snap ring can be removed.



2. Remove diaphragm spring and springs.

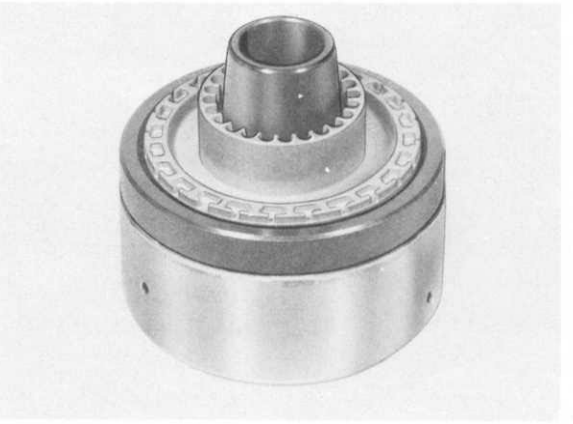
Note:

The quantity of springs for clutch piston will vary. If new springs are required, the same quantity of springs must be installed.



2. Apply Special Tools 9318 and 9317 in outer plate carrier.

3. Install piston carefully and press into outer plate carrier without canting.



Assembling

1. Install seals in piston that sealing lips face down (direction of arrow).

Note:

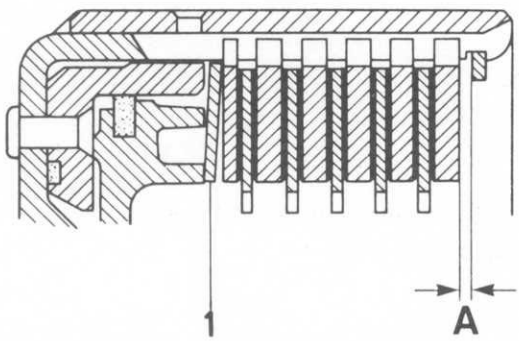
Coat seals and sliding surfaces on Special Tools 9318 and 9317 with ATF.

4. Install springs in piston and place on diaphragm spring, whereby each spring must be centered by a guide pin.

5. Apply and tighten Special Tool 9315.

6. Install snap ring and release special tool. Check that snap ring fits properly.

7. Install diaphragm spring with curved surface on piston as shown in figure.



1 = Diaphragm spring

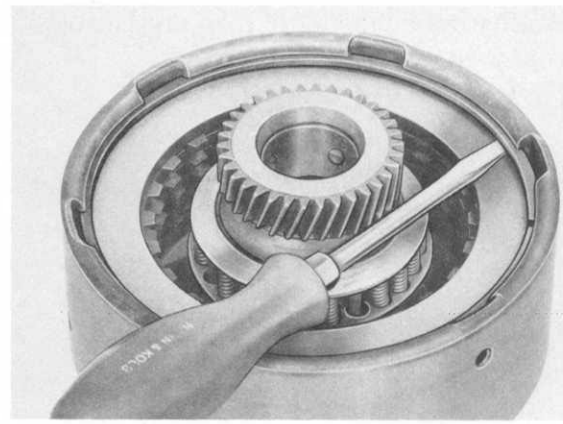
8. Assemble set of plates as shown in layout drawing and install in plate carrier.

Note:

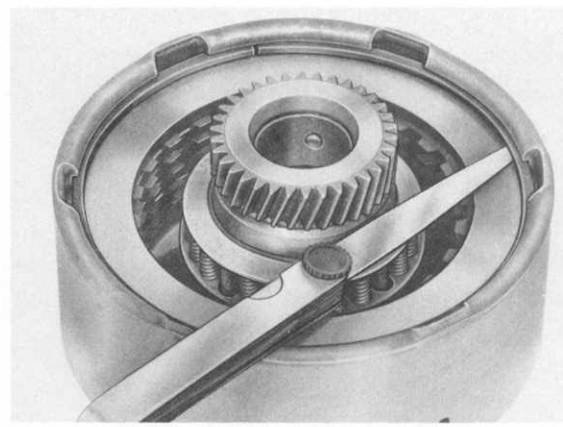
New inner plates must be placed in ATF about 1 hour before installing.

Checking Play (0.7 to 1.2 mm) of Clutch:

1. Push up snap ring around entire periphery with a suitable screwdriver.

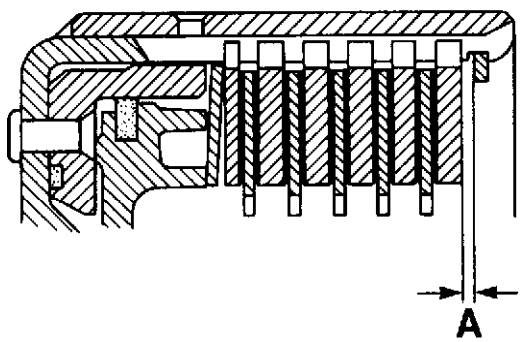


2. Check play "A" with a feeler gauge blade.

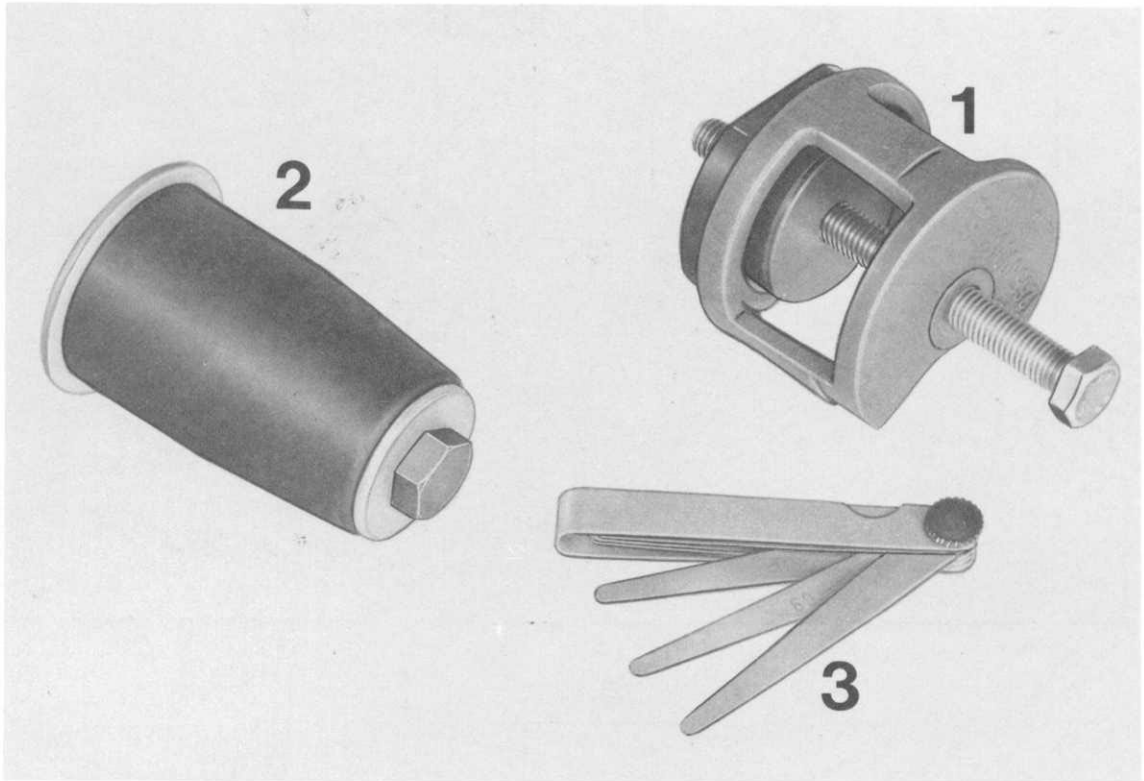


Note:

Play "A" can be adjusted with a snap ring which is available in 3 thicknesses (2.0 / 2.5 / 3.0 mm). However, if the specified play cannot be reached with snap rings, the center outer plates must also be used for adjusting.

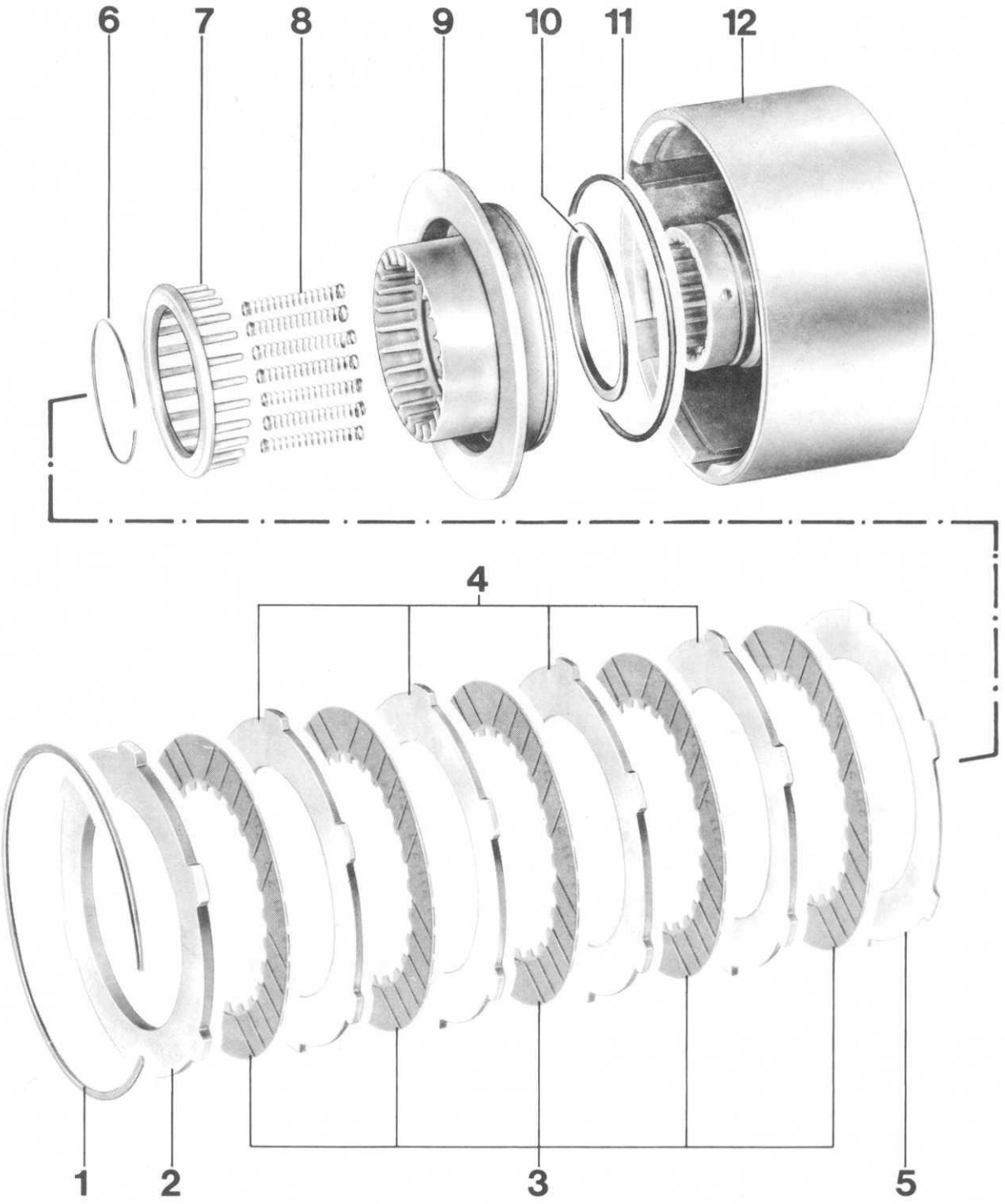


TOOLS



No.	Description	Special Tool	Remarks
1	Assembly tool	9315	
2	Assembly sleeve	9317	
3	Feeler blade gauge	–	Standard tool

DISASSEMBLING AND ASSEMBLING CLUTCH K 2



Printed in Germany

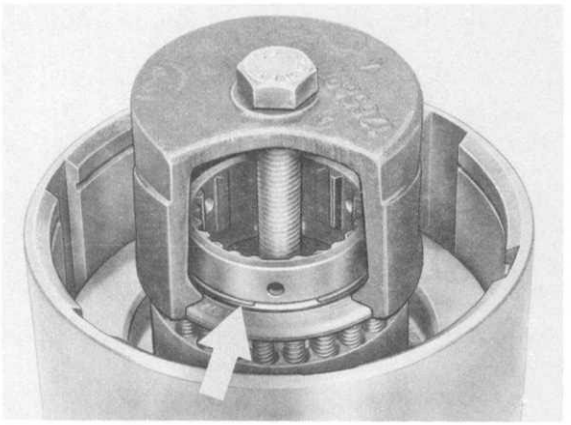
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Snap ring	1		Redetermine thickness if necessary	
2	Outer plate	1		Check for burnt spots and bending	4.5 or 5.0 mm thick (optional to adjust play)
3	Inner plate (2.1 mm thick)	5		Check for burnt spots and wear. Replace if thickness is less than 2 mm. Place in ATF about 1 hour before installing.	
4	Outer plate	4		Check for burnt spots and bending	3.0 or 3.5 mm thick (optional to adjust play)
5	Outer plate (2 mm thick)	1		Check for burnt spots and bending	
6	Snap ring	1	Remove with Special Tool 9315	Install with Special Tool 9315. Check for correct fit	
7	Diaphragm spring	1			
8	Spring	X	Note quantity for reinstallation		
9	Piston	1		Install with Special Tool 9317	

No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
10	Seal	1		Position correctly, coat with ATF	
11	Seal	1		Coat with ATF, must not turn on its own	
12	Plate carrier	1			

DISASSEMBLING AND ASSEMBLING CLUTCH K 2

Disassembling

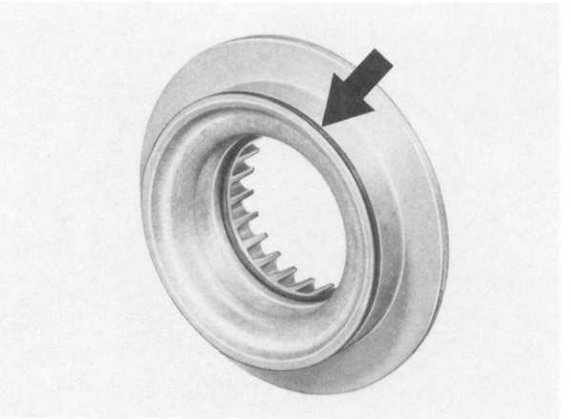
1. Apply Special Tool 9315 on diaphragm spring and tighten until snap ring can be removed.



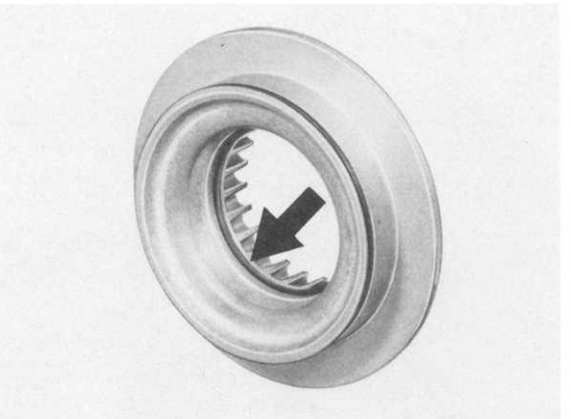
2. Remove diaphragm spring and springs.

Note:

The quantity of springs for clutch piston will vary. If new springs are required, the quantity must not be changed.



2. Install seal in piston that sealing lip faces down (direction of arrow).

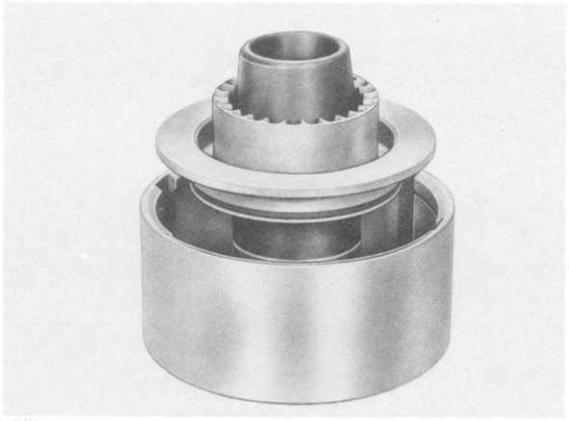


3. Apply Special Tool 9317 on plate carrier.

Assembling

1. Install seal and make sure that seal does not turn on its own.

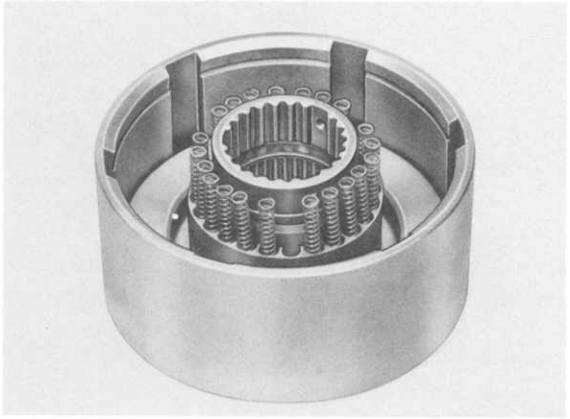
4. Install piston in plate carrier by turning slightly. Do not cant the piston.



Note:

Coat seals and sliding surfaces on special tool with ATF.

5. Install springs in piston and mount diaphragm spring that each spring is centered by a guide pin.



6. Apply and tighten Special Tool 9315.

7. Install snap ring.

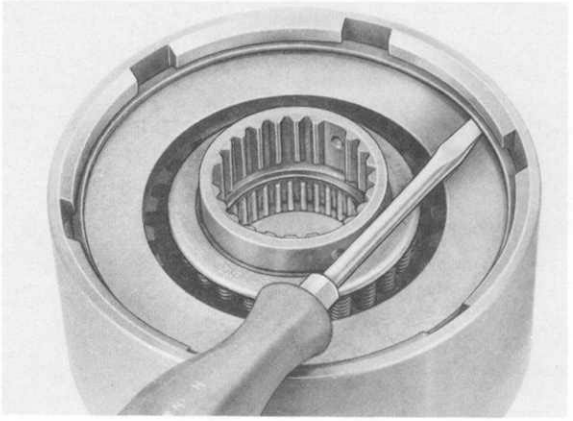
8. Assemble set of plates as shown in layout drawing and install in plate carrier.

Note:

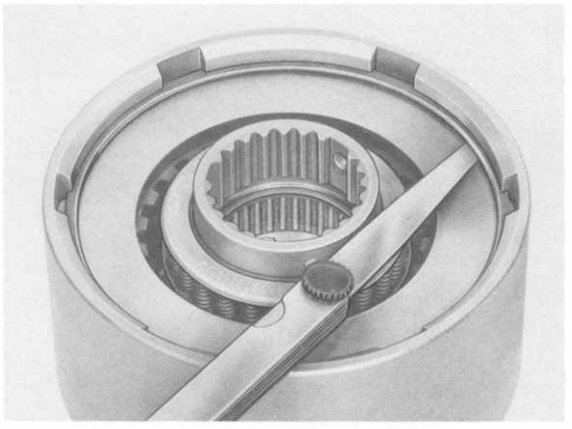
Place new inner plates in ATF about 1 hour before installing.

Checking Play (0.7 to 1.2 mm) of Clutch:

1. Push up snap ring around entire periphery with a suitable screwdriver.

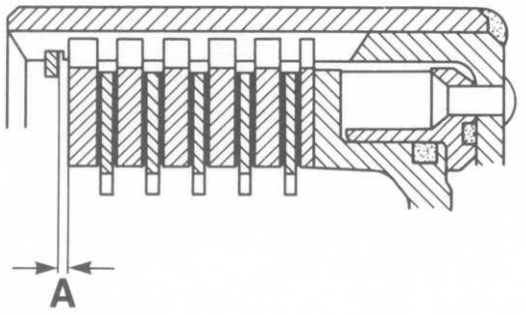


2. Check play "A" with a feeler gauge blade.

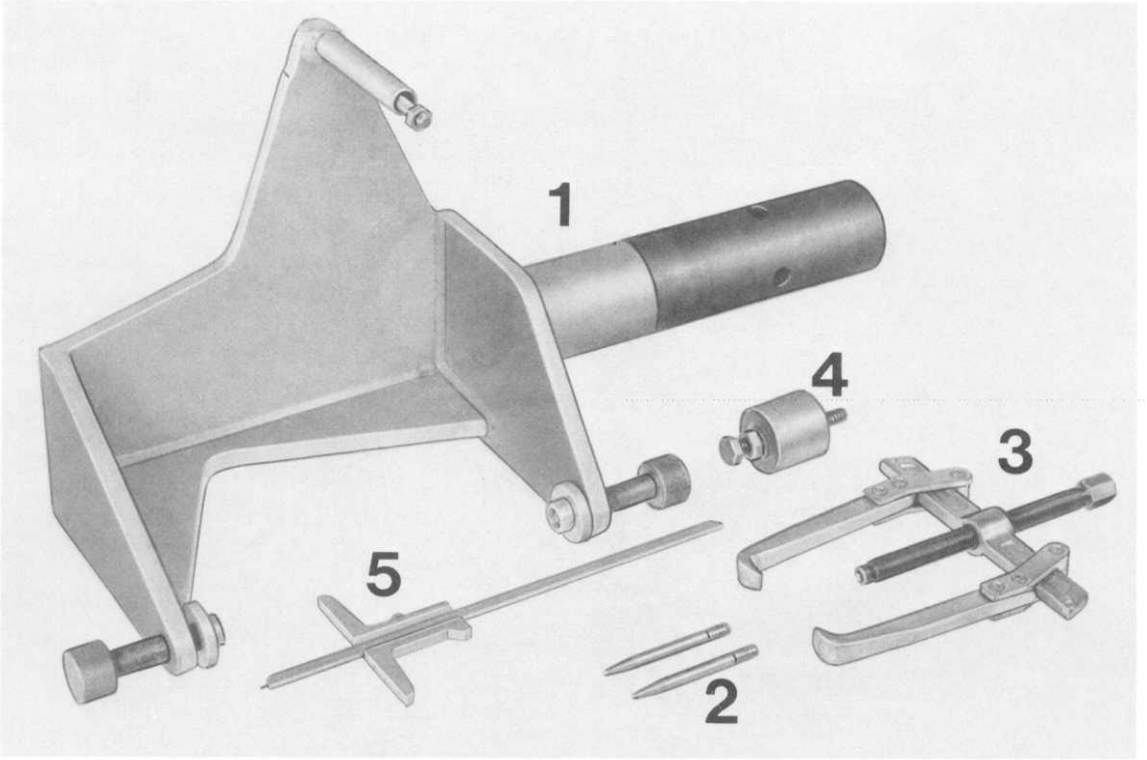


Note:

Play "A" can be adjusted with a snap ring which is available in 3 thicknesses (2.0 / 2.5 / 3.0 mm). However, if specified play cannot be reached with snap rings, the center outer plates must also be used for adjusting.

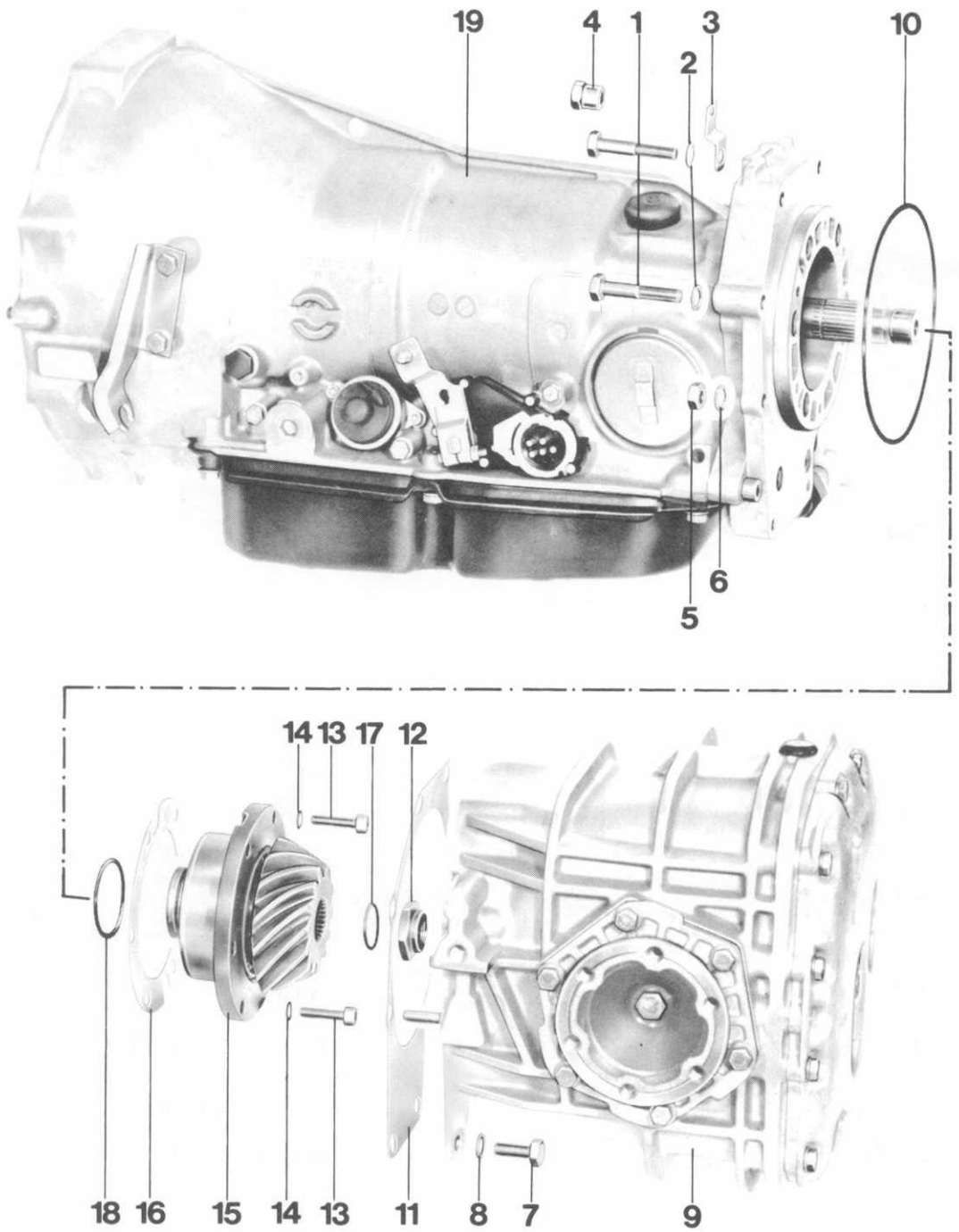


TOOLS



No.	Description	Special Tool	Remarks
1	Holder	9216	
2	Centering pin	9321	
3	Puller	–	Standard tool
4	Pressing in tool	–	Made locally (45 x 5 x 40 mm steel pipe with welded cover and 11 mm dia. bore)
5	Depth gauge	–	Standard tool

REMOVING AND INSTALLING FINAL DRIVE



No.	Description	Qty.	Note when Removing	Note when Installing
1	Bolt	4		Torque: 49 Nm / 33 ftlb
2	Washer	4		
3	Holder	1		
4	Collar nut	1		Torque: 46 Nm / 33 ftlb
5	Nut	1		Torque: 46 Nm/ 33ftlb
6	Washer	1		
7	Bolt	2		Torque: 46 Nm / 33 ftlb
8	Washer	2		
9	Final drive	1		
10	O-Ring	1		Replace, coat with ATF, check for correct fit
11	Shim S_3	X	Note quantitiy and thickness for reinstallation	Redetermine, if necessary
12	Flange nut*	1	Engage parking lock and unscrew	Tighten to 380 Nm / 275 ftlb and lock
13	Bolt	6		Torque: 33 Nm / 24 ftlb
14	Lock washer	6		Hollow side faces flange

* As of MY '92 (Transmission type A 28.18) = **450 Nm** (332 ftlb.)

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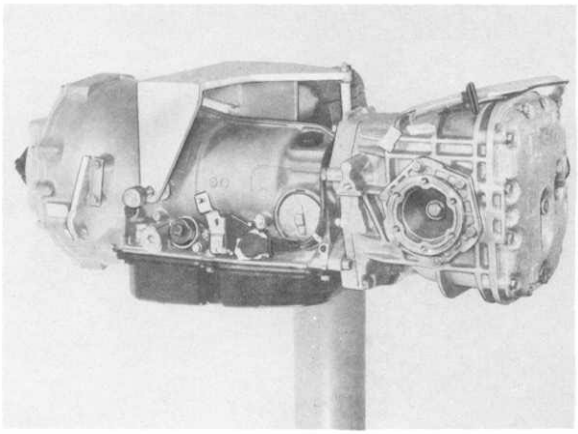
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
15	Bearing assembly with drive pinion	1	If necessary, pull out with suitable puller	If necessary, press in with locally made tool	
16	Shim	X	Note quantity and thickness for reinstallation	Redetermine, if necessary	
17	O-ring	1		Replace, coat with ATF	
18	O-ring	1		Replace, coat with ATF	
19	Automatic transmission	1			

REMOVING AND INSTALLING FINAL DRIVE

Removing

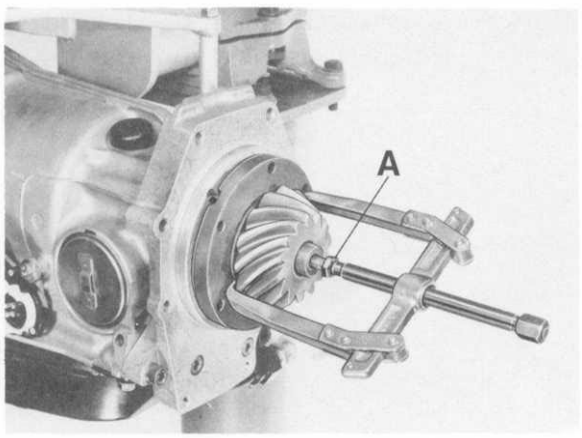
1. Remove transmission.

2. Mount transmission on assembly stand with Special Tool 9216 and drain final drive oil.



3. Engage parking lock and remove collar nut for drive pinion.

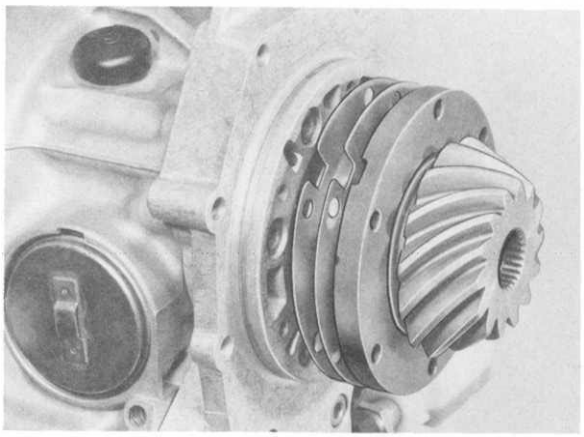
4. Remove mounting bolts for bearing assembly and pull off bearing assembly (if necessary, use a suitable puller).



A = M 10 x 30 bolt with centering bore

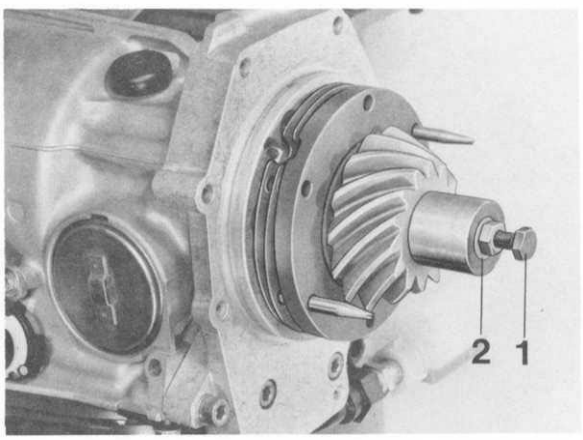
Installing

1. Install quantity of shims noted during removal or shims of redetermined thickness and bearing assembly on drive pinion.



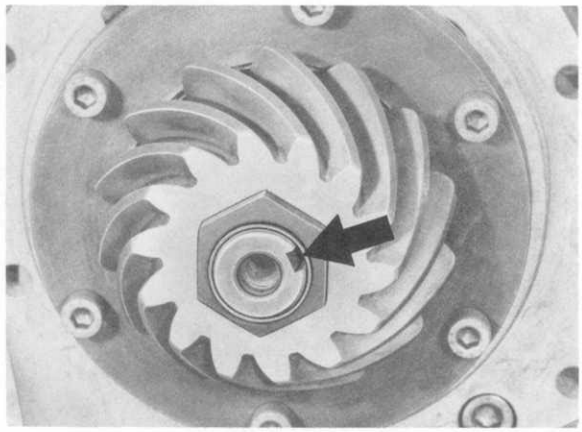
Note:

Use centering pins, Special Tool 9321, and a locally made pressing in tool to make installation easier.



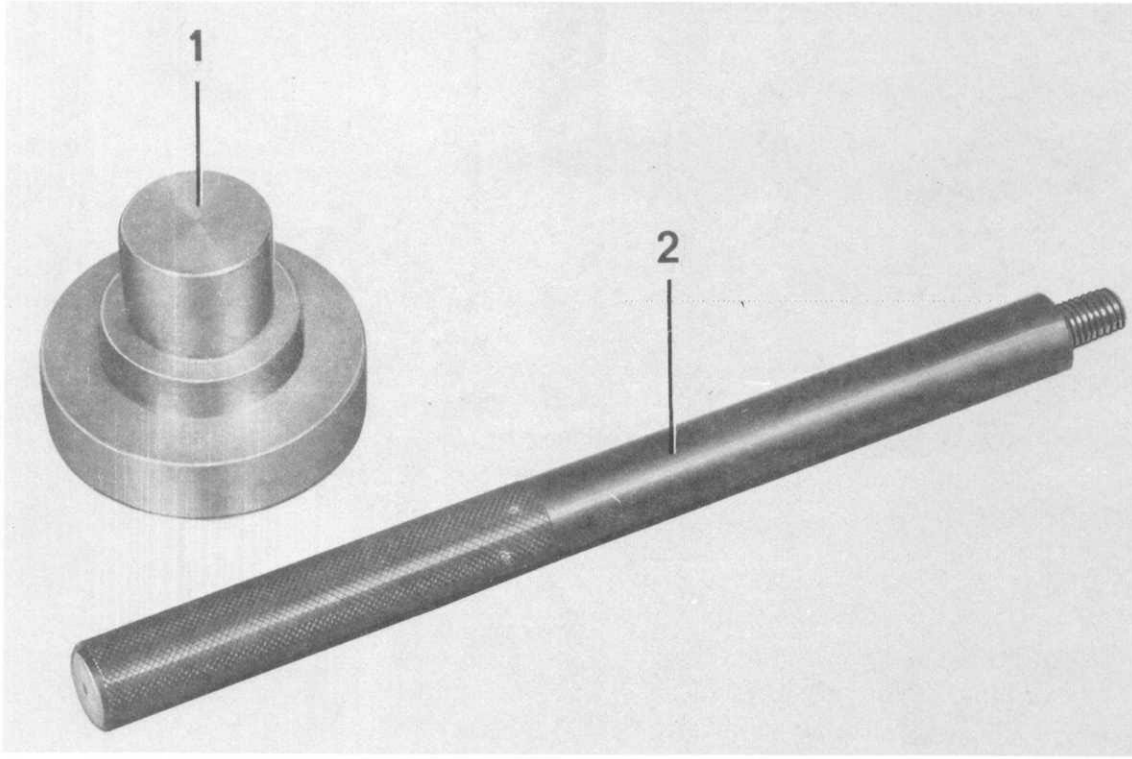
1 = Bolt from Special Tool 9148
2 = Washer

2. Tighten flange nut for drive pinion to specified torque and lock by upsetting the flange.



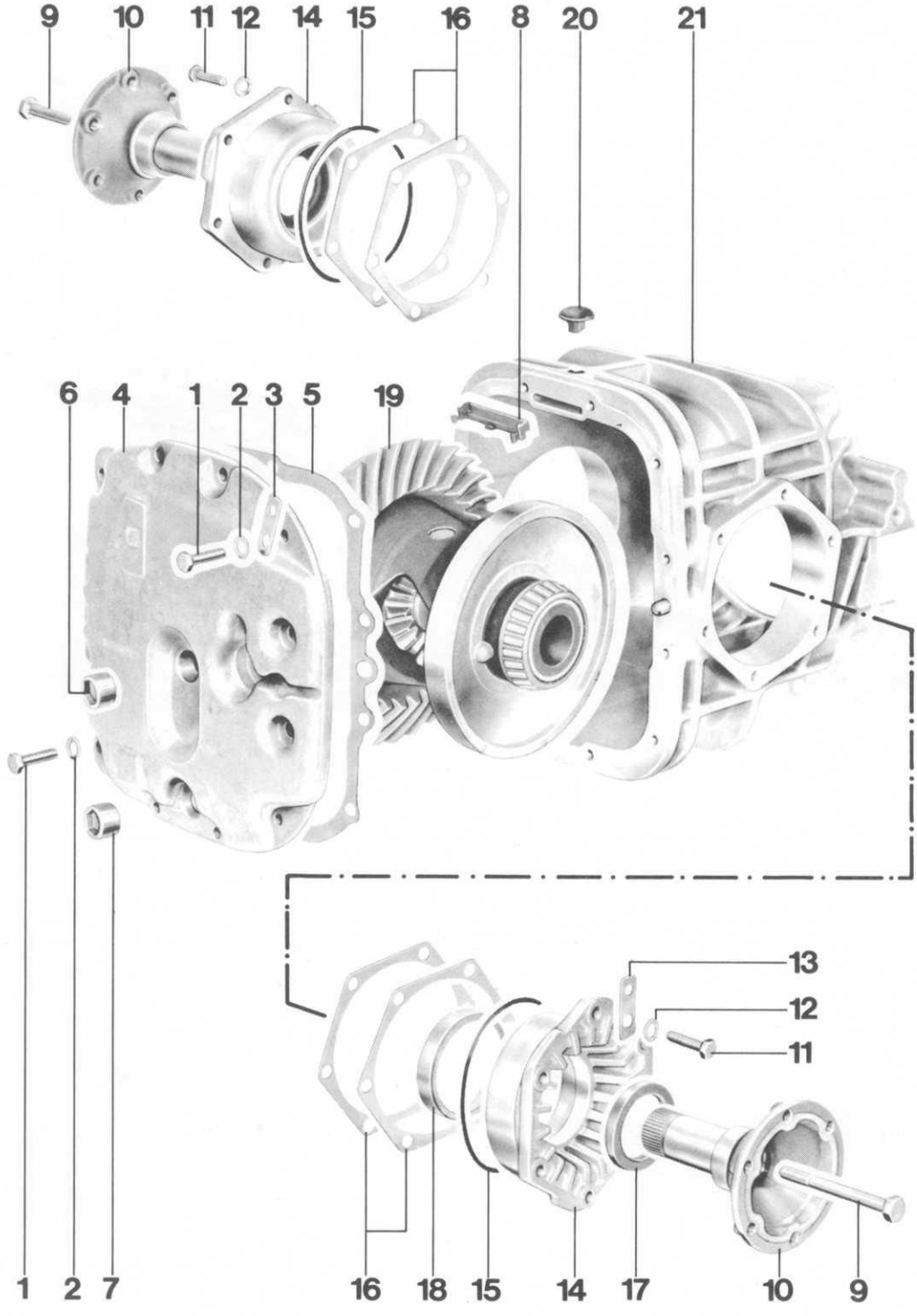
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TOOLS



No.	Description	Special Tool	Remarks
1	Pressure pad	9147	
2	Pin	–	From P 254

DISASSEMBLING AND ASSEMBLING FINAL DRIVE



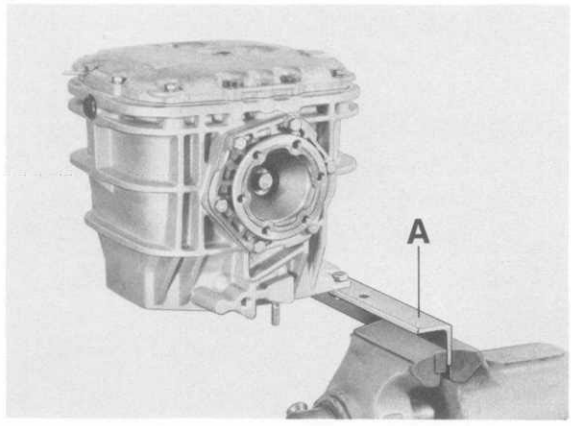
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bolt	12		Torque: 23 Nm/17 ftlb	
2	Washer	12			
3	Holder	1			
4	Cover	1			
5	Gasket	1		Replace	
6	Plug	1		Torque: 22 Nm/17 ftlb	
7	Plug (with magnet)	1		Torque: 22 Nm/17 ftlb	
8	Shield	1			
9	Bolt	2		Torque: 46 Nm/33 ftlb	
10	Joint flange	2			
11	Bolt	12		Torque: 23 Nm/17 ftlb	
12	Washer	12			
13	Holder	1			
14	Bearing cap	2	Mark for reinstallation	Must be installed same side	
15	O-ring	2		Replace, coat with final drive oil	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
16	Shim	X	Note quantity and thickness on each side for reinstallation	Redetermine, if necessary	
17	Seal	2	Drive out with a suitable screw-driver	Drive in with Special Tool 9147	
18	Tapered roller bearing outer race	2	Mark for reinstallation	Install in same bearing cap. Heat bearing cap to 100 °C/212 °F and drive in with a suitable pressure pad	
19	Differential	1		Adjust, if necessary	
20	Vent	1			
21	Case	1			

DISASSEMBLING AND ASSEMBLING FINAL DRIVE

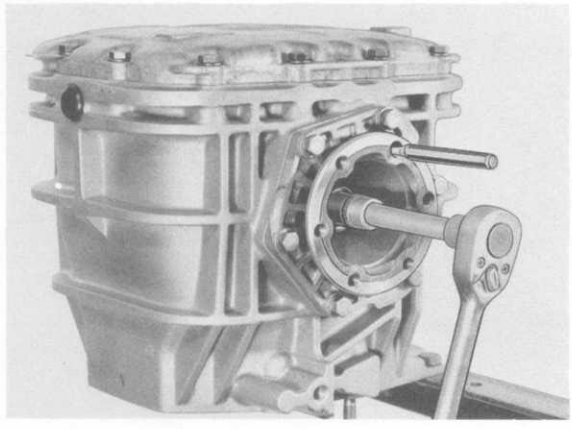
Disassembling

1. Clamp final drive in a vise with a suitable fixture.



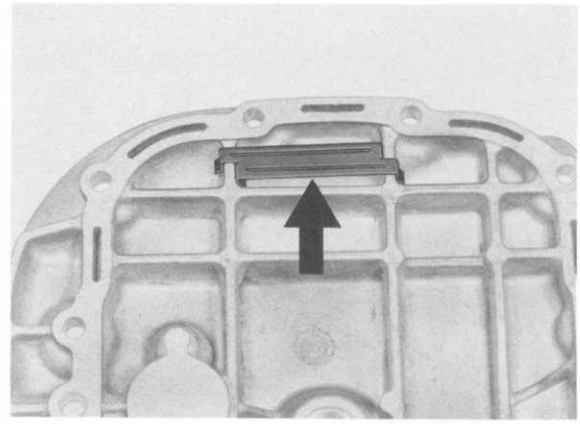
A = Iron angle

2. Remove bolt for joint flange and take off flange.

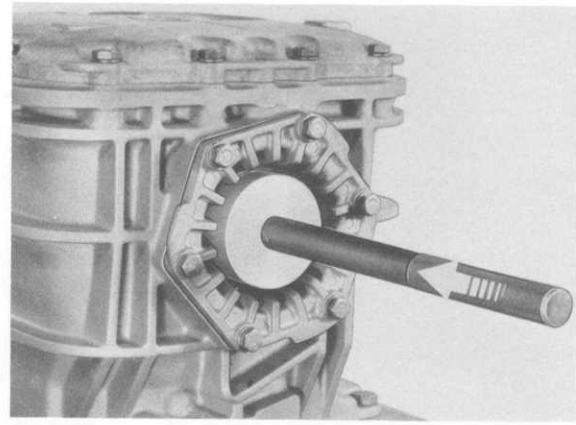


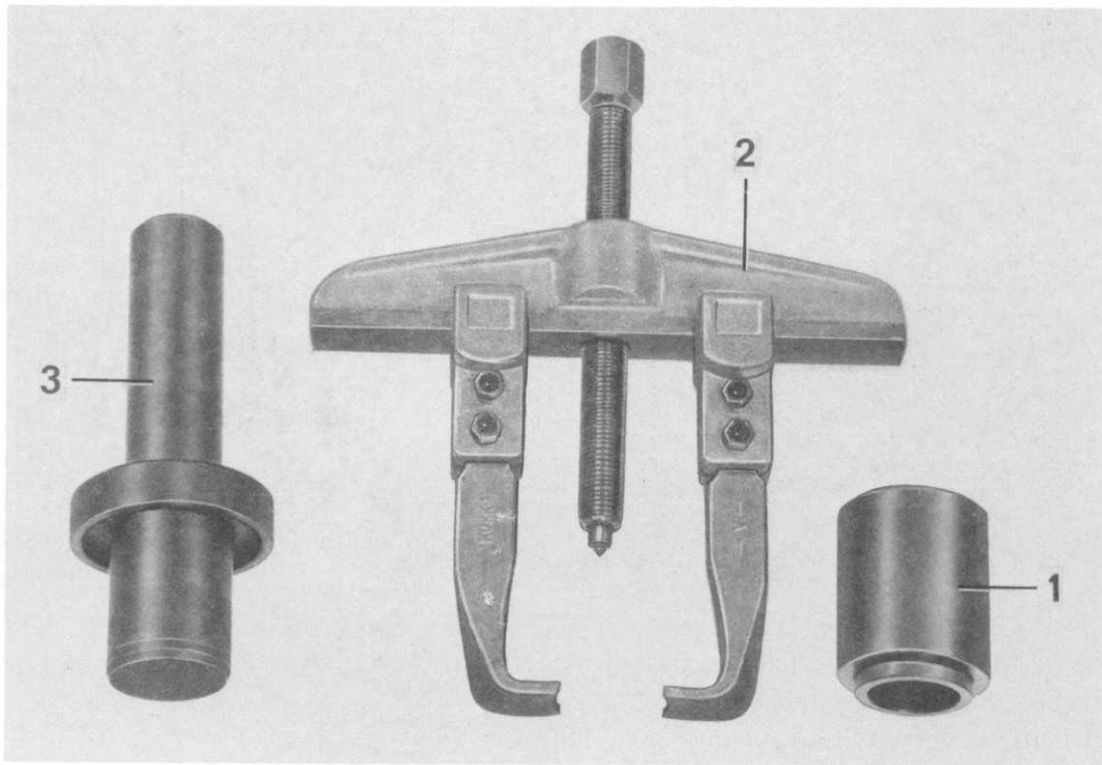
Assembling

1. Install shield.



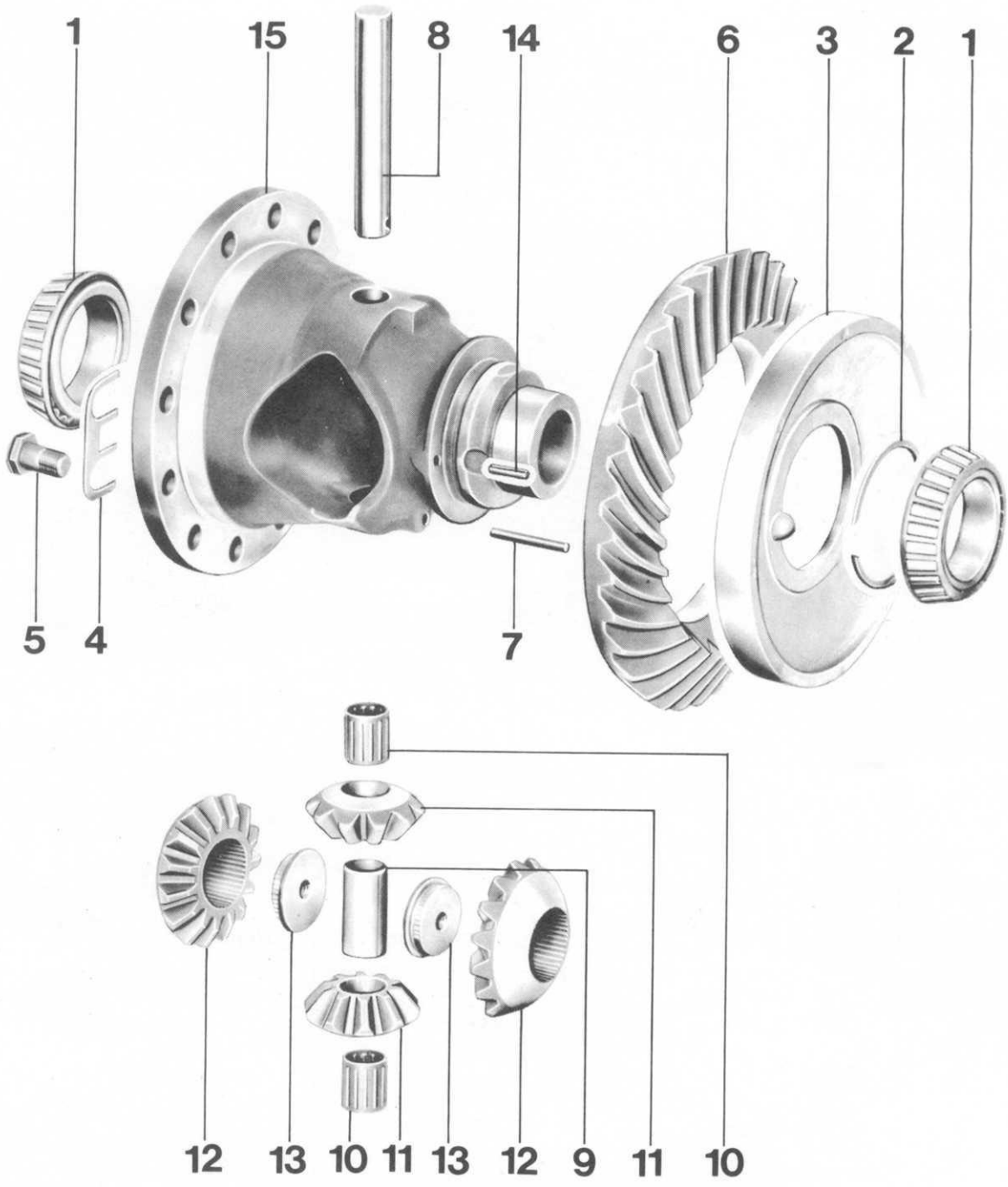
2. Drive in seal for joint flange with Special Tool 9147.





No.	Description	Special Tool	Remarks
1	Pressure pad	P 263	
2	Puller	—	Standard tool
3	Pressure pad	P 264 b	

DISASSEMBLING AND ASSEMBLING DIFFERENTIAL



No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Tapered roller bearing inner race	2	Pull off with a suitable puller and Special Tool P 263	Drive on with Special Tool P 264 b	
2	Circlip	1			
3	Magnet carrier plate	1			
4	Lockplate	6		Replace	
5	Bolt	12		Threads must be dry and greaseless. Torque: 150 Nm/ 108 ftlb	
6	Ring gear	1		Tapped holes for ring gear bolts must be dry and greaseless. Note pair number. Adjust if necessary	
7	Pin	1			
8	Differential pin	1			
9	Spacer *	1			
10	Needle cage *	2			
11	Small differential gear	2		Coat oval surface with MoS_2 paste. Replace only in pairs	

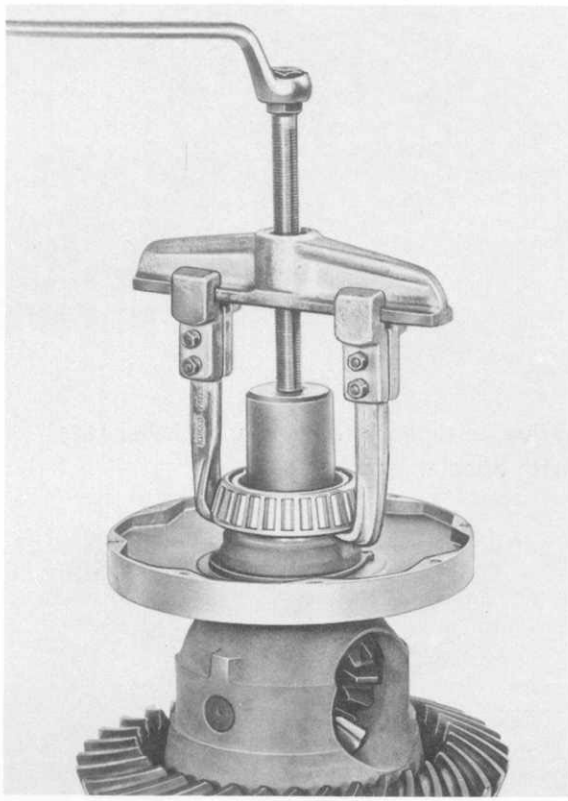
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
12	Large differential gear	2		Coat oval surface with MoS_2 paste. Replace only in pairs	
13	Threaded piece	2			
14	Key	1			
15	Differential case	1			

* Modified needle-bearing mount as from Model '86. The spacer sleeve is no longer required thanks to the new needle-roller assembly.

DISASSEMBLING AND ASSEMBLING DIFFERENTIAL

Disassembling

1. Pull off tapered roller bearing inner race with a suitable puller and Special Tool P 263.



2. Coat oval surface of differential gears with MoS_2 paste.

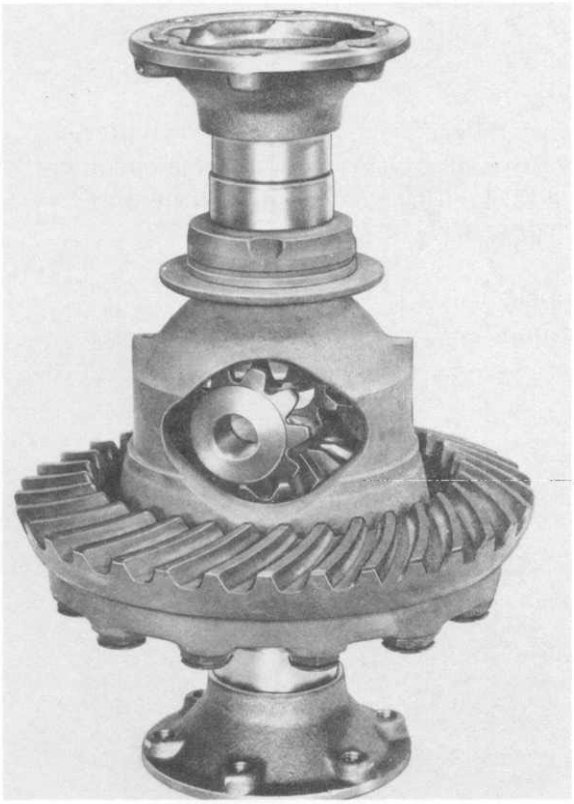
3. Install large differential gears with press-fit threaded plates through large opening in differential case and hold with joint flanges.



Assembling

1. Install ring gear on case and tighten ring gear bolts to 150 Nm/108 ftlb. Slide lock-plate into groove of bolts, squeeze together at front with a pliers (to unite lockplate with bolt) and bend down over a hexagon surface to lock.

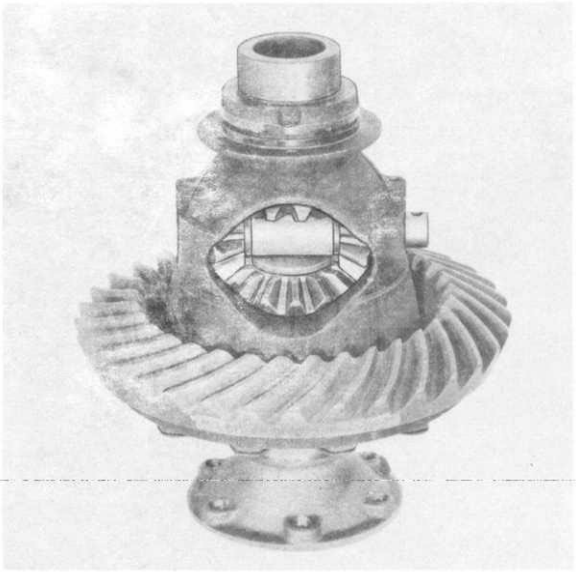
4. Install small differential gears between large differential gears and turn, until bores of gears are aligned with bores in case.



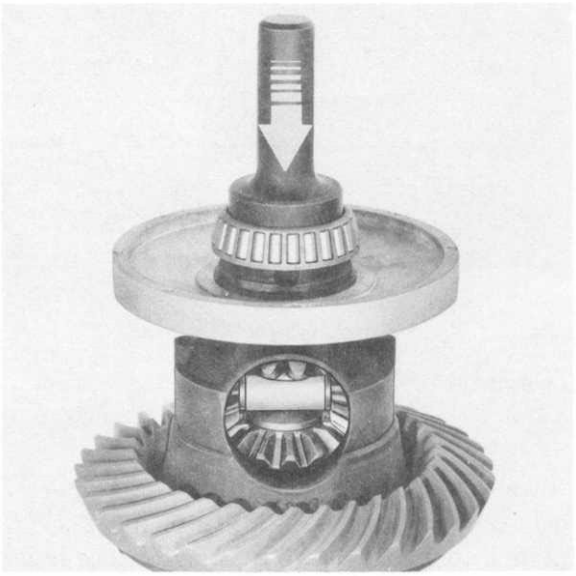
5. Install needle cages and spacer.



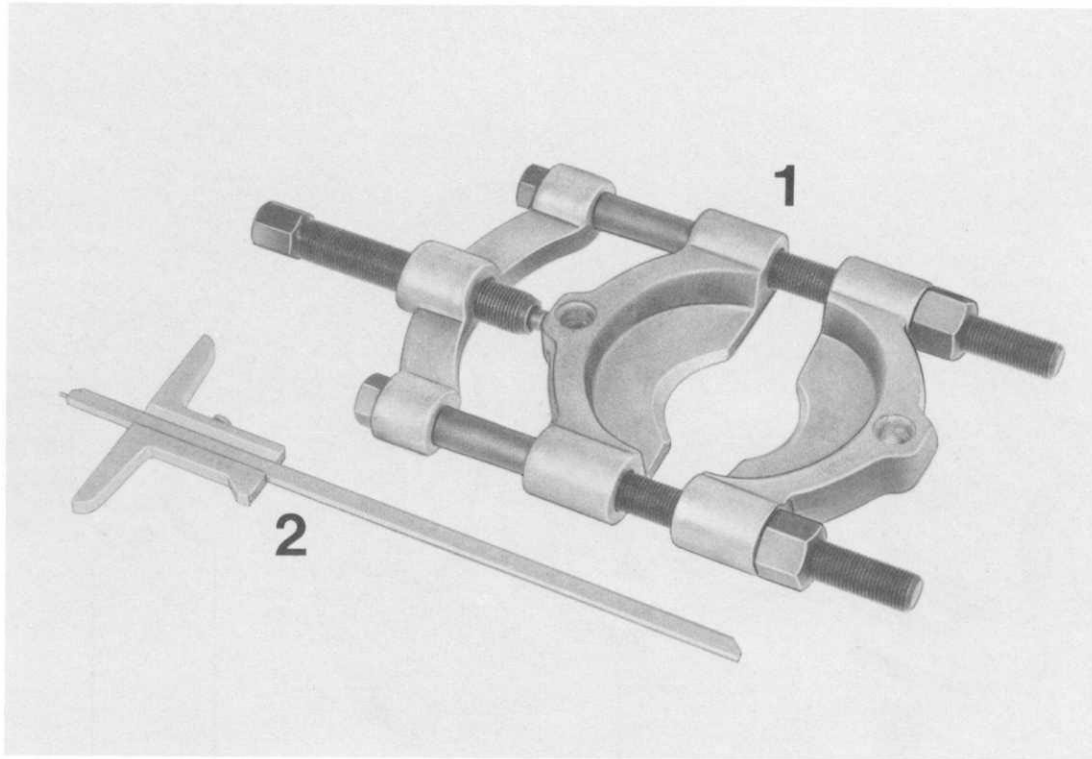
6. Drive in differential pins to correct position and lock with key.



7. Drive on tapered roller bearing inner race with Special Tool P 2546.

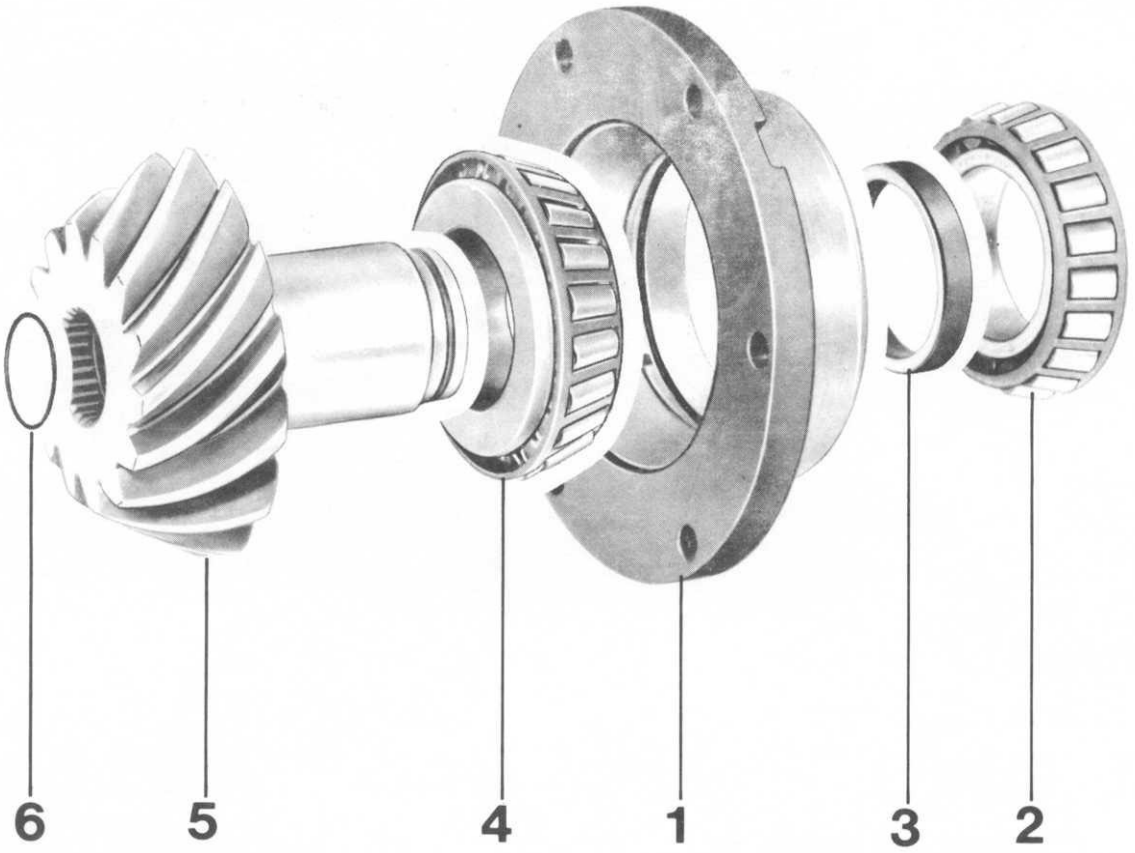


TOOLS



No.	Description	Special Tool	Remarks
1	Puller	–	e. g. Kukko, size 2
2	Depth gauge	–	Standard tool

DISASSEMBLING AND ASSEMBLING BEARING ASSEMBLY

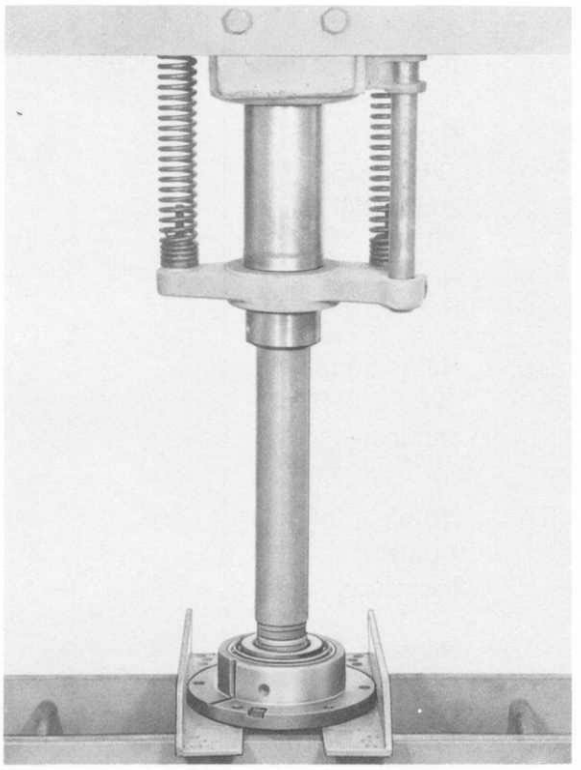


No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bearing flange	1		For replacements only available as complete part (positions 1 to 4)	
2	Tapered roller bearing inner race	1		Heat to approx. 120 °C/250 °F and install	
3	Adjusting ring	X			
4	Tapered roller bearing inner race	1		Heat to approx. 120 °C/250 °F and install	
5	Pinion	1	Press out with a piece of suitable pipe	Note pair number. Adjust if necessary	
6	O-ring	1		Replace, coat with ATF	

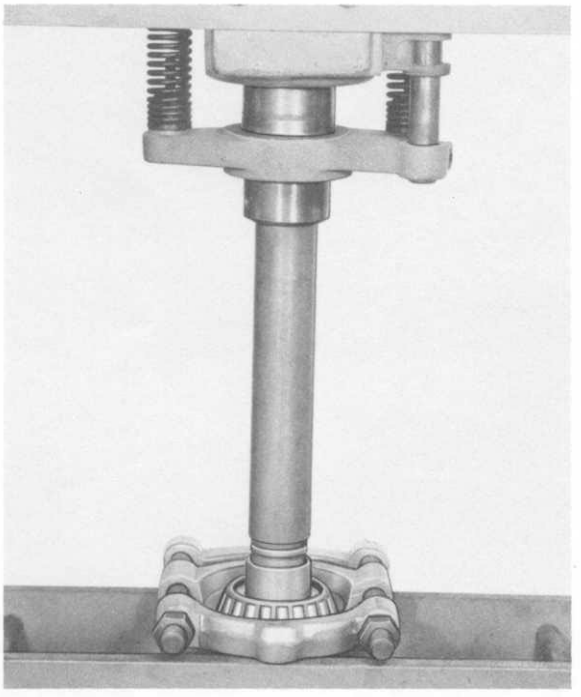
DISASSEMBLING AND ASSEMBLING BEARING ASSEMBLY

Disassembling

1. Press out pinion with a piece of suitable pipe.



2. Press off tapered roller bearing inner race with a special tool (e. g. Kukko, size 2).



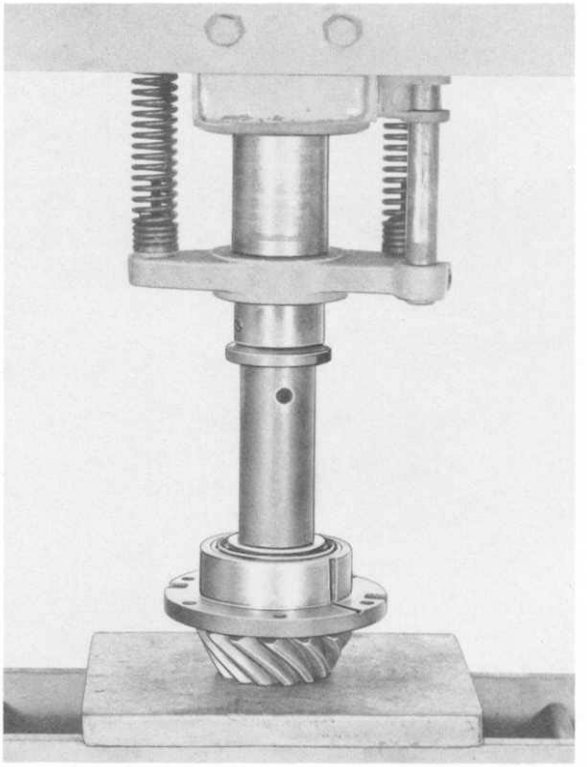
Assembling

Note:

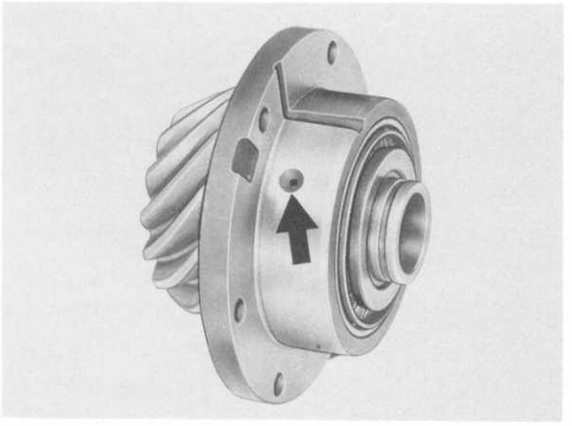
Bearing flange is only available as a complete unit (with tapered roller bearings and adjusting ring) for replacements.

1. Heat tapered roller bearing inner races to approx. 120 °C/250 °F and install.

2. Press on assembled bearing with a piece of suitable pipe (approx. 5 tons force).



3. Lubricate both tapered roller bearings with final drive oil through oil feed bore after installation.



4. If necessary, determine thickness of shims for bearing assembly.

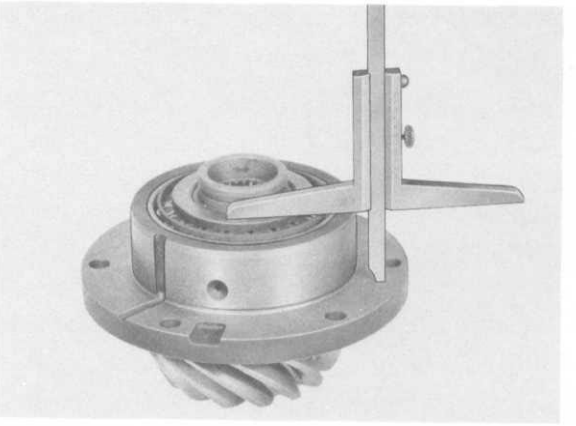
Determining Thickness of Shims for Bearing Assembly

Note:

The adjustment of bearing assembly is important for axial play of automatic transmission.
Consequently the thickness of shims has to be determined again after repairing or replacing a bearing assembly.

Use a depth gauge to measure distance from tapered roller bearing surface to bearing flange surface (for example: 34.55 mm).

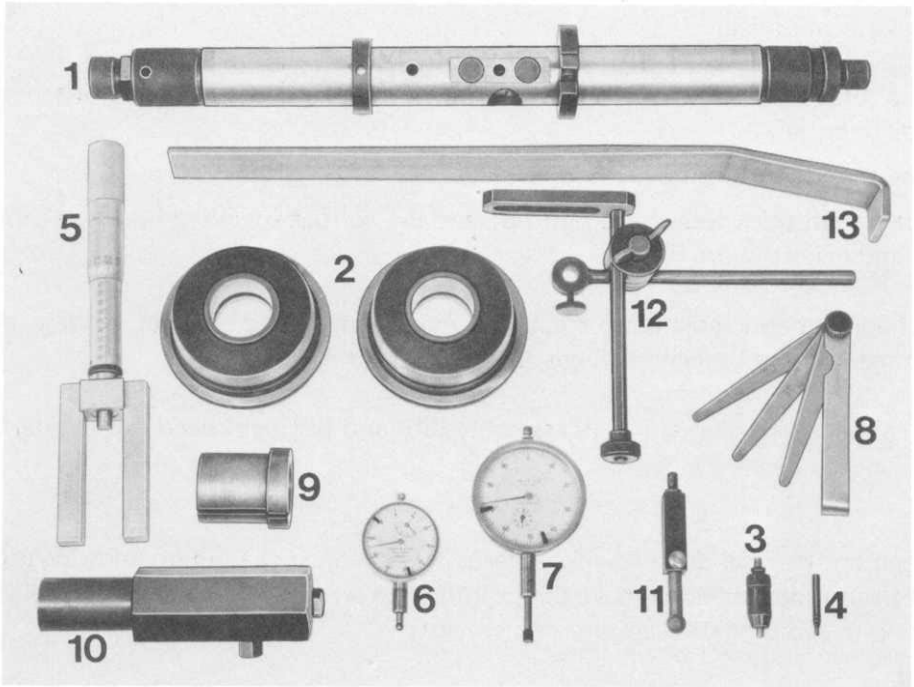
Since the design calls for a distance of only 34 ± 0.05 mm, a shim 0.55 mm thick has to be used.



Example:

34.55 mm	actual distance (measured)
– 34.00 mm	nominal distance (specified)
0.55 mm	thickness of shims

TOOLS



No.	Description	Special Tool	Remarks
1	Master gauge	VW 385/1	
2	Centering plates	VW 385/4	
3	Master plunger	VW 385/14	
4	Dial gauge extension (30 mm)	9323	
5	Adjusting gauge	VW 385/30	
6	Dial gauge	–	Standard, 3 mm range
7	Dial gauge	–	Standard, 10 mm range
8	Feeler gauge	–	Standard, 0.05 to 1.0 mm
9	Clamping sleeve	9145	
10	Adjusting fixture	VW 521/4	
11	Master lever	VW 388	
12	Dial gauge holder	VW 387	
13	Lever	–	Made locally

Recommended Sequence for Adjustment of Pinion/Ring Gear

If drive pinion and ring gear have to be adjusted, the following sequence of procedures would be most economical.

1. Determine total shim thickness "Sges" (S_1 plus S_2) for specified preload of tapered roller bearing/differential.
2. Determine shim thickness "S_3".
3. Divide total shim thickness "Sges" into S_1 and S_2, so that specified backlash is between ring gear and drive pinion.

Objective of adjustments must be to regain the maximum degree of quiet running, as had been determined by the special testing machine in manufacturing.

Absolute cleanliness is essential for all assembly jobs and testing procedures to guarantee perfect results.

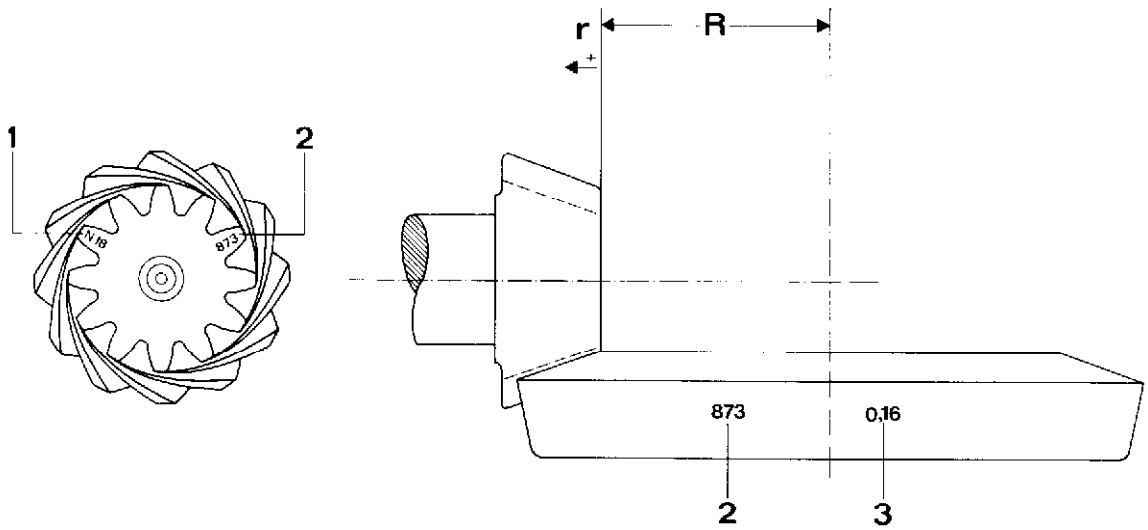
After working on the final drive it will be necessary to adjust the pinion and ring gear, if parts had been replaced which have direct influence on said adjustment. The following chart will help in avoiding unnecessary adjustments!

Adjust: / Part Replaced	Ring Gear ($S_1 + S_2$)	Drive Pinion Deviation "r" (S_3)
Transm. case (automatic) or rear transmission case	X	X
Bearing assembly for pinion	X	X
Final drive case	X	X
Side transmission cover	X	X
Pinion/ring gear	X	X
Differential case	X	
Tapered roller bearing for differential	X	

ADJUSTING DRIVE PINION AND RING GEAR

General Information

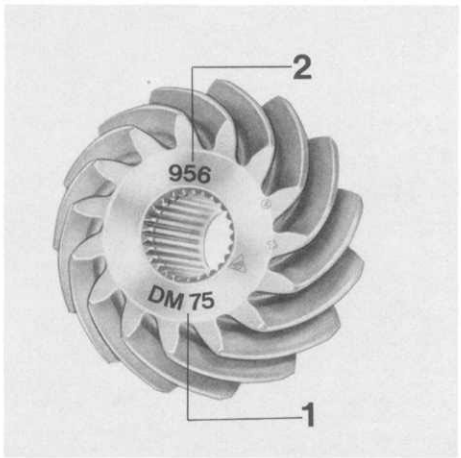
Accurate adjustments of the pinion and ring gear are immensely important for the service life and smooth running of the final drive. This is why pinions and ring gears are paired during manufacture and checked in special machines for tooth pattern and quietness in both directions of rotation. The position of smoothest running is determined by moving the pinion in an axial direction, whereby the ring gear is lifted out of the no-play meshing position far enough so that the backlash will be kept with specified tolerances. Deviation "r" from the adjusting distance called for by design (design distance "R_o") is measured and recorded on face of drive pinion. Ring gears and pinions are designed so that deviation "r" is always added to "R", i. e. is preceded by a + sign.

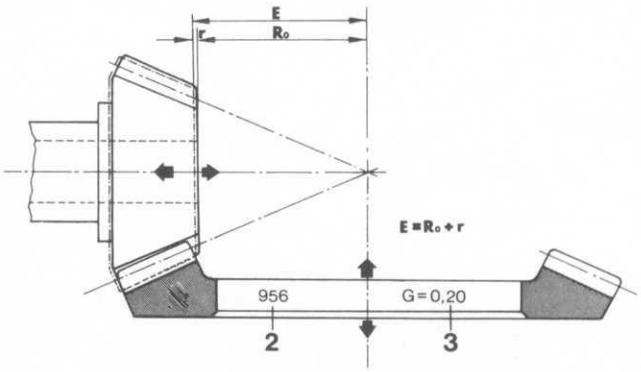


R_o = Design distance 74.70 mm
r = Deviation from R in 1/100 mm
1 = Deviation r
2 = Pair number
3 = Backlash

Changes on Drive Pinion/Ring Gear

Since about January of 1984 manufacturing uses optionally drive pinions/ring gears, on which a DM value (e. g. DM 75) is recorded instead of deviation "r" (N).
Since this DM value is equal to adjusting distance E (R_o + r), the adjusting distance does not have to be figured out for these drive pinions/ring gears.

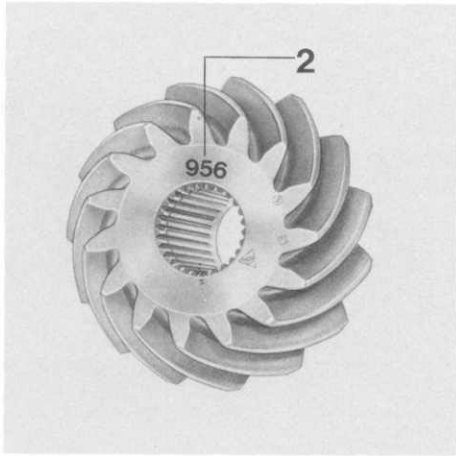


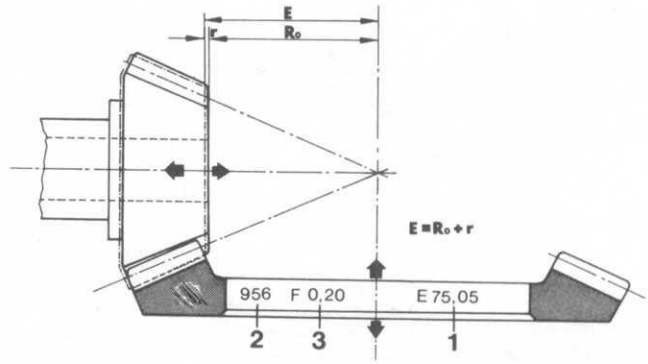


R_o = Design distance 74.70 mm
E = Adjusting distance
r = Deviation
1 = Adjusting distance (R_o + r)
2 = Pair number
3 = Backlash

Changes on Drive Pinions/Ring Gears

In the near future there will be drive pinions/ring gears with the following adjusting information.





R_o = Design distance 74.70 mm
E = Adjusting distance
r = Deviation
1 = Adjusting distance (R_o + r), e. g. 75.05 mm
2 = Pair number (three digits: 001 . . . 999)
3 = Backlash

Note:

The missing 5 mm thick gauge plate VW 385/17 must also be considered for adjustments with these drive pinions/ring gears.

Example:

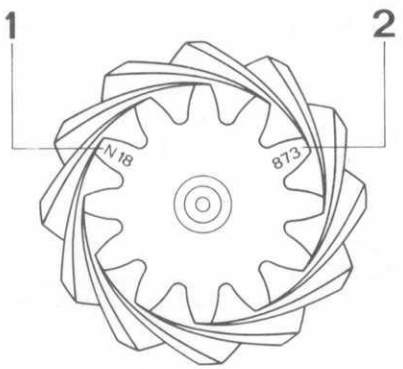
Recorded on ring gear – adjusting distance E = 75.05

Adjusting distance E	75.05 mm
Missing gauge plate	+ 5.00 mm
Adjustment of adjusting gauge	80.05 mm

ADJUSTING PINION

Pinion/Ring Gear Marked "N"

On these drive pinion/ring gear sets adjusting distance "E" is calculated from known design distance "R_o" = 74.70 mm + deviation "r", which is located on face of drive pinion.



1 = Deviation "r" in 1/100 mm
2 = Pair number

Note:

The design of the drive pinion will not allow use of the 5 mm thick Special Tool 385/17, normally applied for adjustments.

Since Special Tool VW 385/30 includes this 5 mm distance, it is important to add 5 mm to adjusting distance "E".

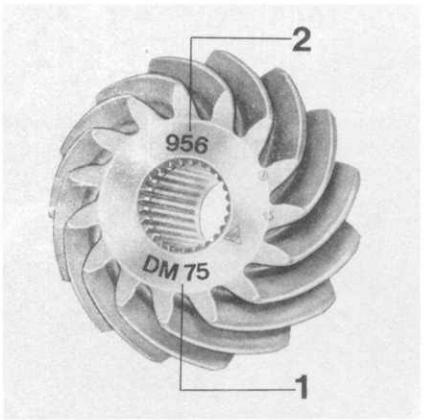
Example:

N 18 is the deviation "r" on face of pinion.

R_o = design distance	74.70 mm
r = deviation	+ 0.18 mm
E = adjusting distance	74.88 mm
Missing special tool	+ 5.00 mm
Adjustment of master gauge	79.88 mm

Pinion/Ring Gear Marked "DM"

On these drive pinion/ring gear sets "DM" is adjusting distance "E"



1 = Adjusting distance (75.00 mm in example)
2 = Pair number

Note:

The design of the drive pinion will not allow use of the 5 mm thick Special Tool 385/17, normally applied for adjustments.

Since Special Tool VW 385/30 includes this 5 mm distance, it is important to add 5 mm to adjusting distance "E".

Example:

DM 75 is adjusting distance on face of pinion.

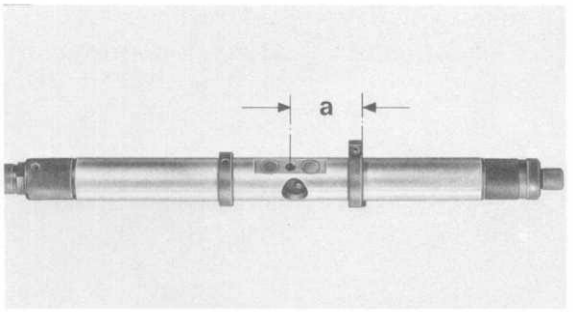
DM = adjusting distance	75.00 mm
Missing special tool	+ 5.00 mm
Adjustment of master gauge	80.00 mm

1. Install bearing assembly with shims and tighten collared nut to 380 Nm/275 ftlb.

2. Install final drive case (without shims) and tighten all bolts or nuts to 46 Nm/ 33 ftlb.

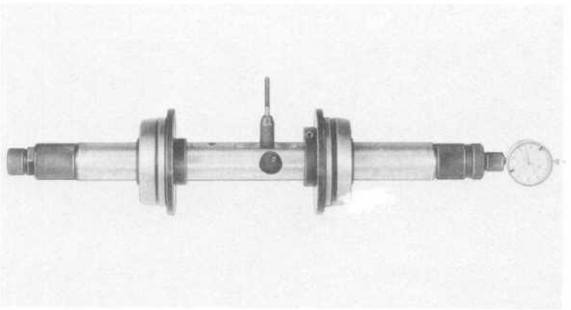
3. Install one side bearing cover without O-ring and secure with two bolts.

4. Adjust setring of Special Tool VW 385/1 to distance "a".



a = 39 mm

5. Slide Special Tools VW 385/4 on to 385/1. Install Special Tool VW 385/14 with dial gauge extension 9323.

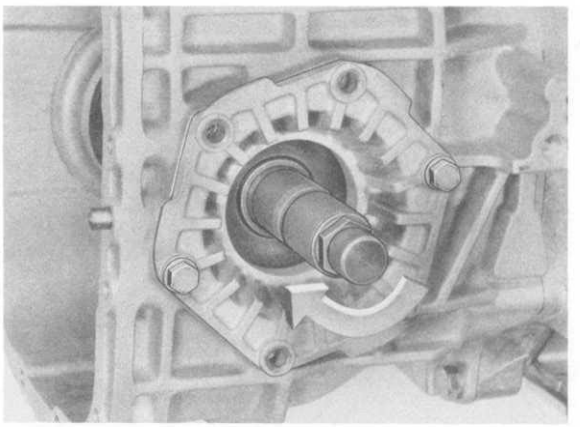


6. Turn pinion that surface of collared nut is vertical.

7. Insert master gauge into case.

8. Install second side bearing cover without O-ring and secure with two bolts.

9. Pull out centering plate of master gauge with the spindle that master gauge can still just be turned by hand.



10. Set Special Tool VW 385/30 to adjusting distance "E" + 5 mm (for missing Special Tool VW 385/17).

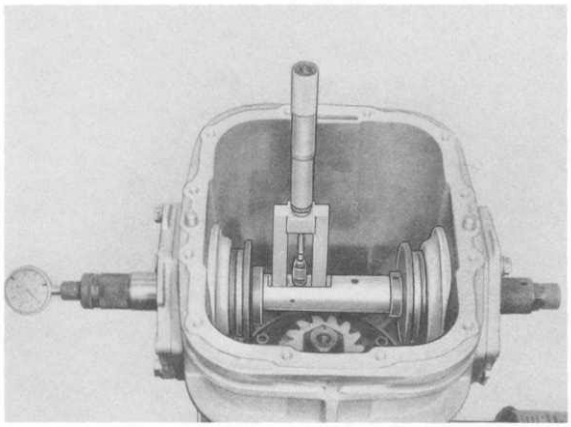
Example:

R_o =	74.70 mm		
r =	+ 0.18 mm		
E =	74.88 mm		
	+ 5.00 mm		
	79.88 mm	adjustment of master gauge	

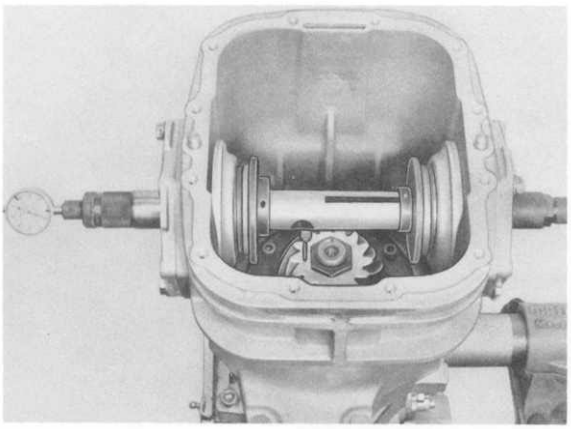
Example:

DM = E 75.00 mm
+ 5.00 mm
80.00 mm adjustment of master gauge

11. Install master gauge and set (3 mm range) dial gauge at zero with 1 mm preload.



12. Turn master gauge carefully until dial gauge extension is vertical to face of drive pinion head. At this moment dial gauge needle will reach its point of reverse direction, at which dial gauge must be read.



Note:

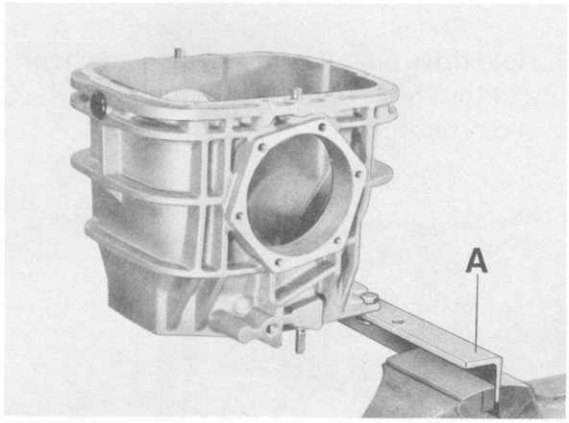
The measured value will always deviate from the set distance in clockwise direction (small needle of dial gauge will be between 1 and 2), i. e. when adjusting the dial gauge with 1 mm preload the value deviating from 1 is added as shim thickness S_3.

13. Install the determined shim thickness S_3 between transmission case and final drive case.

14. Recheck distance after installation of shims with determined thickness.
A deviation of ± 0.03 mm is permissible.

ADJUSTING RING GEAR (Sges)

1. Clamp final drive case in a vise, using a suitable fixture.



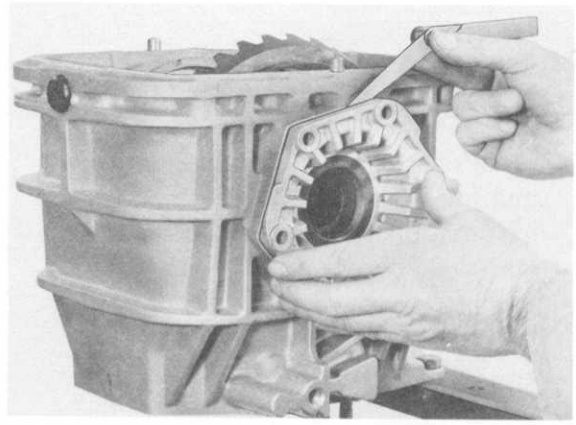
A = L-iron bar

2. Install differential with ring gear in case.

3. Install side transmission cover (ring gear end) without shims and tighten all hexagon head bolts to 23 Nm/17 ftlb.

4. Guide in second side transmission cover without shims carefully.

5. Check gap between transmission case and side transmission cover with a feeler gauge.



6. Calculate shim thickness Sges.

Sges. = gap – 0.30 mm (bearing preload)

Example:

Gap	1.25 mm
Bearing preload	– 0.30 mm
Sges.	0.95 mm

ADJUSTING BACKLASH

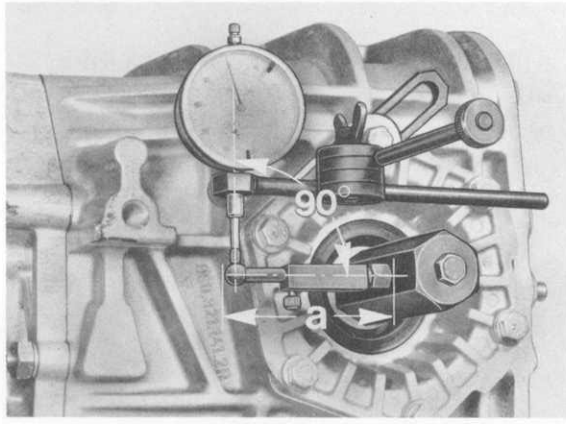
1. Place shims determined for pinion adjustment between transmission case and final drive case. Install final drive case and tighten all mounting bolts to specified torque of 46 Nm/33 ftlb.

2. Install differential in case.

3. Install side transmission cover, using total shim thickness "Sges" as determined on ring gear end and tighten all hexagon bolts to 23 Nm/17 ftlb.

4. Turn differential in both directions several times, to settle tapered roller bearings.

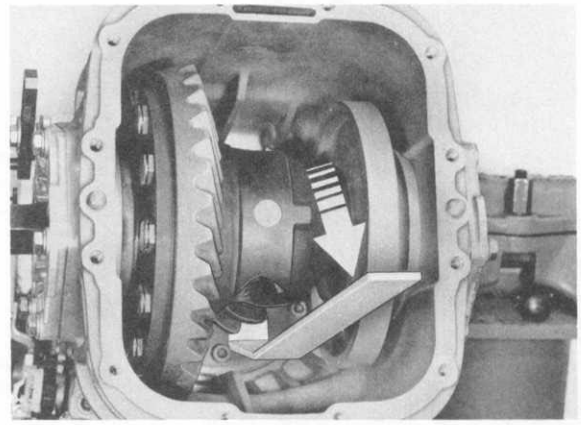
5. Install measuring tools. Set Special Tool VW 388 to distance "a" = 80 mm.

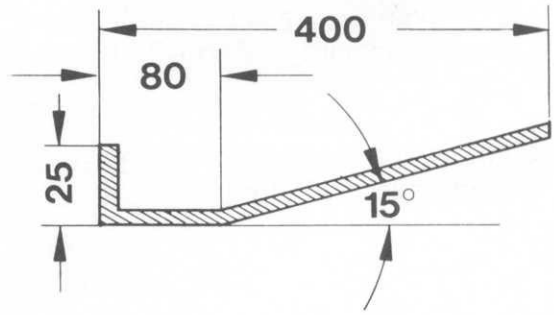


6. Engage parking lock.

7. Turn ring gear carefully by hand against stop and set dial gauge to zero.

8. Hold drive pinion with locally made hook and turn back ring gear carefully. Read and note amount of backlash.





Hook made locally from flat iron 30 x 5 mm

DETERMINATION OF SHIMS S_1 AND S_2

Measured backlash must be brought to value specified by manufacturer of pinion/ring gear by splitting total shim thickness Sges.

Backlash required is stamped on ring gear. Adjusted backlash value could be less by 0.05 mm, but must never be greater than the stamped value.

Determining Shim Thickness S_1 (Ring Gear End)

S_1 = Sges (total shim thickness)
− measured backlash
+ backlash inscribed on ring gear

Example:

Sges	0.95 mm
− measured backlash	0.88 mm
	0.07 mm
+ inscribed backlash (by way of example)	0.20 mm
S_1	0.27 mm

Determining Shim Thickness S_2 (Opposite Ring Gear)

$S_2 = Sges - S_1$

Example:

Sges	0.95 mm
S_1	− 0.27 mm
	0.68 mm

Note:

On the basis of experience with these pinions/ring gears the shims S_2 (opposite ring gear) can be selected approx. 10 to 15 % thinner in favor of shims S_1 (ring gear end).

1. Remove side transmission cover and split total shim thickness Sges, that it gives the determined shim thicknesses S_1 and S_2.

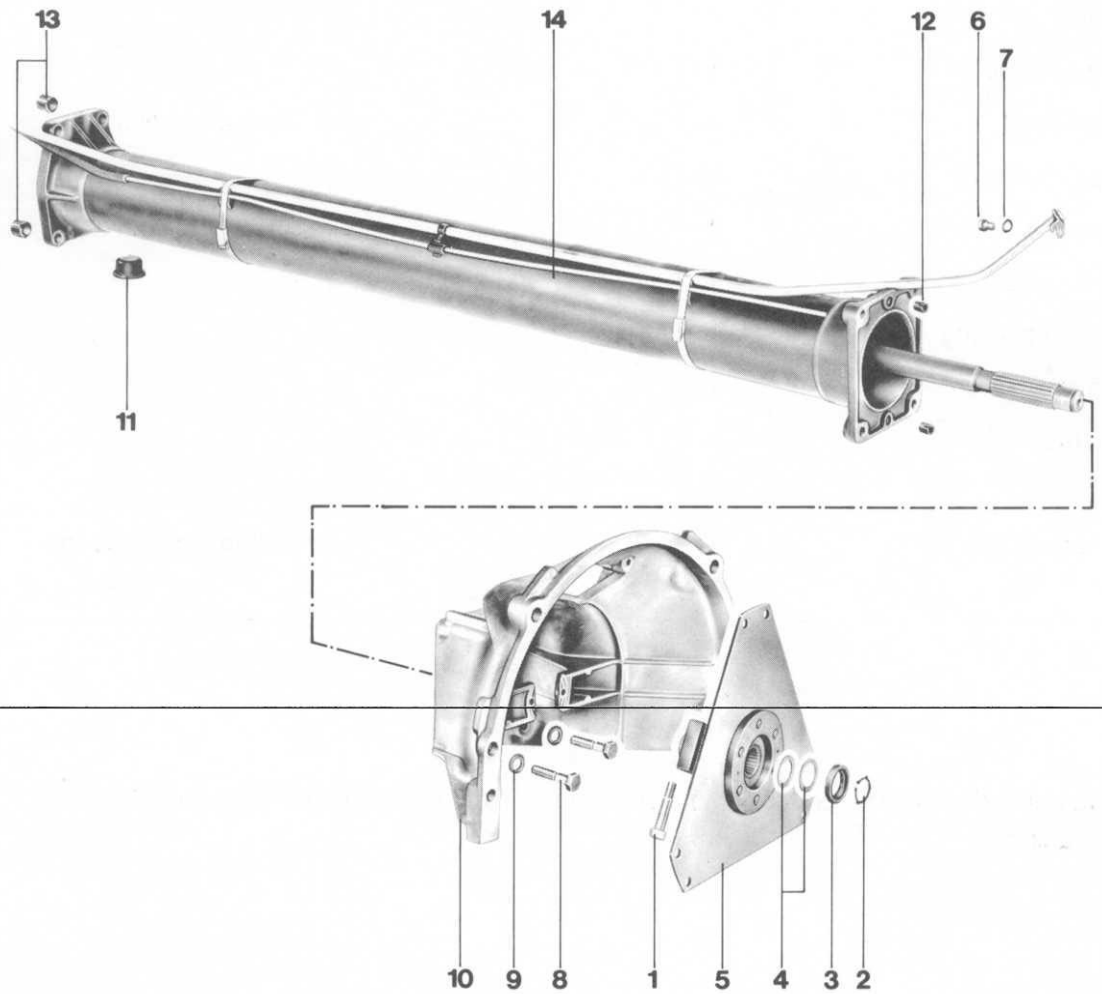
Note:

When tightening nuts for side transmission covers, always remember that there is a certain amount of backlash.
Never let the drive pinion and ring gear clamp.

2. Measure backlash and, if necessary, change shims S_1 and S_2 again until specified play is reached.

3. Check backlash at four places on periphery, turning ring gear by 90° each time. Measurements must not deviate from each other by more than 0.05 mm.

DISASSEMBLING AND ASSEMBLING CENTRAL TUBE



No.	Designation	Qty.	Note when: Removing	Replacing
1	Pan-head screw	1		Tighten only after driver plate (5) has been fitted to flywheel. Tightening torque: 80 Nm
2	Circlip*	1		
3	Sleeve*	1		
4	Shim*	X		
5	Driver plate	1		
6	Pan-head	1		Torque: 20 Nm
7	Spring washer	1		
8	Hex bolt	4		Torque: 45 Nm
9	Spring washer	4		
10	Clutch housing	1		
11	Cover	1		
12	Sleeve	2		
13	Sleeve	2		
14	Central pipe	1		prüfen ggf. erneuern

* Parts are deleted as of MY '85. Adjustment of the driver plate (including pre-1985 models) is no longer required.

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Checking Central Tube

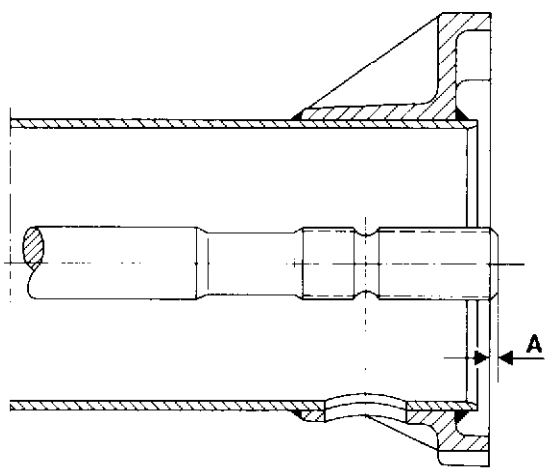
Note:

Replace entire central tube with shaft and bearings, if bearings and/or shaft are damaged.

There are no replacement parts available.

1. Check easy movement of central shaft bearings by turning shaft by hand. Shaft must turn easily and without restriction at any point.

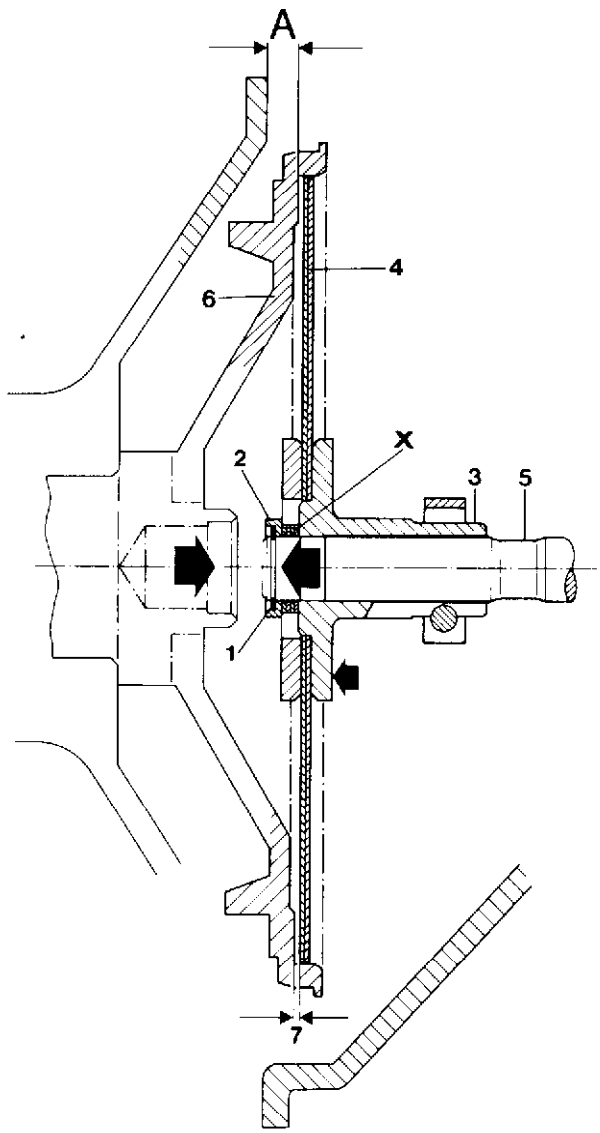
2. Position of central shaft and rear flange shaft is important to guarantee proper function.
   Distance between central shaft and rear flange must be A = 2 ± 0.5 mm.



3. Small corrections can be made by tapping face of central shaft with plastic hammer.

Adjusting Drive Plate

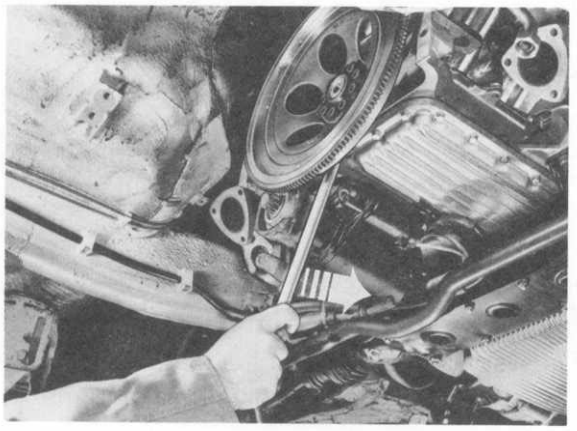
To avoid axial pressure on crankshaft and crankshaft thrust bearings, the connections between flywheel and drive plate (distance X) must be checked and adjusted after replacement of engine, flywheel or central tube. This adjustment is not necessary after replacement of transmission or transmission parts.



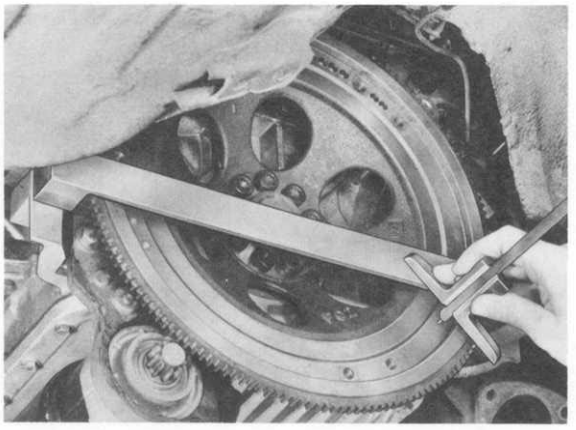
1 – Circlip
2 – Bushing
3 – Holding flange
4 – Drive plate
5 – Central shaft
6 – Engine flywheel
7 – Preload 0.3 + 0.2 mm
A – Distance A, engine flange/flywheel mating surface
X – Shim thickness (must be determined again)

Determining Distance "X"

1. Crankshaft must contact thrust bearing toward the rear. Use a lever to press flywheel in direction of transmission, until axial play of crankshaft is eliminated.



2. Determine distance "A", by using 9211 and measuring distance from engine flange to flywheel mating surface.



Note:

Mark thickness of gauge when measuring.

Example:

Measured value	52.5 mm
Gauge thickness	– 40.0 mm
Distance "A"	12.5 mm

3. Mount transmission on central tube to specified torque. Screw in clamping sleeve mounting bolt by hand (do not tighten).

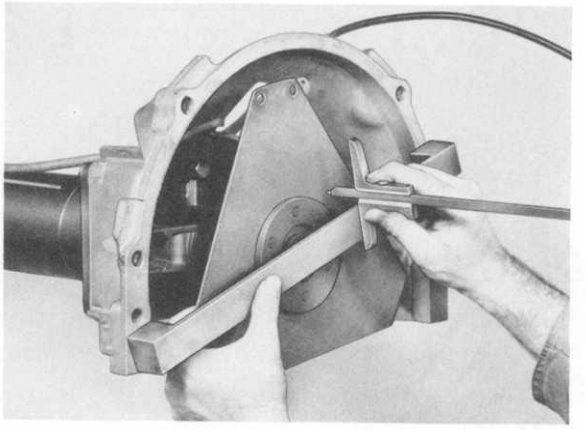
4. Push drive flange with bushing, but without shims, on to central shaft and install circlip.

5. Use a suitable lever and push central shaft on drive flange far enough forward, that central shaft rests on rear clamping screw in shaft groove.

6. Tighten rear mounting bolt for clamping sleeve to 75 . . . 85 Nm/54 . . . 61 ftlb.

7. Push drive flange forward against stop on circlip and tighten bolt.

8. Determine distance "B". Use 9211 and measure distance from clutch housing to drive plate bearing surface (as far in as possible).



Note:

Mark thickness of gauge used for measuring.

Example:

Measured value	45.4 mm
Gauge thickness	− 40.0 mm
Distance B	5.4 mm

Determine distance "X"

X = A − B + 0.3 mm preload

A =	12.5 mm
B =	− 5.4 mm
	7.1 mm
Preload	+ 0.3 mm
X =	7.4 mm

Install shim having thickness X (in example 7.4 mm).

Shims are available in thicknesses of 0.2 mm, 0.5 mm and 1.0 mm.

Tighten mounting bolt for front drive flange only after central tube has been installed.

PSD diagnosis / Troubleshooting

PSD = Electronically controlled Porsche limited-slip differential

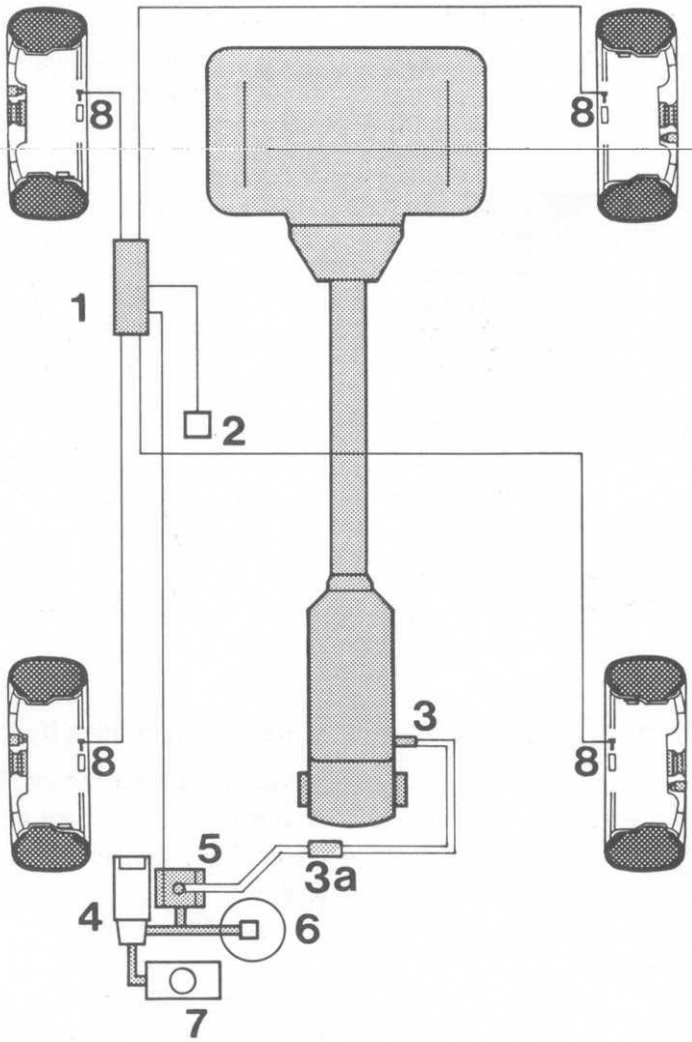
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	Component layout	D39-202b
	PSD - fault display / troubleshooting procedure	D39-202c
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2	Measuring plate wear of controlled limited-slip differential	D39-202e
3	Checking locking torque (friction coefficient) of transverse lock	D39-203
4	Checking pilot pressure valve in the lock hydraulics (lock operation)	D39-215
5	Lateral acceleration sensor (mounting/testing)	D39-219
6	PSD - Diagnosis with system tester 9288	D39-223
7	Checking lock hydraulics	D39-247
	Pressure test on lock hydraulics	D39-251
–	Replacing the pressure warning switch	D39-257
–	Replacing the pressure reservoir	D39-259

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PSD layout



2394-D39

1 - ABS / PSD control unit
2 - Lateral acceleration sensor
3 - Slave cylinder, transverse lock
3a- Pilot pressure valve in lock hydraulics
4 - Pressure pump with pressure warning switch*
5 - Lock solenoid valve*
6 - Pressure reservoir*
7 - Supply tank*
8 - Wheel speed sensor

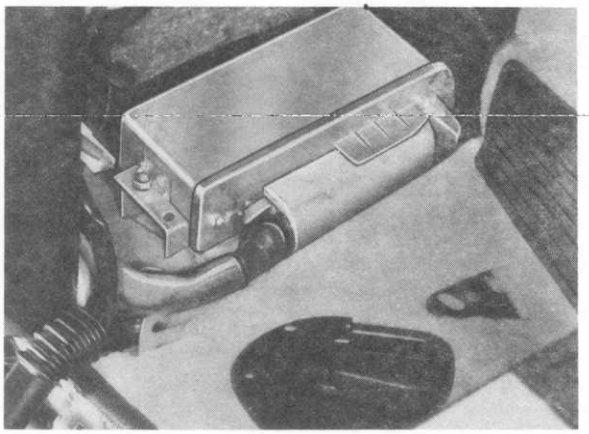
* The lock hydraulics (No. 4 to No. 7) is located on a joint bracket in the left-hand wheel well. Brake fluid is used as the operating medium.
Further information on P. D39-247.

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Component layout

ABS / PSD control unit

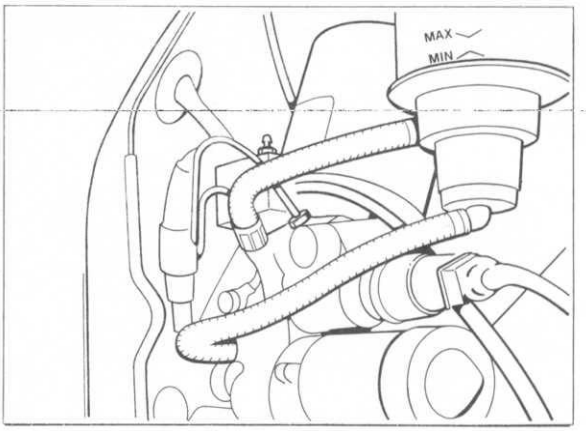
The control unit is located in the driver's foot-well - near the A-pillar - above the front cover opening handle.



9537

Lock hydraulics

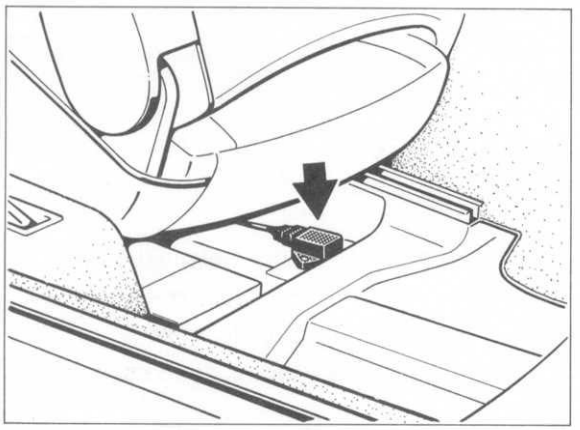
The lock hydraulics is accessible in the left-hand rear wheel housing after removal of the wheel housing cover.



992 - D39

Lateral acceleration sensor

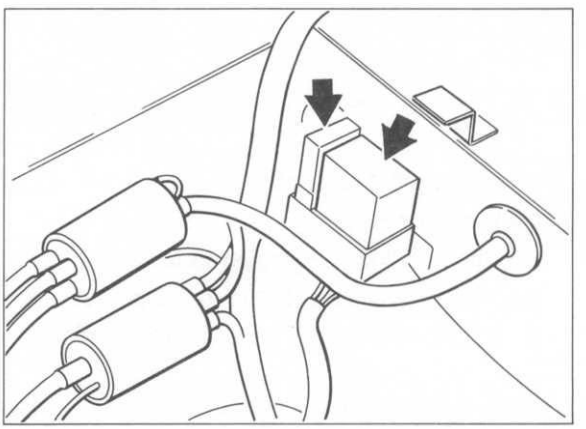
The sensor is mounted on a welded-on bracket below the left-hand seat.



2038 - 39

Voltage supply, lock hydraulics

Voltage supply for the lock hydraulics (energy production) is via a fuse and a relay. The relay and fuse are located in the spare-wheel well.



2395/1 - D39

PSD - Fault display / Troubleshooting procedure

Fault display

If the ABS/PSD control unit detects a fault in the electronically controlled limited-slip differential (PSD), the PSD is switched off for safety reasons and the following fault display appears in the display fields of the information system:

PSD OFF

The PSD is always switched off when the ABS (antilock braking system) is switched off.

Note

The **PSD indicator lamp** (green lamp) in the instrument cluster lights up while the lock is active.

Troubleshooting procedure

Read out the DTC memory with system tester 9288 and remedy the fault if necessary.
This is described on Page D39-223 ff.

If only the PSD is switched off (ABS OK) and **no** fault is stored in the ABS/PSD DTC memory, the fault lies in the lock hydraulics (energy production).

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Bleeding hydraulics of Porsche controlled limited-slip differential (PSD)

Preparatory work:

- Remove rear left inner fender.
- Connect bleeding device to PSD hydraulic reservoir.
- Disconnect vent line (if present).
- Build up bleed pressure (approx. 1.5 - 2.0 bar).

1. Bleeding the pressure reservoir.

To charge the pressure reservoir, **the ignition must be switched on**.
When the pressure reservoir has been charged, the pump cuts out; reservoir pressure is then approx. 180 bar.

- Connect the bleed cylinder.
- Switch off the ignition.
- Carefully open the bleed valve and allow the pressure level to drop gradually.
  While this is being done, the **ignition must remain switched off** to ensure that the pressure is completely reduced and the air is expelled from the reservoir.
- Repeat this procedure several times, making sure that the **ignition is switched on/off at the appropriate stages in the procedure.**

2. Bleeding the valve block and the locking line to the lock slave cylinder

- Connect the 9288 system tester.
- Switch the ignition "ON".
- Connect the bleed cylinder to the bleed screw on the slave cylinder.
- Open the bleed screw on the slave cylinder.
- Select "Start PSD Bleeding" and actuate repeatedly until no further air emerges.
- The bleeding device must remain switched on, because the reservoir volume is used up rapidly.
- After this, close the bleed screw on the slave cylinder.
- Select "Stop Bleeding" and "Start Pressure Reduction" on the system tester.
- Switch off the bleeding device and disconnect it.
- Screw on the reservoir cover.
- Open the vent line at the reservoir again (if present).

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- Check level in the reservoir. The fluid must be approx. 1 cm above the step in the reservoir body or between the markings (with the pressure reservoir charged).

Measuring the plate wear on the controlled-slip differential

Note

The wear dimension can be determined only by means of the measuring cylinder - special tool 9514.

1. Remove slave cylinder.

Note

In order to avoid venting of the lock system, the pressure line at the slave cylinder must not be disconnected when the transmission is installed. In this case, unflange the slave cylinder with pressure line from the housing.

2. Back off the adjusting screw of the measuring cylinder as far as possible (this facilitates assembly of the cylinder).

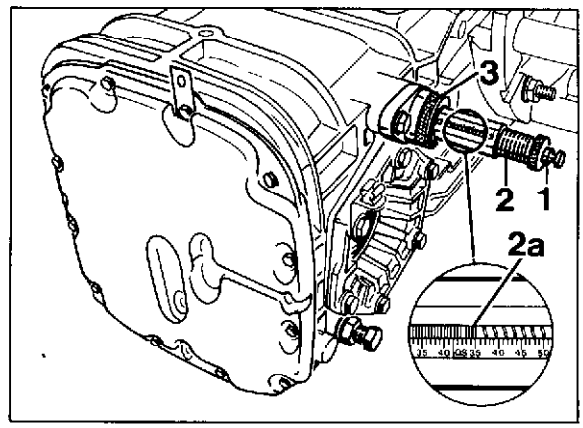
3. Mount the measuring cylinder on the transmission and tighten the knurled nut.

Note

If the transmission is installed, it is recommended to use two studs M8 x 45 with continuous thread to secure the measuring cylinder.

4. Screw in the adjusting screw on the measuring cylinder until there is no longer any axial play at the spacer tappet. Read off the wear dimension in this position.

New dimension = 34.5 mm
Wear dimension = 45.0 mm



357-39

LS = Measuring range for longitudinal lock 911 Carrera 4

QS = Measuring range for transverse lock 928 S 4,
928 GT, 928 GTS and 911 Carrera 4

1 - Spacer tappet

2 - Adjusting screw

2a - Measuring groove on adjusting screw

3 - Knurled nut

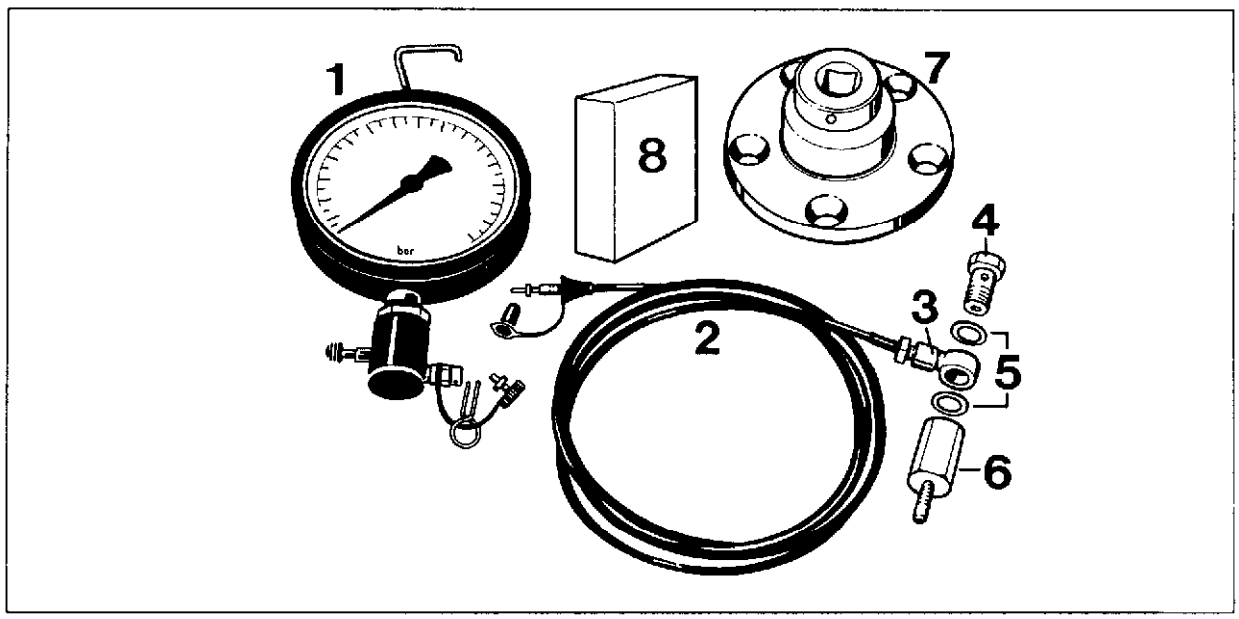
Note

When the wear dimension has been reached, the plates of the lock must be replaced. Do not correct the wear dimension at the thrust bearing under any circumstances.

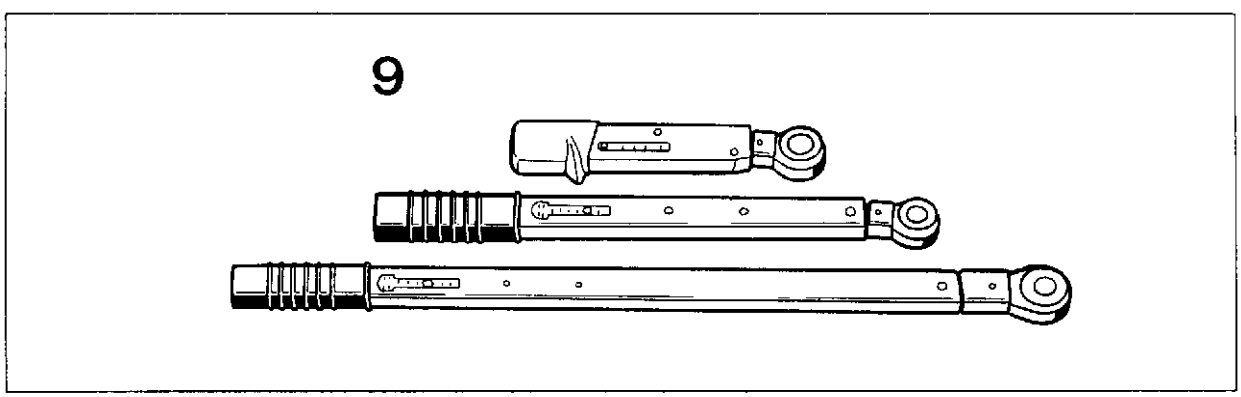
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Checking locking torque (friction coefficient) of transverse lock

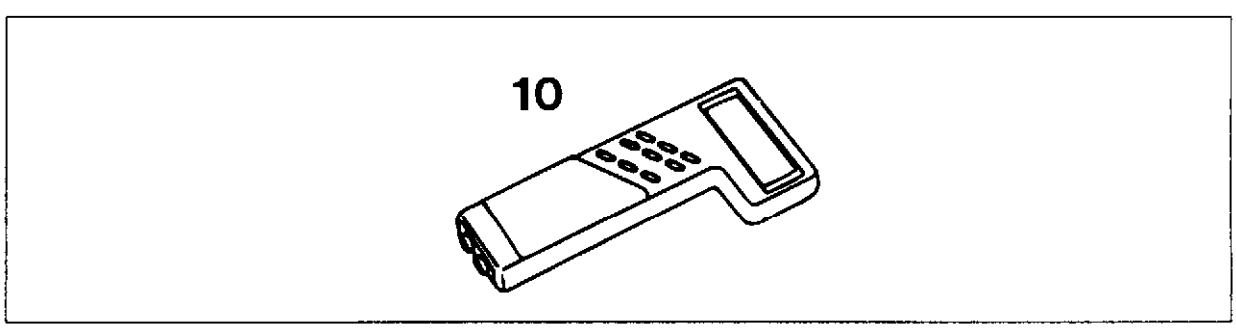
Tools



345-D39/45



483-D39/45



Printed in Germany - XXVII, 1991

No.	Designation	Special tool	Order number	Explanation
1	Pressure gauge	9509	000.721.950.90	
2	High-pressure measuring line	9509/1	000.721.950.91	
3	Ring flange	-	999.215.027.02	
4	Banjo bolt	-	930.110.547.00	shorten threads by approx. 4 mm
5	Seal	-	N 013 811 2	2 pc.
6	Union	9509/3	000.721.950.93	
7	Torque adapter plate	9510/1	000.721.951.01	
8	Support block	9509/4	000.721.950.94	1 pc.
9	Self-disengaging torque wrench (click wrench) covering a range of 5 Nm (4 ftlb) to 500 Nm (369 ftlb)	-		commercially available (refer to shop manual). Depending on the type of torque wrench used, corresponding reduction pieces or adapters are required for connection to the adapter plate (No. 7).
10	System Tester 9288	9288	000.721.928.80	
	with connecting hose	9288/1	000.721.928.81	
	and corresponding program module (acc. to language used)	928DV	000.721.928.DV.008	German
		928GV	000.721.928.GV.008	English
		928FV	000.721.928.FV.008	French
		928IV	000.721.928.IV.008	Italian
		928EV	000.721.928.EV.008	Spanish
		928SV	000.721.928.SV.008	Swedish
		928JV	000.721.928.JV.008	Japanese

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Checking locking torque (friction coefficient) of transverse lock

Important notes

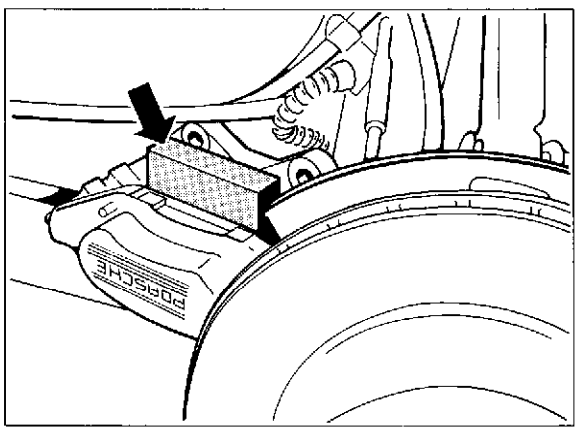
Check with cold transmission. Parking brake released, no gear engaged.

When checking the locking torque, it is not the rotating torque (starting torque) but rather the breakaway torque that is measured. For this reason, self-disengaging torque wrenches must be used.

Checking

Procedure	Execution / Notes
1. Carry out general preparations according to right-hand column	– Remove rear wheels – Fit torque adapter plate (Special Tool 9510/1) with original wheel bolts **to left-hand rear wheel hub.** – Remove rear left-hand inner wheel arch panel – Prepare self-disengaging torque wrenches (click wrenches) covering a range of approx. 5 Nm (4 fllb) to 500 Nm (369 ftlb). To fit them to the torque adapter plate, suitable reduction pieces or adapters are required.

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Procedure	Execution / Notes
2. Prepare vehicle for transverse lock measurement.	
Proceed as follows: – Remove rear left-hand brake caliper (do not open hydraulic brake system) and place support block - Special Tool 9509/4 - into the brake caliper, replacing the brake disc. – Connect pressure gauge to transverse lock cylinder. – Connect System Tester 9288 to diagnosis socket. – Bleed pressure gauge. To keep the reservoir level from dropping too far (low volume), connect a bleeder unit to the reservoir. Bleeding pressure approx. 1.5 to 2.0 bar. The venting line remains clamped.	– Remove rear left-hand brake caliper. Place the support block (arrow) into the brake caliper, replacing the brake disc. Place brake caliper on rear axle trailing arm or suspend in a suitable place.  989-D39

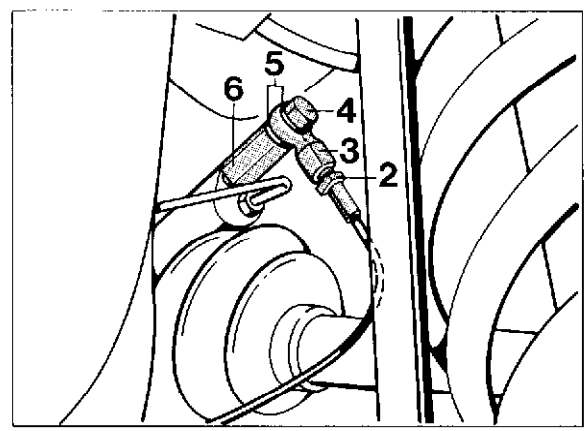
Printed in Germany - XXVII, 1991

Procedure	Execution / Notes

– Connect ring flange (No. 3) to measuring line (No. 2). Proceed by fitting this assembly, complete with banjo bolt, seals and fitting (Nos. 4, 5 and 6), **to the transverse lock slave cylinder, replacing the bleeder valve.**

Important note

Tighten Nos. 4 and 6 carefully and use a second wrench to lock when tightening, making sure the parts do not bind. If this is not observed, the fitting (No. 6) may shear off. Pilot pressure is normally present at the bleeding valve (No. 6). Open valve slowly before removing it (to allow the pressure level to be dumped slowly).

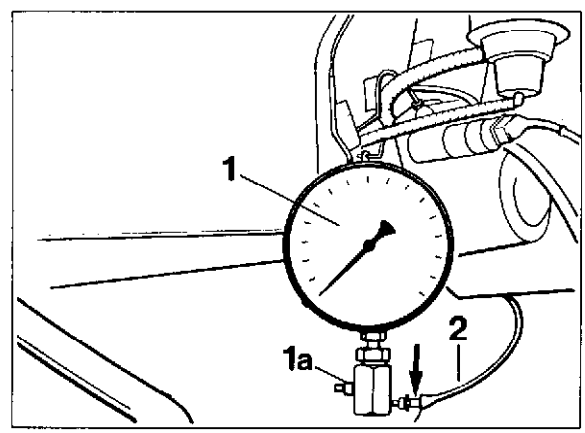


990-D39

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Procedure	Execution / Notes

- Connect high-pressure measuring line (No. 2) to pressure gauge (cf. arrow) and suspend pressure gauge (No. 1) in rear left-hand wheel housing area so that it may be read off easily.
  Bleed pressure gauge by connecting the bleeding device to the PSD reservoir. Clamp venting line.
  Build up bleeding pressure (approx. 1.5 to 2.0 bar).
  Connect System Tester 9288 along with adapter line 9288/1 to diagnosis socket (located next to the passenger's seat under the booster cover).
  Clock lock solenoid valve complete with System Tester 9288 in "Drive links / Bleed position" menu and allow brake fluid to escape at the bleeder valve (No. 1 a) until it is free from air bubbles. (Use collector bottle).
  Close bleeder valve and press stop button. Select pressure reduction position.
  Switch off bleeding device.



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Procedure	Execution / Notes
3. Perf. transverse lock measurement (locking torque to pressure ratio)	
Testing cond. / important information – Transmission cold / parking brake released, no gear (driving position) selected – Before starting measurements, close lock once for a short time (activate full pressure) – To measure the locking torque, rotate only in forward direction! Always measure across adapter plate at left-hand rear hub – Lock right-hand rear wheel fully using the service brake – Measure breakaway torque / locking torque at the specified test pressures using the torque wrench. Do not jerk when rotating. **Advance carefully from bottom (low value) to top until the breakaway torque / locking torque is reached.** – Establish test pressures using System Tester 9288, clocking the transverse lock solenoid valve. (Drive links / Check transv. lock menu)	– Observe testing conditions indicated in opposite column – Switch on System Tester. Select "Check transv. lock" – Fully close transverse lock by applying approx. 20 pulses (gauge pressure ≈140...180 bar). Pressing operating button at tester once = 1 pulse – Switch to pressure release position and start with measurement no. 1 – **Measurement 1 = gauge pressure 0...5 bar** Set torque wrench to approx. 5 Nm and use adapter plate to connect to left-hand rear wheel hub (No. 7). Observe clicking direction of torque wrench. While performing measurements, actuate service brake to ensure that the right-hand rear wheel is fully locked. Turn torque wrench carefully (i.e. avoiding jerks) **in forward direction**. If the wheel hub does not yet rotate when the torque wrench clicks the actual locking torque has not yet been reached. Adjust torque wrench to higher value and repeat operation. The actual locking torque (actual value) is achieved when the wheel hub turns and the moment when the torque wrench starts to click is just about reached. If the wheel hub turns but the wrench does not yet click, the torque set at the wrench is too high (actual locking torque is lower).
Test pressures / measuring process Measurem. 1 = press. between 0...5 bar Measurem. 2 = " " 10...20 bar Measurem. 3 = " " 20...40 bar Measurem. 4 = breakaway torque 500 Nm (369 ftlb) minimum, with pressure held at 60 bar or above Measurem. 5 = check pilot pressure transverse lock. Specified value approx. 3.0...4.5 bar	

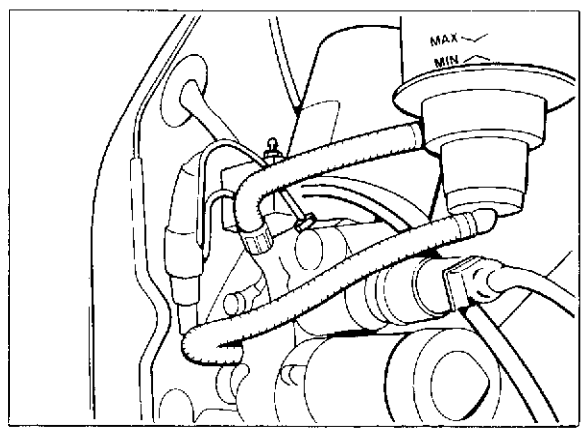
Printed in Germany - XXVII, 1991

Procedure	Execution / Notes
Refer to page D39-213 for a listing of the actual values (admissible locking values) vs. the corresponding pressures. **Possible causes for deviation from specification** – Test requirements not met. Example: RH rear wheel not fully locked, pressure gauge and lock hydraulics not properly bled. – Faulty discs – Hydraulic pressure does not become effective to the degree indicated at the discs, e.g. due to faulty setting of the mating bearing screw of the engaging lever (engaging lever rides).	When measuring the breakaway torque, measure at several locations (angular positions) within one wheel revolution. After the actual locking torque has been reached, immediately read off the pressure at the pressure gauge. Record both actual values (torque + pressure). – **Measurement 2 = Gauge pressure 10...20 bar** Use the System Tester to build up test pressure, applying a corresponding number of pulses. Set torque wrench to bottommost value (depending on pressure) according to boundary value window (p. D39-213). Repeat process as described for measurem. no. 1. – **Measurement 3 = Gauge pressure 20...40 bar.** Repeat process as described for measurements 1 and 2, respectively. – Compare actual values obtained in measurements 1/2/3 with values specified on p. D39-213.

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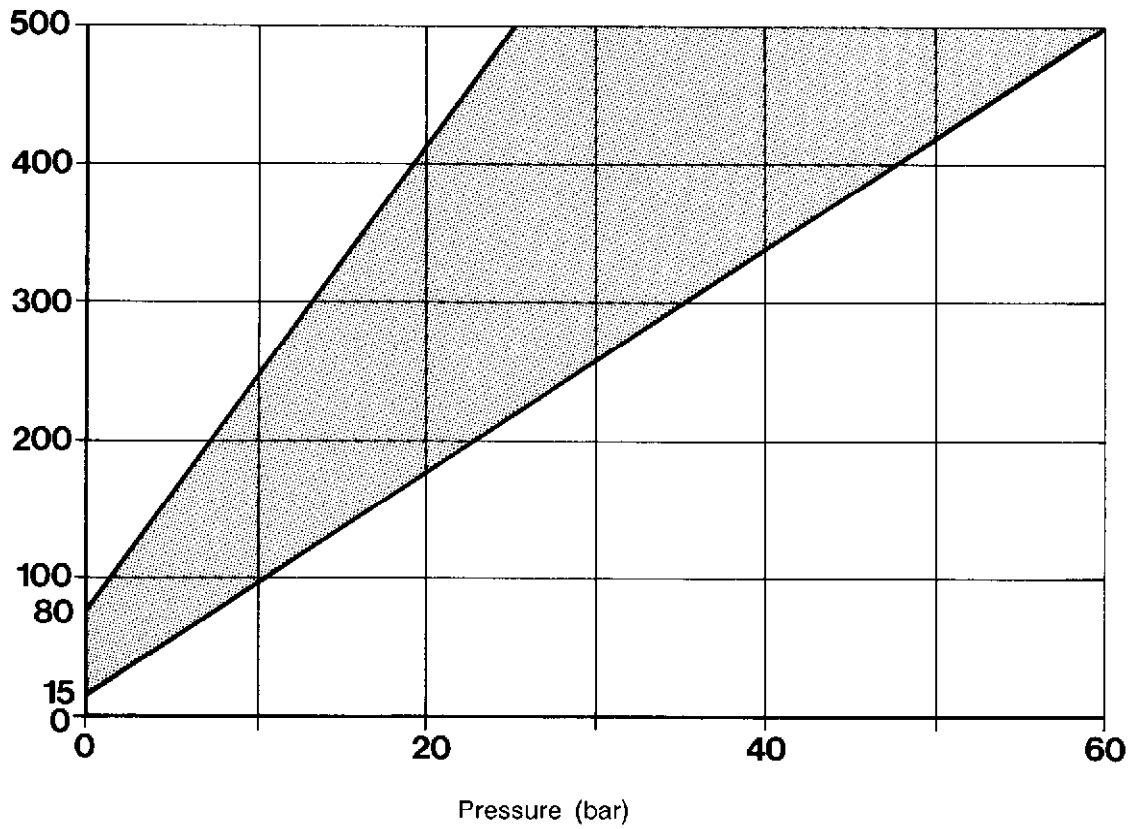
Procedure	Execution / Notes
	Example: **Measurement 2 = Gauge pressure 10...20 bar** Actual values: Gauge pressure = 13 bar, locking torque measured = 240 Nm (177 ftlb) Specified value according to table at 13 bar: 120...300 Nm (88...221 ftlb) Measurement 2 o.k. since results are within the tolerance band (boundary value window) – Measurement 4 = **Minimum locking torque of 500 Nm (369 ftlb) must be ensured. Equivalent pressure 60 bar or higher** – **Measurement 5 = pilot pressure valve** Proceed to pressure release position and read off pressure at gauge. Specified value: approx. 3.0...4.5 bar. If measurements are out of limits, repeat process, starting from low pressure - max. 20 bar. In this case, release pressure by switching off ignition.

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Procedure	Execution / Notes
4. With the System Tester switched off (to ensure that only pilot pressure is present at the measuring line), remove pressure gauge complete with connecting lines. Install bleeder valve and bleed transverse lock. Correct reservoir fluid level.	– Open measuring line and transverse lock cylinder carefully (observing pilot pressure). Remove measuring line and fit bleeder valve. – Bleed transverse lock using System Tester 9288, with bleeding device connected to reservoir and switched on (vent line clamped off). Follow by correcting reservoir level (to a level between MIN and MAX mark) with accumulator fully charged. Screw on reservoir lid, open vent line at reservoir again.
	 992-D39
5. Check lock hydraulics for leaks. Disconnect System Tester. Install rear brake caliper.	– Check hydraulic lines for outside leaks, controlling full system pressure at lock cylinder using System Tester 9288. – Then disconnect System Tester. – Tighten brake caliper mounting bolts to 85 Nm (63 ftlb).
6. Fit rear left-hand wheel housing inner panel. Fit rear wheels. Take vehicle for a short test drive (to check lock and brake operation).	

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Locking torque-to-pressure limits



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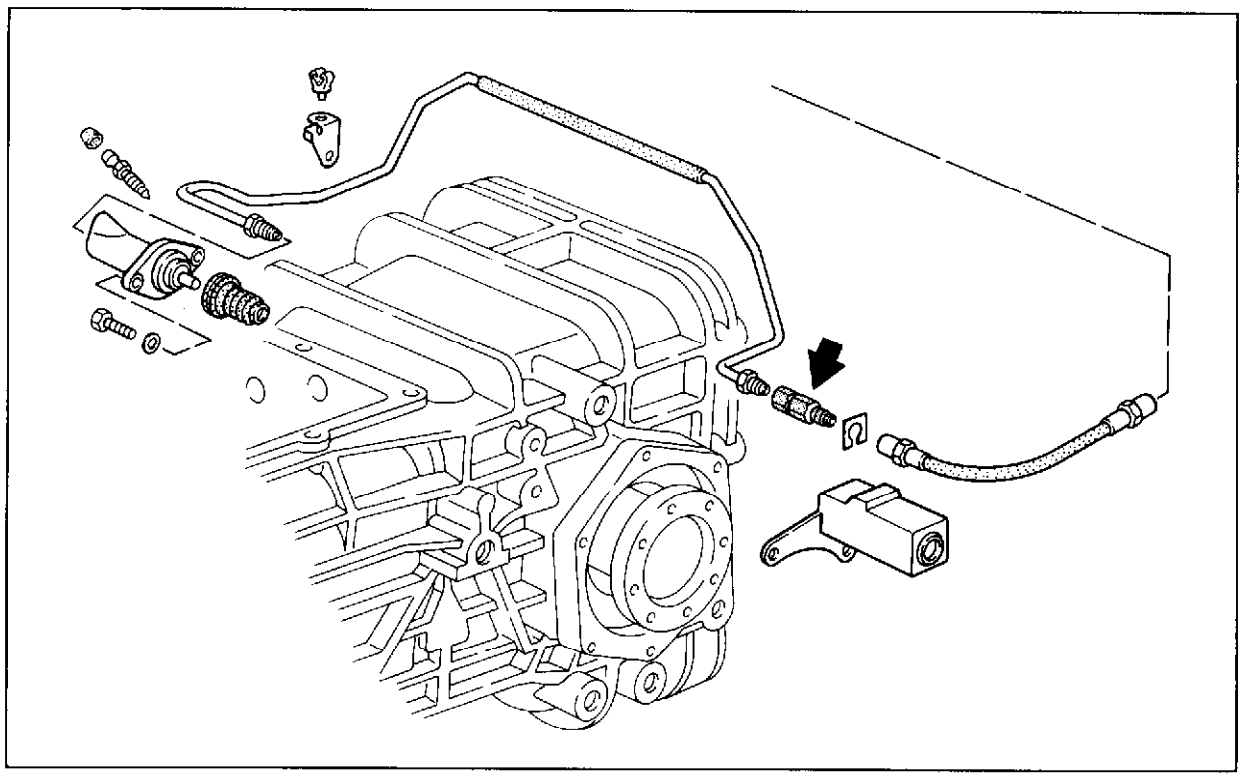
Checking pilot pressure valve of lock hydraulics (lock operation)

General

Normally the pilot pressure valve is checked within the scope of measuring the friction coefficient of the transverse lock (test item 3).

A pilot pressure valve (arrow) is located ahead of the transverse lock slave cylinder on the left-hand transmission side.

If pilot pressure is too high, squeal noises may result. Due to wear and vehicle dynamics constraints, zero pilot pressure is also to be avoided. **When replacing components, do not confuse with the PDAS pilot pressure valves designated for the 911 Carrera 4.**



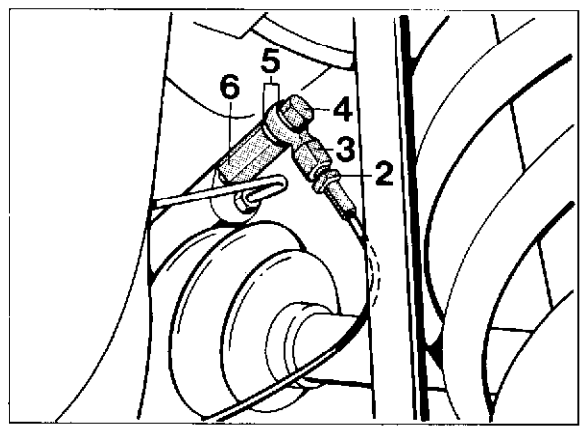
993-D39

Specifications / identification of the pilot pressure valves

Type	Specification	Identification
911 Carrera 4	approx. 2.0 to 3.5 bar	2 - 3 stamped on valve
928 with PSD	**approx. 3.0 to 4.5 bar**	**3 - 4 stamped on valve**

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Checking pilot pressure valves

Procedure	Execution / Notes
1. Prepare vehicle for pilot pressure valve check. **Operations:** – Connect pressure gauge to lock slave cylinder. – Connect System Tester 9288 to diagnosis socket. – Bleed pressure gauge.	– Connect ring flange (No. 3) to measuring line (No. 2). Proceed by fitting this assembly complete with banjo bolt, seals and **fitting** (Nos. 4, 5 and 6), **to the lock cylinder, replacing the bleeding valve.** Connect high-pressure measuring line (No. 2) to pressure gauge. **Important note** **Tigthen Nos. 4 and 6 carefully and lock when tightening, making sure the parts do not bind. If this is not observed, the fitting (No. 6) may shear off.**  990-D39

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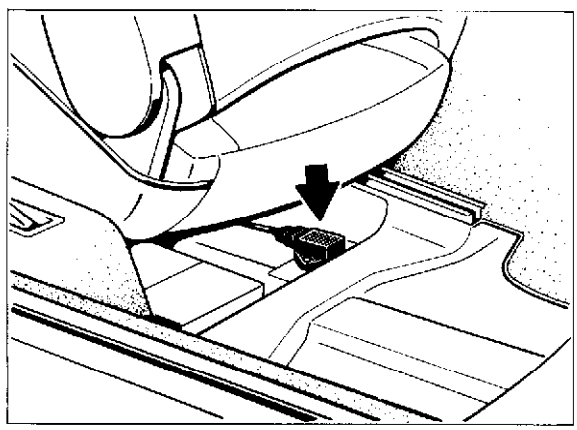
Procedure	Execution / Notes
	– Connect System Tester 9288 along with adapter line 9288/1 to diagnosis socket (located next to the passenger's seat under the booster cover). Bleed pressure gauge by clocking lock solenoid valve complete with System Tester in "Drive links / Bleed position" menu and allow brake fluid to escape from the pressure gauge at the bleeder valve until it is free from air bubbles. (Use collector bottle). For this purpose, leave bleeding device connected to reservoir and leave bleeding line clamped. Bleeding pressure approx. 1.5 - 2.0 bar. Close bleeding valve and press stop buttom. Select pressure reduction position. **Switch off bleeding device.**
2. **Check pilot pressure valve operation as described below:** Use System Tester 9288 to activate transverse lock solenoid (Drive links / Check transv. lock menu) with 1 - 2 pulses. Then switch to pressure reduction position and read off gauge pressure after a short interval (to allow for gauge damping). **For specifications, refer to p. D39-215.**	**Important note** If pilot pressure is too high (before replacing a valve), build up a lower pressure and reduce pressure by switching off the ignition, thus deviating from the previous testing procedure. Pilot pressure may drop by max. 0.2 bar within 5 minutes.
3. Follow check by bleeding the transverse lock and correcting the reservoir level.	– After disconnecting the pressure gauge, use the System Tester (Drive links - **Select bleeding menu)** and allow brake fluid to escape at bleeder valve of the transverse lock slave cylinder until fluid is free from air bubbles. – Correct reservoir level with accumulator fully charged (after pump unit has switched off automatically). **Do not fill above "max. mark".** Screw on reservoir lid. Open venting line at reservoir again. Disconnect System Tester.

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Lateral acceleration sensor

Installation position

The lateral acceleration sensor has been installed on a support welded in under the LH seat.
The sensor is required for the electronically controlled limited slip differential.



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Important notes

The sensor must not be exposed to extreme accelerations which may, for example, be caused by throwing, falling down or shocks.

After an accident, the sensor must always be checked. If the sensor is out of specifications, it has to be replaced.

Installation

The sensor is fastened onto a welded-in support (2 bolts). The correct installation position (sensor in horizontal position) will be obtained automatically, if the welded-in support has not been deformed.
If the support has been deformed (due to an accident), it has to be readjusted using a bubble level:
For this purpose, park the vehicle on level ground.

After installation, check the sensor for proper functioning.

Checking

Notes on checking

Checking relates to the following aspects:

- correct installation position of the sensor

- sensor function

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The **55-pin** ABS 2 LED adapter lead (see item 1), a multimeter, a shop trolley jack and a measuring tape are required for this test. The **55-pin** adapter lead required to run an ABS test on the Carrera 4 (964) and the 928 with PSD (instead of the **35-pin** adapter lead) has 3 outputs incorporated for testing the longitudinal and lateral acceleration sensors.
The longitudinal acceleration sensor is only fitted to the Carrera 4 (964).

Manufacturer of the adapter lead:

Robert Bosch GmbH
Dept.: KH/VKD 2
Postfach 41 09 50
D-76225 Karlsruhe
Phone: 0721/942-0
Fax: 0721/9422187

Supplier of the adapter lead:

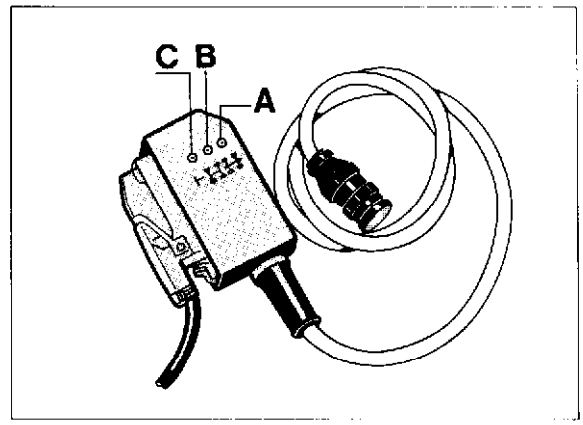
Authorized dealer
Part No. KDAS 0003/7

1. With the ignition switched off, take off the ABS/PSD control unit connector and connect it to the 55-pin ABS 2 LED adapter lead.

Note

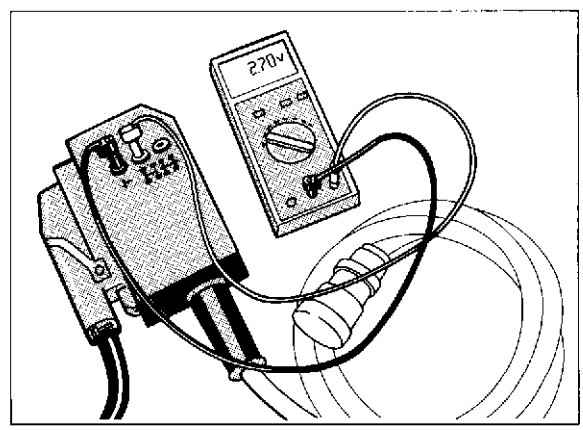
The following tests can be carried out with or without the ABS 2 LED tester being connected. The 3 outputs are identified by special symbols

A = Signal of longitudinal acceleration sensor
B = Signal of lateral acceleration sensor
C = Ground contact for both sensors



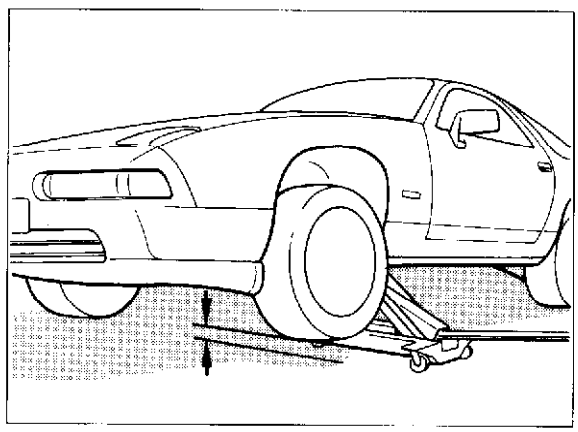
2039 - 39

2. With the vehicle in normal position, check and record the voltage reading at the **lateral acceleration sensor** (with the ignition switched on).
Specification: 2.7 ± 0.14 volts.
Normal position means: Vehicle must be on a level surface. If the vehicle was off the ground before the test, slacken the suspension if required (move vehicle a few yards and jounce front and rear ends of vehicle several times).
If the reading deviates from the specification, continue with the assessment table at the end.



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3. Establish a ground clearance of approx. 150 mm at the left front wheel by lifting the vehicle at the left front jacking point. Read off and record sensor voltage value.



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4. Lower left front side of vehicle. **Then raise vehicle at the front right end in the same manner by approx. 150 mm.** Read off and record sensor voltage value.

5. Assess readings according to the below table. Correct any faults that may be present.

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Assessment table for sensor tests

Test item / Notes	Requirements Fault / Troubleshooting
Sensor installation position via output voltage The sensor is supplied with an input voltage of 5 volts across the ABS /PSD control unit. The output voltage is 2.7 volts, provided that the sensor is in a horizontal position and fully operative.	- **Specified reading:** **2.7 ± 0.14 volts when the vehicle is on a level surface (ignition is switched on).** If the reading exceeds or falls below the specification, this means that the sensor bracket is bent or that the sensor is faulty. If no voltage is displayed, the wiring has gone open circuit, the sensor is faulty or an incorrect socket was used at the test lead. Check wiring rouring according to wiring diagram if requried. Some faults (open circuit / short circuit, sensor fault) are stored in the fault memory of the ABS/PSD control unit. The fault memory (in PSD system) must therefore be read out with System Tester 9288 and erased after the fault has been eliminated.
Sensor operation To test, raise vehicle once at front right and once at front left by approx. 150 mm in each case. This must result in an exactly predefined change of the voltage. Use the above measurement (initial reading obtained with vehicle on level surface) as a reference.	- **Specified display:** Based on the initial reading, **the voltage must be higher when the left side is raised and lower when the right side is raised.** Example: Initial reading 2.65 V Raised at front left 2.85 V Raised at front right 2.46 V If the voltage does not change when the vehicle is raised (by the same amount on left and right), this means that the sensor is faulty. Read out fault memory (in PSD system) with System Tester 9288 after eliminating the fault and erase the fault memory as required.

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PSD - Diagnosis with system tester 9288

General information

The PSD/ABS control unit is suitable for self-diagnosis. This means that the control unit can detect, store and output certain faults of the PSD and the ABS.

Diagnosis is performed with system tester 9288 in combination with the adapter lead 9288/1 and the corresponding module (depending on the language in question).
The diagnosis socket is located next to the passenger's seat underneath the booster cover. Positive potential is permanently connected to the PSD/ABS control unit in order to prevent detected and stored faults from being deleted when the ignition is is switched off.

PSD diagnosis is **not** possible with the engine running.

Overview of available PSD menus

1 = DTC memory

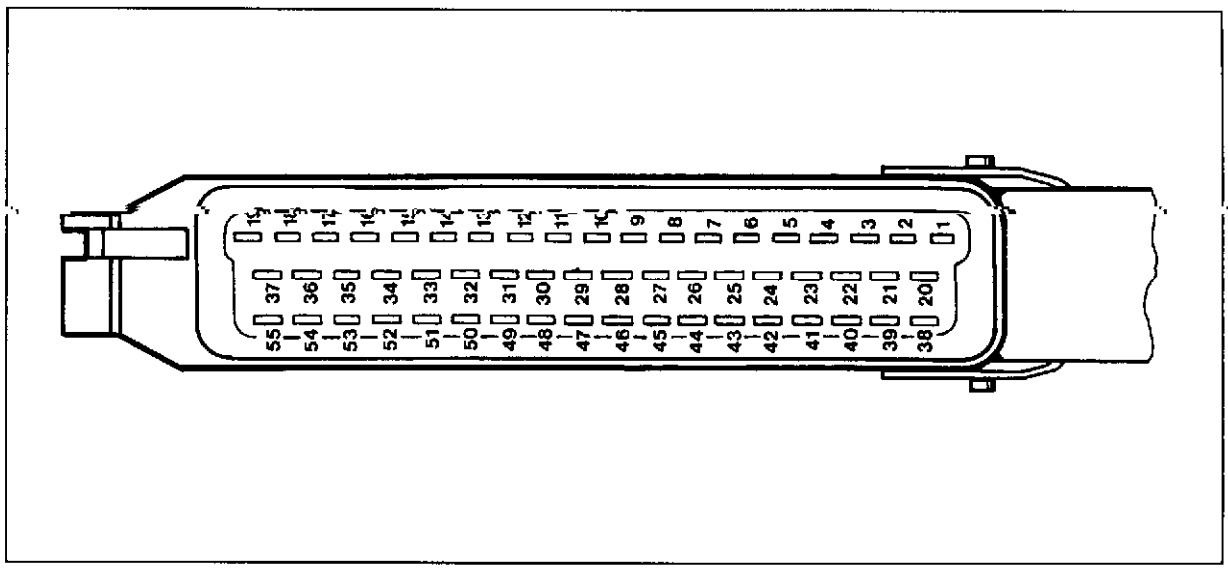
2 = Drive links

1 = DTC memory see Page D39 - 226

2 = Drive links
Submenu:
Bleeding see Page D39 - 202d
Checking the transverse lock see Page D39 - 203

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Connector pin assignment for control unit (PSD/ABS)



2397-D39

1 - Voltage, terminal 15

2 - Operation of ABS rear-axle solenoid valve

3 - Ground, ABS solenoid valve, front right

4 - K wire from diagnosis

5 - Operation of pump motor relay on hydraulic unit

6 - Free

7 - Operation of valve relay on hydraulic unit

8 - Free

9 - Ground of acceleration sensor

10 - Speed sensor output at rear right for RDK (tire pressure monitoring system) control unit

11 - Voltage, terminal 30

12*- Speed sensor output at rear left for RDK control unit*

13 - Free

14 - Free

15 - Voltage supply (+5V) for acceleration sensor

16*- Speed sensor output at front right for RDK control unit*

* **additionally for vehicle speed.** PIN 16 (front left) on mod. 1991/ 1992. PIN 12 (rear left) as of mod. 1993.

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17 - Monitoring, voltage supply for ABS solenoid valves

18 - Free

19 - Operation of ABS solenoid valve, front left

20 - Voltage for valve and motor relays on hydraulic unit

21 - Operation of transverse lock solenoid valve

22 - Operation of ABS solenoid valve, front right

23 - Monitoring of voltage supply for lock solenoid valve

24 - Operation of ABS warning lamp

25 - Free

26 - Free

27 - D + (Terminal 61 / charge)

28 - Free

29 - Brake light switch

30 - L wire from diagnosis

31 - Pump motor monitoring (hydraulic unit)

32 - Free

33 - Free

34 - Signal from lateral acceleration sensor

35 - Operation of instrument cluster: PSD off

36 - Free

37 - Ground, ABS solenoid valves, front left + rear axle

38 - Free

39 - Free

40 - Indicator lamp (green) for PSD function

41 - Free

42 - Ground, shield, speed sensor at rear right

43 - Signal, speed sensor at rear right

44 - Ground, shield, speed sensor at rear left

45 - Signal, speed sensor at rear left

46 - Ground, shield, speed sensor at front right

47 - Signal, speed sensor at front right

48 - Ground, shield, speed sensor at front left

49 - Free

50 - Signal, speed sensor at front left

51 - Free

52 - Electronics ground

53 - Speed sensor output at front right for RDK control unit

54 - Free

55 - Free

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DTC memory

Overview of the possible fault displays

§§: Transverse lock valve §§§§§§§§§§§§§§§§§§§§	DTC 11
§§: Lateral acceleration sensor, short circuit/discont. §§§§§§§§§§§§§§§§§§§§	12
§§: Lateral acceleration sensor, signal implausible §§§§§§§§§§§§§§§§§§§§	13
§§: Transverse lock, deviation §§§§§§§§§§§§§§§§§§§§	14
§§: Control unit defective §§§§§§§§§§§§§§§§§§§§	15
§§: Speed sensor, front left §§§§§§§§§§§§§§§§§§§§	21
§§: Speed sensor, front right §§§§§§§§§§§§§§§§§§§§	22
§§: Speed sensor, rear right §§§§§§§§§§§§§§§§§§§§	DTC 23
§§: Speed sensor, rear left §§§§§§§§§§§§§§§§§§§§	24
§§: ABS valve, front left §§§§§§§§§§§§§§§§§§§§	31
§§: ABS valve, front right §§§§§§§§§§§§§§§§§§§§	32
§§: ABS valve, rear axle §§§§§§§§§§§§§§§§§§§§	33
§§: Valve relay §§§§§§§§§§§§§§§§§§§§	34
§§: Return pump §§§§§§§§§§§§§§§§§§§§	35

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Fault overview/Troubleshooting (diagnosis/test plan)

Test point	DTC	Fault display (short fault text)	Page
1	11	Transverse lock valve	D39 - 230
2	12	Lateral acceleration sensor, short circuit/discontinuity	D39 - 232
3	13	Lateral acceleration sensor, signal implausible	D39 - 233
4	14	Transverse lock, deviation	D39 - 234
5	15	Control unit defective	D39 - 235
6	21	Speed sensor, front left	D39 - 236
7	22	Speed sensor, front right	D39 - 238
8	23	Speed sensor, rear right	D39 - 238
9	24	Speed sensor, rear left	D39 - 238
10	31	ABS valve, front left	D39 - 238
11	32	ABS valve, front right	D39 - 240
12	33	ABS valve, rear axle	D39 - 240
13	34	Valve relay	D39 - 241
14	35	Return pump	D39 - 245

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DTC memory / Troubleshooting

Important notes

If warning displays light up and/or faults are shown in the DTC memory of the PSD/ABS, they may also have been triggered by the following problems:

— Control unit supply voltage less than 9.5 Volt (undervoltage)

— Control unit plug disconnected.

— Contact resistance caused by poor ground connections, leading to differences in potential or inadequate shielding of speed sensors. The poor ground connection may not only occur at the affected components, but also at other important grounding points.

— **Important:**The warning "PSD off" may appear in the display fields of the instrument cluster, even though no fault is stored in the DTC memory. Check the lock hydraulics (lock operation) in this case (as of Page D39-247).

Troubleshooting aids

When measuring with the multimeter at the control-unit plug, make up 1 or 2 auxiliary leads in your own workshop, each with 2 flat pin plugs No. 17.457.2, to avoid damaging the plug contacts in the control-unit plug during the test.

Combined plug connections - distinguishing between wires

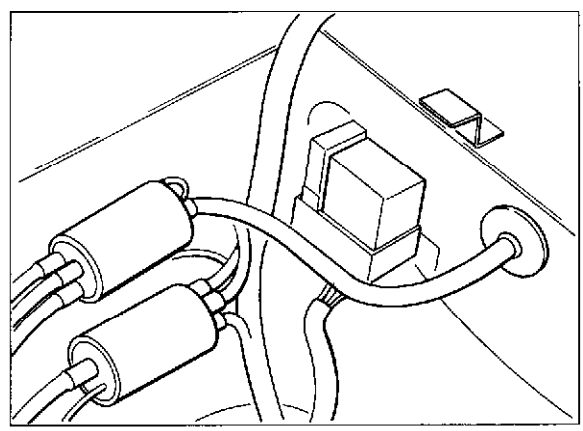
In the brake pad wear, speed sensor and HF sending unit wiring there are several combined plug connections of similar pattern. In this area, the wires can be distinguished as follows:

— Shielded wires for the speed sensors and HF sending units.

— 2 wires with a protective tube for brake pad wear.

— One pin and one socket exist on the HF sending unit plug connections. The speed sensor plug connections possess 2 pins as well as 2 sockets on the opposite side.

— Two combination connectors are located one above the other in the spare tire area. The wires are identified there with **L** = rear left and **R** = rear right.



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Replacing the hydraulic unit

After installing/bleeding the ABS hydraulic unit, carry out a complete ABS test with the ABS 2-LED tester.

Test-drive after eliminating the fault.

Clear the DTC memory after eliminating the fault. Perform a test drive and then read out the DTC memory again.
If necessary (e.g. in the case of a fault in the speed sensors), also clear the DTC memory of the RDK control unit.

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Fault, DTC	Possible causes, remedy, notes

Test point 1

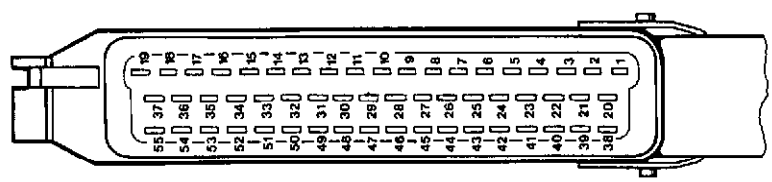
Transverse lock valve
DTC 11

No feedback signal from valve to control unit.

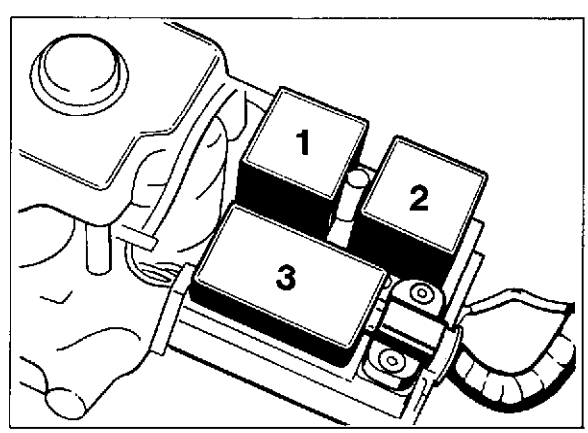
1. Switch off the ignition. Pull the plug off the control unit.
   Check that circuits at plug are not interrupted.

   PIN 21 to PIN 23
   PIN 21 to PIN 17

   If necessary, interrupt the wiring path (plug on transverse lock solenoid valve) and localize the discontinuity by reference to the wiring diagram.



2. Pull off valve relay (No. 1) on the hydraulic unit. (Remove wheel housing cover at the front-left side).
   Check for a short circuit to plus or ground in the wiring path, as described in point 1, by measuring at PIN 21.
   If there is a fault in the wiring path, separate it as described in point 1 so that the unwanted connection to the positive or negative side can be located.

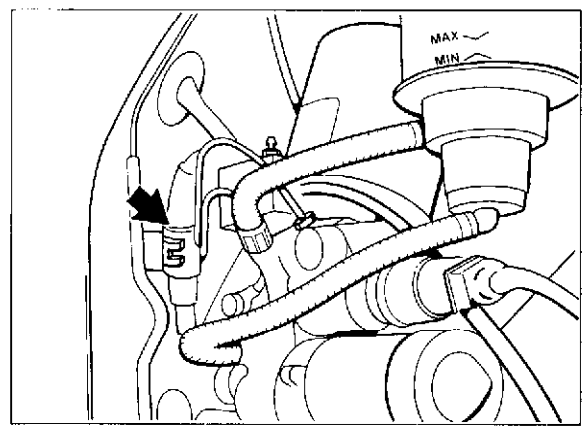


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Fault, DTC	Possible causes, remedy, notes

3. Measure the internal resistance of the transverse lock valve.
For this purpose, disconnect the plug connection on the transverse lock solenoid valve (arrow). The transverse lock solenoid valve is located beneath the rear left wheel housing cover.
Nominal value 2...4 Ω between the PINs on the valve block.
Nominal value not OK: Replace the transverse lock solenoid valve.



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4. Check that the valve relay is energized (voltage present at solenoid valves of ABS and PSD).
Connect all plugs and the relay for this purpose. Push back the protective tube on the transverse lock valve plug (in the wheel housing on the rear left).
Switch off the ignition, then switch it on again.
Battery voltage must be present at the black wire.

If **no** battery voltage is present: Continue with test point 13/DTC 34 (valve relay). Note testing instructions (see below).

If voltage is present, try replacing the PSD/ABS control unit (output stage defective).

Notes on testing

If a plug for the power supply to the solenoid valves (ABS or differential lock) is detached while the ignition is switched on, the valve relay is de-energized. Even if the plug is then reconnected, the relay will not be re-energized until the ignition has been switched off and on again.

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Fault, DTC	Possible causes, remedy, notes

Test point 2

Lateral acceleration sensor, short-circuit/ discontinuity
DTC 12

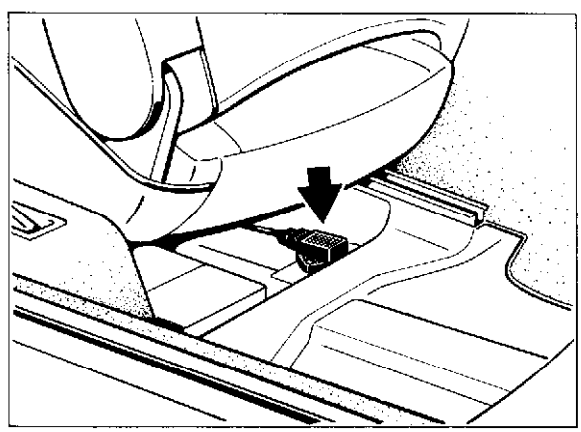
Wiring between control unit and lateral acceleration sensor not in working order (discontinuity, short circuit to plus or short circuit to ground), or the lateral acceleration sensor itself is damaged.
The following wiring is installed:

- Power supply to sensor (5 Volt) =
  PIN 15 at control unit - PIN 3 at sensor
- Ground for sensor =
  PIN 9 at control unit - PIN 1 at sensor
- Signal from sensor to control unit
  (2.7 ± 0.14 Volt with car in normal-load position) =
  PIN 34 at control unit - PIN 2 at sensor

1. Check power supply (approx. 5 Volt) at the sensor plug after detaching it, with the ignition switched on. PIN 1 (-) and PIN 3 (+).

Note

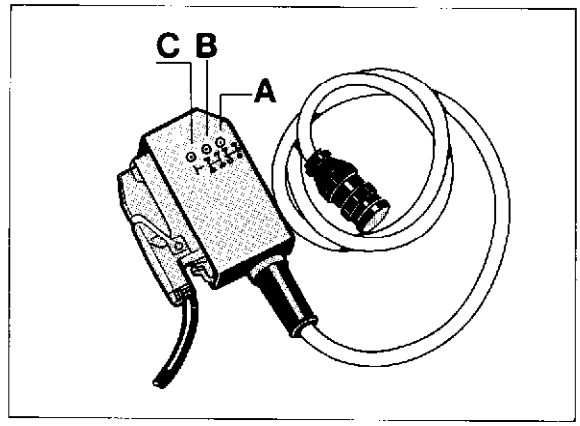
The sensor is located under the left-hand seat.



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2. Check for discontinuity or short circuit to ground at the wire between PIN 2 at the sensor plug and PIN 34 at the control unit plug after this has been detached.
3. Connect the plug to the sensor. Check the installation position of the sensor and its function by testing the output signal. To make this check, connect the 55-pin ABS 2-LED adapter lead to the control unit plug. Connect the multimeter to sockets B and C.
   For the measuring procedure and nominal values, see Pages D39-219...D39-222.

Fault, DTC	Possible causes, remedy, notes



2039-39

Test point 3

Lateral acceleration sensor, signal implausible
DTC 13

Signals from lateral acceleration sensor to control unit are incorrect. The sensor has a mechanical defect or its installation position is incorrect.

1. Check lateral acceleration sensor,
   Pages D39-219 ... D39-222.

2. Replace the sensor if necessary. No repair work on the sensor is permitted.

3. After eliminating the fault, repeat the test.

Fault, DTC	Possible causes, remedy, notes

Test point 4

Transverse lock, deviation
DTC 14

During the transverse lock regulating phase, the monitoring circuit in the PSD/ABS control unit has identified excessive variations between the **nominal** and **actual values.**

Possible faults

- Lock control circuit poorly bled (lock operation hydraulics)
- Lock hydraulics leaking
- Lock solenoid valve has a mechanical defect
- Lock cylinder does not retain preset pressure (leaking through relief bore)
- Inadequate signal from a rear wheel speed sensor
- Fault in transverse lock plates
- Insufficient hydraulic pressure builds up at plates, e.g. because thrust-bearing bolt of engaging lever is wrongly adjusted (engaging lever makes contact).

Procedure

1. Check lock hydraulics for external leaks. Replace defective parts if necessary.

2. Repeat bleeding procedure for lock control circuit (lock hydraulics). If new parts have been installed, the lock must be bled as appropriate (Page D39-202d).

3. Check speed sensor signals (Pages D39-236 ...D39-238).

4. Measure thickness of plates with lock measuring cylinder (special tool 9514). Page D39-202e.

5. Check pressure at locking torque (friction value of the lock) (Pages D39-203...D39-213).

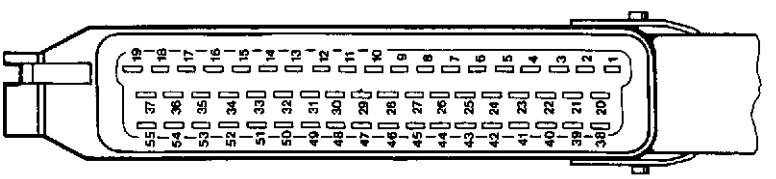
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Fault, DTC	Possible causes, remedy, notes

Test point 5

Control unit defective
DTC 15

Before replacing the control unit, check whether:
- there is any electrical interference from the ignition voltage (for example, if the spark plug caps are not correctly attached)
- there are any differences in potential caused by contact resistance (missing or poor ground connections).
  Important:
  A poor ground connection may occur not only at the affected components but also at other important grounding points.
- ground contact is present at control unit plug PINs 3, 52 and 37. These wires are connected to ground point IV or V (at the steering console in the case of left-hand drive vehicles / over the central electrical system in the case of right-hand drive vehicles).



Important
When replacing the PSD/ABS control unit, make sure that it is not confused with the PDAS/ABS control unit from the 911 Carrera 4 (964).
Distinguishing feature on P. D39-236.

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Fault, DTC	Possible causes, remedy, notes

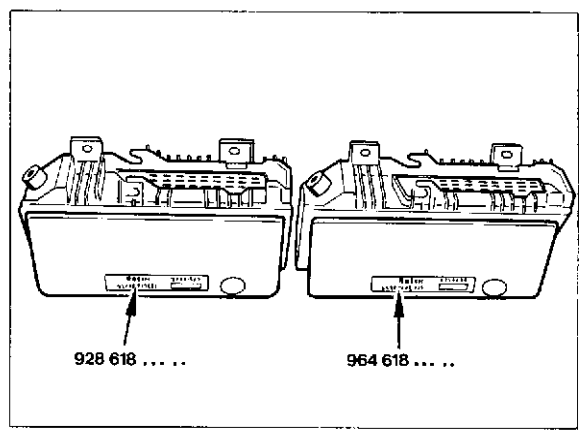
Test point 6

Front left wheel sensor
DTC 21

No signal from speed sensor reaches control unit, or signal is incorrect / unrealistic.

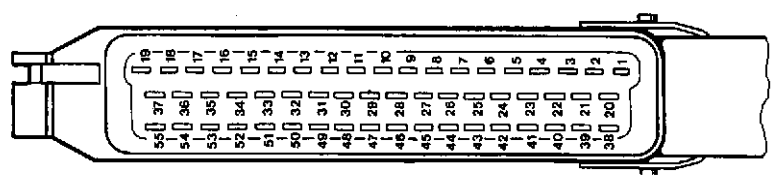
Important: This fault is also indicated if the PDAS/ABS control unit for the 911 Carrera 4 (964) is installed.
If assembly work has already taken place, check that the correct control unit has been installed.
Distinguishing feature: part number.

928 control unit with PSD = 928 618 ... ..
911 Carrera 4 control unit = 964 618 ... ..



1. Pull off the control unit plug. Measure the internal resistance / check continuity between PIN 50 and PIN 48 on the plug.
   Nominal value 600...1600 Ω.
   If the nominal value is not attained, check the wires and plug connections in the circuit from the front left speed sensor.

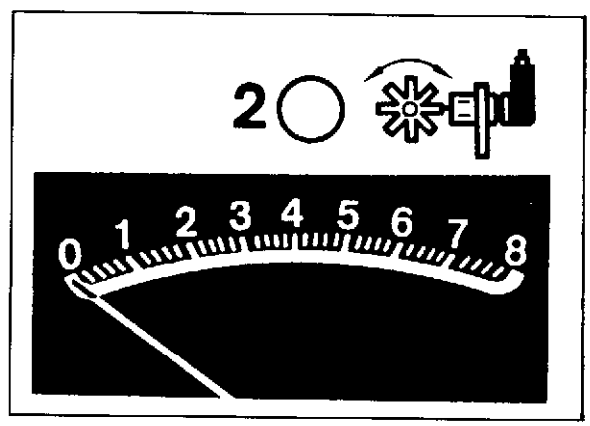
   If the nominal value (600...1600 Ω) is not attained although the wires / plug connections are in working order, replace the speed sensor.
   Important: Perform measurement directly on the speed sensor before replacing the sensor.



Fault, DTC **Possible causes, remedy, notes**

2. Checking the speed sensor signal.
For this check, use the ABS 2-LED tester or an oscilloscope.
Connect the ABS 2-LED tester to the control unit plug with the 55-pole adapter lead.
If an oscilloscope is used, separate the speed sensor plug connection at the wheel suspension or on the spring strut dome in the engine compartment (see Page D39-228 for distinguishing features for wires).
Connect the oscilloscope to the plug at the speed sensor side.
Depending on the tester, select special input or secondary screen.

Check by turning the left front wheel by hand.
ABS tester in program switch position 6 / rotary switch for wheel selection to front-left wheel. Turn the wheel until the LED (No. 2) lights up without flickering.
If an oscilloscope is used, turn approx. 1 revolution per second.



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Nominal values / nominal display

ABS 2-LED tester = > 2.0
Oscilloscope = sine wave > 2 Volt
(measured value: peak to peak)

Possible causes of deviations:

- Air gap at speed sensor too large / too small (check installation).
- Pulse wheel damaged or corroded
- Wheel bearing play too large

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Fault, DTC	Possible causes, remedy, notes

Test point 7

Front right speed sensor
DTC 22

General procedure as for DTC 21 (test point 6)
1. Internal resistance / continuity between PIN 47 and PIN 46 at control unit plug.

2. Speed sensor signal: If the ABS tester is used, turn the wheel selector switch to the front right wheel.

Test point 8

Rear right speed sensor
Rear left

General procedure as for DTC 21 (test point 6)
1. Internal resistance / continuity between PIN 42 and PIN 43 at control unit plug.

2. Speed sensor signal: If the ABS tester is used, turn the wheel selector switch to the rear right wheel.

Test point 9

Rear left speed sensor
DTC 24

General procedure as for DTC 21 (test point 6)
1. Internal resistance / continuity between PIN 44 and PIN 45 at control unit plug.

2. Speed sensor signal: If the ABS tester is used, turn the wheel selector switch to the rear left wheel.

Test point 10

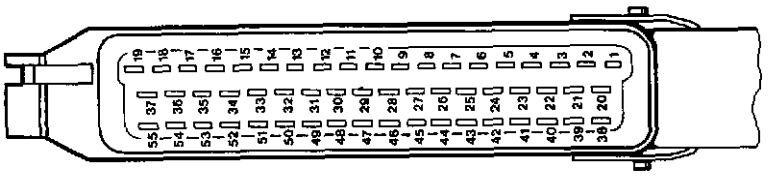
Front left ABS valve
DTC 31

Certain faults in the ABS valve area (short circuit to plus or short circuit to ground in a control wire) can also be shown as a **valve relay fault** by the 9288 system tester.
A fault in the ABS valve circuits is normally stored as an **ABS valve fault** in the DTC memory of the control unit.
When the DTC memory is read out, it is possible in the above situation for **two faults to be displayed (ABS valve and valve relay).**

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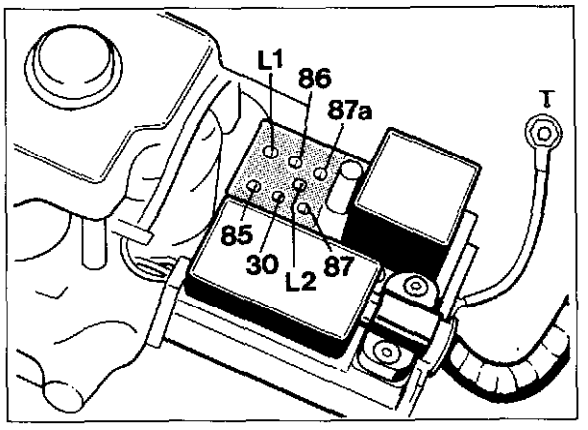
Fault, DTC	Possible causes, remedy, notes

1. Switch off the ignition and pull the plug off the control unit. Check PIN 19 of plug to PIN 17 and to PIN 23 for continuity.
   If necessary, interrupt the circuit (plug at hydraulic unit) and localize the discontinuity by reference to the wiring diagram.



2. Pull off the valve relay (7-pole) at the hydraulic unit.
   Check for a short circuit to plus or to ground in the circuit as described in point 1 by measuring at PIN 19.
   If a fault is detected, interrupt the circuit as described in point 1 in order to localize the incorrect short-circuit to plus or to minus.

3. Check resistance between PIN 19 of the plug and terminal 30 at the valve relay.



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If nominal value is obtained: proceed with point 4.
If nominal value is not obtained:
Pull off the 12-pole plug at the hydraulic unit.
Check internal resistance of the ABS solenoid valve. Measure between PIN 1 and PIN 4 (at the hydraulic unit).
Nominal value 0.7...1.7 Ω.
If nominal value is incorrect: replace the hydraulic unit.

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Fault, DTC	Possible causes, remedy, notes
	4. Check whether the valve relay is energized (voltage is present at the solenoid valves). To make this check, connect all plugs and the relay. Push back the protective tube on the transverse lock valve plug (in the wheel housing at the rear left). Switch the ignition off, then on again. Battery voltage must be present at the black wire. If no voltage is present: continue with DTC 34 (valve relay). Comply with the testing notes. If voltage is present, try replacing the PSD/ABS control unit (output stage defective). **Testing notes** If a voltage supply plug to the solenoid valves (ABS valves or differential lock) is pulled off while the ignition is switched on, the valve relay will be de-energized. It is not re-energized when the plug is reconnected until the ignition has been switched off and on again.
Test point 11 Front right ABS valve **DTC 32**	Comply with note under test point 10: Front left ABS valve (DTC 31). When troubleshooting, proceed as for DTC 31, but use PIN 22 instead of PIN 19 on the control unit plug. To check the internal resistance of the ABS valve (after pulling off the 12-pin plug at the hydraulic unit), measure between PIN 3 and PIN 4 (instead of PIN 1 and PIN 4).
Test point 12 Rear axle ABS valve **DTC 33**	Comply with note under test point 10: Front left ABS valve (DTC 31). For troubleshooting, proceed as for DTC 31, but use PIN 2 instead of PIN 19 of the control unit plug. To check the internal resistance of the ABS valve (after pulling off the 12-pin plug at the hydraulic unit), measure between PIN 5 and PIN 4 (instead of PIN 1 and PIN 4).

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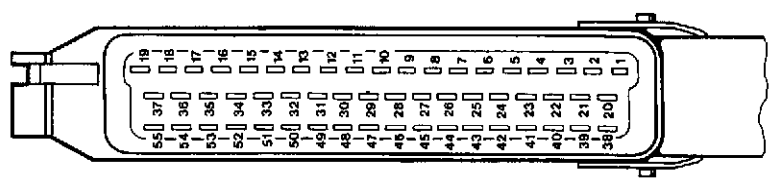
Fault, DTC	Possible causes, remedy, notes

Test point 13

Valve relay
DTC 34

Certain faults in the ABS valve area (short circuit to plus or short circuit to ground in a control wire) may also be shown as **valve relay faults** by the 9288 system tester.
A fault in the ABS valve circuit is normally stored as an **ABS valve fault** in the DTC memory of the control unit.
In the case described above, when the DTC memory is read out the display of **two faults is possible (ABS valve and valve relay).**

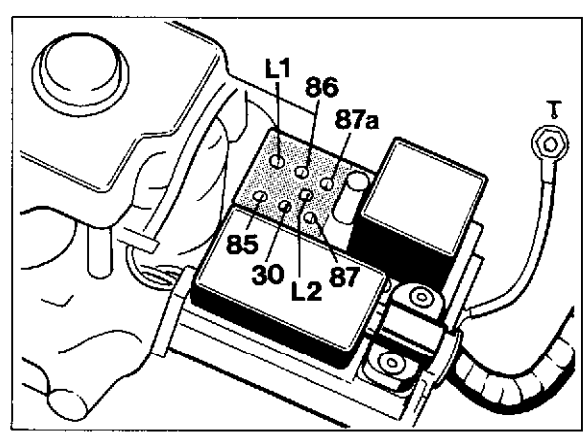
1. Switch off the ignition. Pull off the control unit plug.
   Check the control circuit (wire with relay) - from PIN 20 to PIN 7 - for any discontinuity, short circuit to ground and short circuit to plus.



If no fault is found, proceed with 2.

If there is a discontinuity, short circuit to plus or short circuit to ground, pull off the valve relay. Check the wires between terminal 85 on the relay base and PIN 7 on the control unit plug and between terminal 86 and PIN 20.

If the wires are in working order, replace the valve relay.



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Fault, DTC	Possible causes, remedy, notes

2. Measure resistance between the following PINs at the control unit plug:

PIN 19 to PIN 17
PIN 22 to PIN 17
PIN 2 to PIN 17
Nominal value approx. 1...2 Ω

PIN 21 to PIN 23
Nominal value approx. 2...4 Ω

If the nominal value is correct, proceed with 3.

If incorrect values are obtained, localize the fault as appropriate.
From PINs 19, 22, 2 to PIN 17 = ABS valves + wiring.
From PIN 21 to PIN 23 = Lock valve + wiring.

Re ABS valves + wires

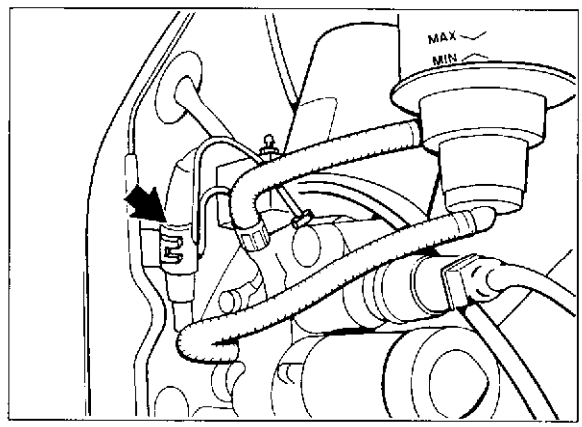
Pull off the 12-pole plug at the hydraulic unit.
Measure the internal resistance of the solenoid valves.
PIN 1 to PIN 4
PIN 3 to PIN 4
PIN 5 to PIN 4
Nominal value approx. 0.7...1.7 Ω

Nominal value not obtained: replace hydraulic unit.

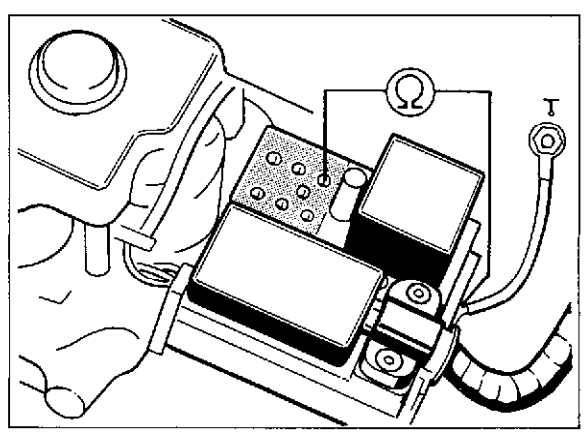
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Fault, DTC	Possible causes, remedy, notes

Re transverse lock valve + wiring:
Separate plug connection at the transverse lock valve (arrow).
Measure internal resistance of the solenoid valve.
Nominal value 2...4 Ω
If an incorrect value is obtained: Replace transverse lock valve.



3. Pull off valve relay (7-pole) at hydraulic unit. Measure at control unit plug PIN 17 in order to determine whether there is a short circuit to plus or to ground.
   If necessary, interrupt the circuit at the hydraulic unit plug (12-pole) and localize the fault by reference to the wiring diagram.
4. Check whether voltage is present at terminal 87 of the relay base when the valve relay is pulled off. Required display: approx. 12 Volt (battery voltage).
5. Measure resistance between terminal 87 a on the relay base and the ground wire at the pump motor.
   Nominal value ≈ 2...4 Ω. The prerequisite is here is that the ground wire and the ground point are in working order.
   If necessary, replace the hydraulic unit (resistance in relay base has increased in value).



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Fault, DTC	Possible causes, remedy, notes

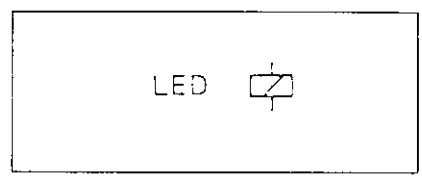
6. Check wires from terminal L1 on the relay base to PIN 24 on the control unit plug and from L2 to PIN 35 for discontinuity.

   Important: The test from L2 to Pin 35 can be performed only if the warning contact of the pressure warning switch is closed (see wiring diagram).
   This means that the pump for the lock hydraulics must have operated beforehand (system pressure greater than 140 bar).

7. Check that the valve relay is energized (voltage present at the solenoid valves).
   Connect all plugs and the relay.
   Push back protective tube on the transverse lock valve plug (at the rear left in the wheel housing).
   Switch the ignition off, then switch it on again.
   Battery voltage must be present at the black wire.

   If no voltage is present, try replacing the valve relay, or test the relay with the ABS 2-LED tester in order to determine whether it is actually defective.

   If the LED of the ABS tester fails to light up steadily in program switch position 5 with the ignition switched on, the relay is defective.



8. If the valve relay is in working order, try replacing the PSD/ABS control unit (output stage defective).

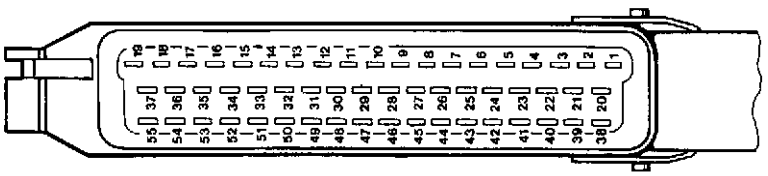
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Fault, DTC	Possible causes, remedy, notes

Test point 14

Return pump,
DTC 35

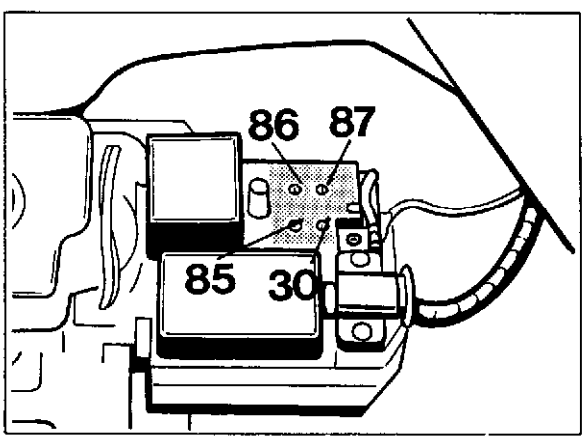
1. Switch off the ignition. Pull off the plug at the control unit. Check control circuit (wire with relay) - PIN 20 to PIN 5 - for discontinuity and short circuit to ground/to plus.



If no fault is found, proceed with 2.

If there is a discontinuity, short circuit to plus or to ground, pull off the motor relay. Check wiring between terminal 85 at the relay base and PIN 5 on the control unit plug, and between terminal 86 and PIN 20.

If the wiring is in working order: Replace the motor relay.



2. Pull off the motor relay. Battery voltage (approx. 12 Volt) must be present at terminal 87 of the relay base.

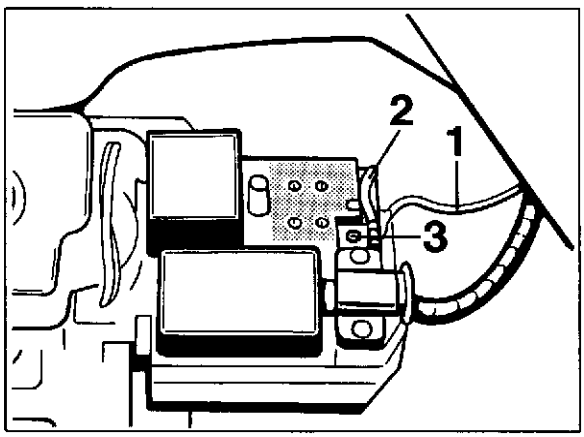
3. Bridge terminals 30 and 87 at the relay base.
If the return pump does not run, continue with 4.

If the return pump runs:
Check wire from terminal 30 on the relay base to PIN 31 at the control unit plug. If the wire is in working order: Replace the motor relay.

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Fault, DTC	Possible causes, remedy, notes

4. Check connections at ground wire (1) and plus wire (2) (contact resistance).
Bridge terminals 30 and 87 at the relay base and check whether voltage is present at the connection point (3).
If voltage is present (but the return pump is not running): Replace the hydraulic unit (defective return pump).



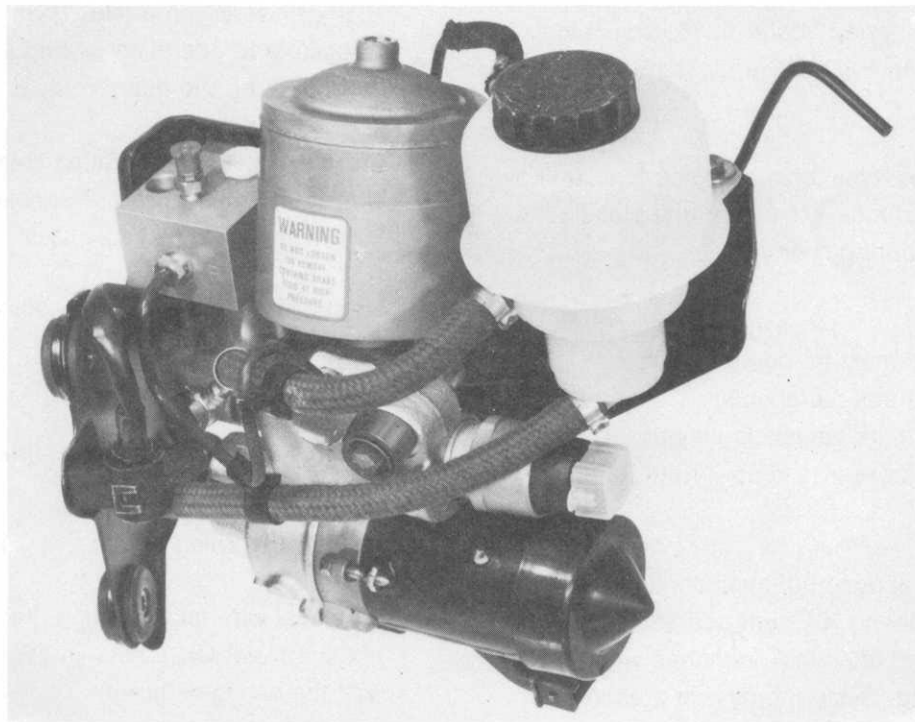
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Check lock hydraulics (energy production)

General information

The hydraulics comprises the high-pressure pump, solenoid valve, pressure reservoir and supply tank. The components are located on on a joint bracket in the rear-left wheel housing.

The brake fluid for operating the transverse lock is obtained from the piston reservoir mounted on the high pressure pump. The operating pressure is between 140 and 180 bar. The pump is activated via a pressure warning switch.
The solenoid valve familiar from the ABS system controls the functions pressure increase, pressure maintenance and pressure reduction, and applies pressure to the slave cylinder of the transverse lock.



Important note

Check hydraulics of the lock (energy production) if "PSD off" appears in the display fields of the instrument cluster even though no fault is stored (following pages).

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Check hydraulics of the lock

This comprises: check of the lock hydraulics without pressure gauge (special tool 9509).

Precondition

Read out DTC memory with system tester 9288. No fault stored.

1. Jack up the vehicle on one side until a rear wheel can be turned freely.

2. Switch on system tester 9288. Select lock test (system PSD/ Drive Links menu).

3. Pulse transverse lock (pressing function key 1 on tester once = 1 pulse) and simultaneously turn the rear wheel.

4. The wheel must be completely fixed (locked) after several pulses.
   Caution: If the vehicle is fully raised, hold the opposite rear to keep it from turning.

5. If the wheel does not lock, continue with troubleshooting "System depressurized".
   If the wheel does lock, continue with troubleshooting: System pressure present.

Troubleshooting

If the system is depressurized, the following faults are possible:

- Brake fluid reservoir (No. 12) empty (system leaks).

- Voltage supply for high-pressure pump (No. 1) not OK (check pump relay No. 38 and fuse in the luggage compartment).

- Pressure warning switch (No. 2) not OK. Test on Page D39-251 ff.

- High-pressure pump (No. 1) defective. Check pump operation by bridging terminals 30 and 87 on the pump relay (in the luggage compartment).
  Important: Pump operating time when bridging the terminals max. 3 seconds. (Perform test only once.)

- **Mechanical** defect of lock solenoid valve (No. 9).

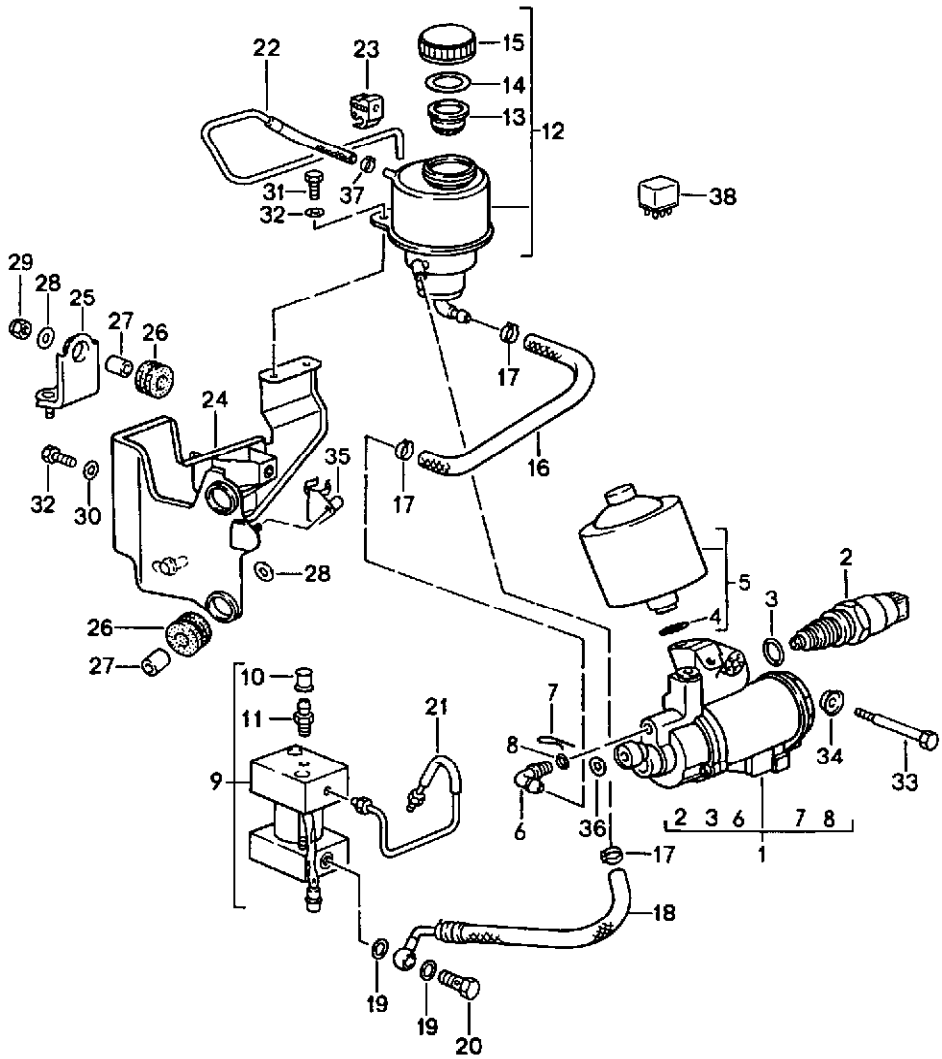
The following faults are possible if system pressure is present:

- Pressure warning switch (No. 2) not OK.

- Electrical wire for activating the fault display "PSD off" not OK (check in combination with the wiring diagram).

- High-pressure pump no longer operates (defect, or voltage supply not OK), but there is still a residual pressure of less than 107 bar in the system. This pressure is reduced each time the pump is operated.

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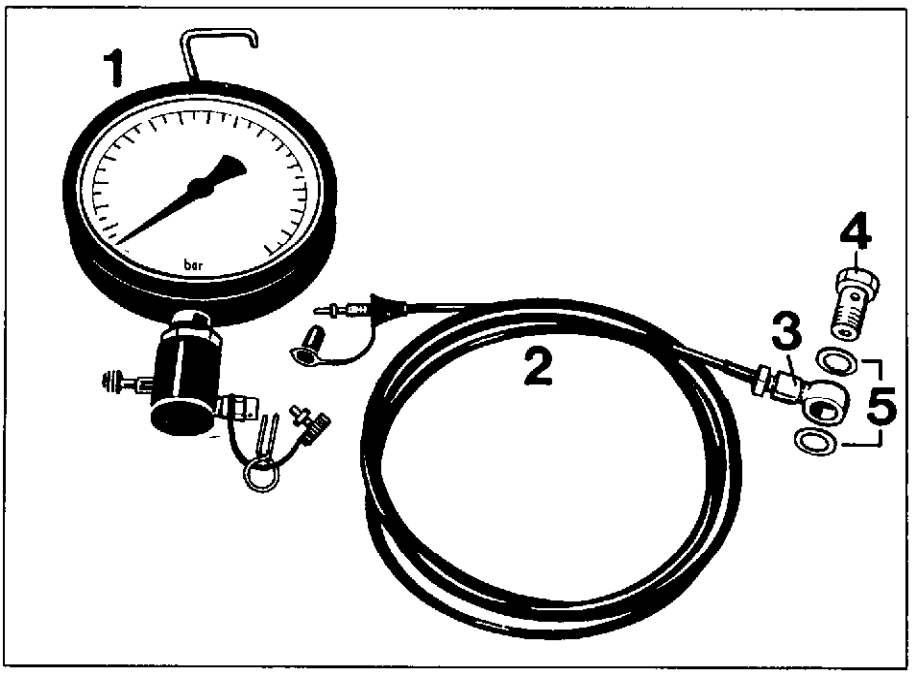
3/07/82

Important note

If the pressure warning switch (No. 2) and / or the pressure reservoir (No. 5) is detached with the high-pressure pump (No. 1) **removed, do not set down the pump upside down** (with the pressure reservoir connection facing down). **If this is not observed** , the pump might not function after installation (air in the pump). Fast turning or shaking motions from thr normal position might make the pump operational again.

Checking locking torque (friction coefficient) of transverse lock

Tools



345/1-D39/45

No.	Designation	Special tool	Order number	Explanation
1	Pressure gauge	9509	000.721.950.90	
2	High-pressure measuring line	9509/1	000.721.950.91	
3	Ring flange	-	999.215.027.02	
4	Banjo bolt	-	930.110.547.00	shorten threads by approx. 4mm
5	Seal	-	N 013 811 2	2 pc.

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Pressure tests on the lock hydraulics (energy production)

Overview

1. General

2. Pressure gauge connection

3. Tests

4. Nominal values/Notes

1. General

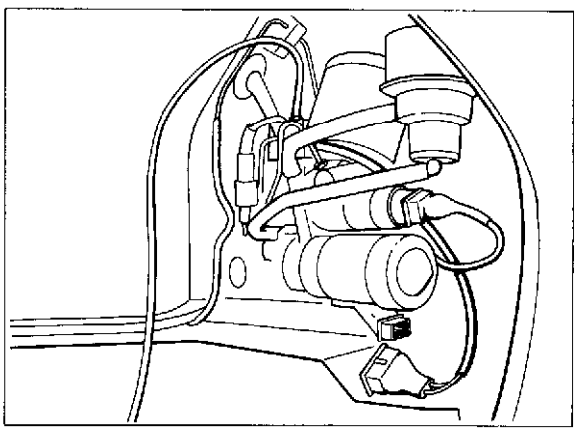
The following points can be checked by means of the pressure test on the differential lock hydraulics (lock control):

- Freedom from leaks of the lock hydraulics (any internal leak can thus be localized)
- Gas filling pressure of the pressure reservoir
- Switching points for the lock hydraulics (display "PSD off" and operating pressure). This is controlled by the pressure warning switch of the pump assembly.

2. Pressure gauge connection

- Depressurize the lock hydraulics. To do this, disconnect the electrical plug at the pressure pump (pump assembly) and then relieve the pressure at the pressure relief valve of the lock solenoid valve (use a collection bottle).

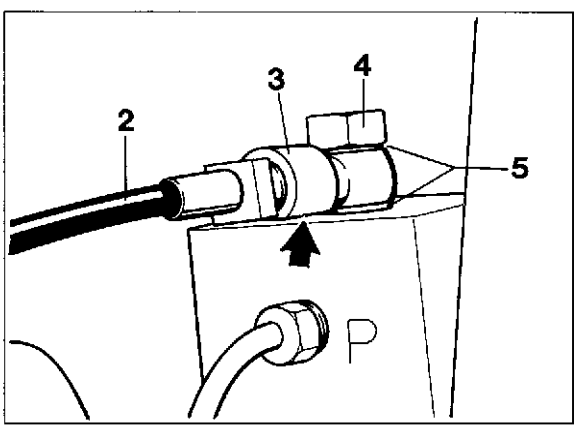
Important: Wear goggles and protective gloves, as the pressure may be as high as 180 bar.



2389-D39

- Connect pressure gauge 9509 - in combination with the high-pressure measuring line 9509/1 (No.2), ring connection (No. 3), banjo bolt (No. 4) and two seal rings (No. 5) - at the lock solenoid valve instead of the bleeder valve.

Important: Machine ring connection (No. 3) beforehand (apply face/arrow).



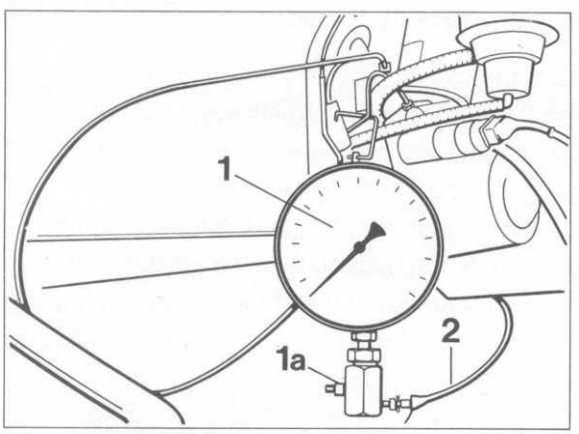
2390-D39

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– **Bleed pressure gauge (No. 1).** To do this, connect a collection bottle to the pressure gauge bleeder valve (No. 1a) and open the valve.
Turn ignition key to position 2 (necessary for pump operation).
Plug the electrical plug onto the pump. **Disconnect the electrical plug and close the bleeder valve** as soon as no air bubbles are visible anymore in the transparent bleeder line of the collection bottle.
Make sure that the brake fluid reservoir is not sucked empty. Fill in brake fluid from time to time if necessary.

Note

Depressurize the lock hydraulics before removing the pressure gauge after the test.



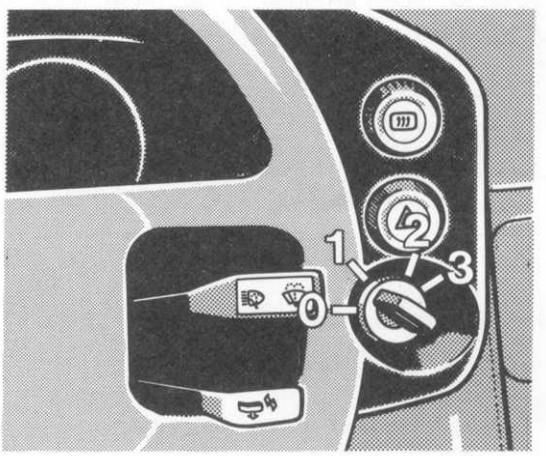
991A-D39

3. Tests

Note

Operation of the pump is regulated by means of the ignition key for testing purposes.

Position 0 = Pump **off**
Position 2 = Pump **on** until switched off by the pressure warning switch.



BA-928/30

– In ignition key position 0, plug the electrical plug onto the pump. Locate the pressure gauge in a position where it can be seen.

For the tests, it is expedient to observe the following sequence:

a. Pressure reservoir - gas filling pressure

b. Switching points for the warning display "PSD off"

c. Cut-in and cut-out points of the pump

d. Leak test

– Turn the ignition key to position 2 (pump starts up).

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a. Gas filling pressure of the pressure reservoir.

Turn the ignition key to position 0 at approx. 100 bar. Briefly open the bleeder valve on the pressure gauge (use collection bottle) and close it again immediately. The pressure drop on the pressure gauge should be approx. 5 bar. Continue this process in intervals. The pressure reservoir gas filling pressure has been reached at the instant the pointer of the pressure gauge abruptly falls to 0 bar.
Refer to Page D39-255 for nominal values.

Important: Always wear goggles and protective gloves when decreasing the pressure via the bleeder valve.

b. Checking the switching points for the warning display in the instrument cluster.

During pressure increase:

Start the engine and observe the warning display. Immediately turn the ignition key to 0 position at the instant the warning display (PSD off) goes out. Read off the pressure on the pressure gauge.

During pressure reduction

Produce a system pressure of approx. 140 bar.
Disconnect the plug at the pressure pump.
Start the engine.
Reduce the pressure - in a similar manner to the procedure described in Gas filling pressure of the pressure reservoir - until the warning display (PSD off) lights up. Read off the pressure on the pressure gauge. Refer to Page D39-255 for nominal values.

c. Checking the switching points of the pressure pump

Cut-out pressure: Turn the ignition key to position 2. The electrical plug must be plugged onto the pressure pump for this.
Read off the pressure on the pressure gauge **immediately** after the pump cuts out automatically.

Cut-in pressure: Turn ignition key to position 2. Wait until the pump cuts out automatically if necessary. Carefully reduce the system pressure at the pressure gauge bleeder valve (use collection bottle) until the pump cuts in again. Read off the pressure on the pressure gauge at this moment. Refer to Page D39-255 for nominal values.

d. Checking the tightness (pressure loss) of the lock hydraulics.

Turn the ignition key to position 2. Wait until the pump cuts out automatically. Carefully lower the system pressure at the pressure gauge bleeder valve (use collection bottle) until the pump cuts in again. After the pump cuts out automatically, turn the ignition key to position 0 and disconnect the electrical plug at the pump. Measure the pressure decrease over time.
The permissible values are given on Page D39-255.

Note

Depressurize the lock hydraulics before removing the pressure gauge.

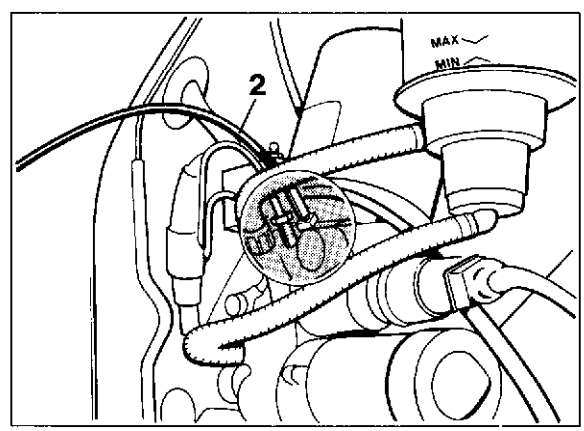
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4. Nominal values/Notes

Nominal values		Notes
Pressure reservoir - Gas filling pressure		Replace pressure reservoir if the gas filling pressure has reached or fallen below the wear limit
new	80 ± 5 bar	
wear limit	40 bar	
Switching points of the pressure warning switch		If the actual values deviate from the nominal values, replace the pressure warning switch.
PSD off	Warning point	
for pressure increase	up to approx. 115 bar	
	max. up to 133 bar	
for pressure reduction	as of 105 + 2 / – 5 bar	
Cut-out point of the pump		Read off the pressure immediately after the pump cuts out automatically.
at the latest	at approx. 180 bar	
at the earliest	at approx. 160 bar	
Cut-in point of the pump (after pressure reduction)	140 + 5 / – 6 bar	
Freedom from leaks of the lock hydraulics Pressure reduction, starting from the cut-out point of the pump (precondition: the nominal value has been achieved)		Fill the pressure reservoir completely 2x previously (start the pump running again after the 1st cut-out operation by opening the bleeder valve on the pressure gauge). Use a collection bottle. Then turn the ignition key to position 0 and disconnect the electrical plug at the pump. External leak: Retighten lines or replace the corresponding parts.
not below 140 bar in 30 minutes		Possible internal leaks: Refer to Page D39-256
not below 100 bar in 3 hours		

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Nominal values	Notes
	Possible internal leaks: – Lock solenoid valve – Pump assembly First check the lock solenoid valve. Then remove the pressure line from the pump assembly (with the system depressurized). Connect high-pressure measuring line 9509/1 (No. 2) – **without ring connector** – to the pump assembly. Repeat the test. If the nominal values are now achieved, replace the lock solenoid valve. If the nominal values are not achieved, the fault lies in the pump assembly. Replace faulty parts and bleed the system. **Caution:** Wear goggles and protective gloves when reducing pressure via the bleeder valve.



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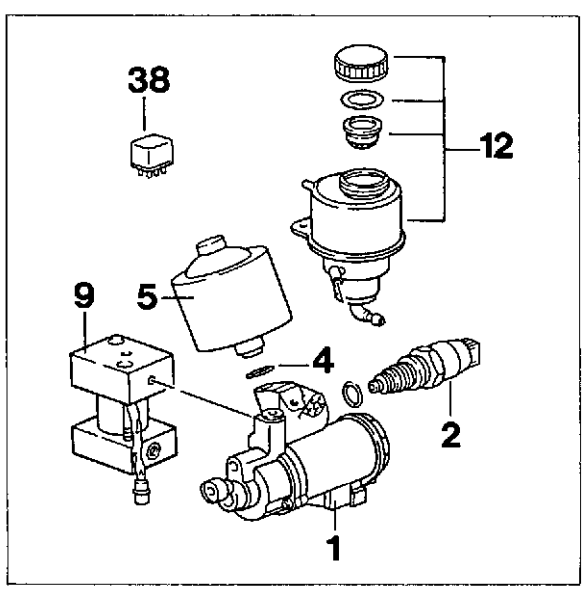
Removing and installing pressure warning switch of lock hydraulics

Removal

1. With the ignition key in position 0, pull off both plugs at the pump assembly.

2. Completely depressurize the system. To do this, slowly open the bleeder valve on the lock solenoid valve and drain the brake fluid into a collection bottle.
   Important: The system is under a pressure of up to 180 bar. Wear goggles and protective gloves.

3. Remove pressure warning switch (No. 2) with special tool 9524. Prevent the pump assembly from turning while loosening the switch.
   Important: First clean the area around the pressure warning switch and cover it with lint-free cleaning cloths to trap the small amount of residual brake fluid that emerges.



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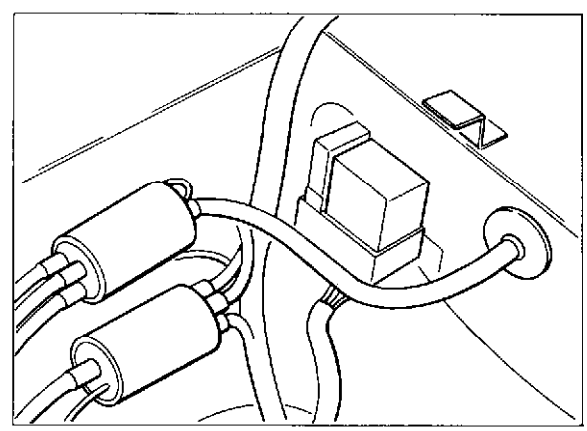
Installing

1. Screw in the pressure warning switch (No. 2) and tighten to a torque of 26 Nm (19 ft-lb). Replace the O-ring if necessary. Prevent the pump assembly from turning while tightening the pressure warning switch.

Note

Wet the sealing ring with brake fluid only. Never use brake cylinder paste. Absolute cleanliness is essential. Use only lint-free cleaning cloths.

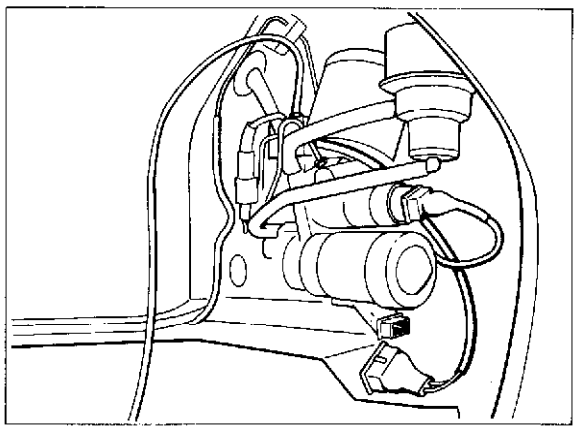
2. If there is an electrical fault at the pressure warning switch, always replace the hydraulic pump relay (in the luggage compartment) as well.



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3. Attach plug to pressure warning switch (plug on the pump side remains disconnected at this point).



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4. Partially bleed the lock hydraulics as follows: With the ignition switched on, open the bleeder valve on the lock solenoid valve. Attach the electrical plug to the pump. As soon as brake fluid emerges free from air bubbles, pull off the electrical plug and close the bleeder valve.
Next, charge the pressure reservoir completely. To do this, attach the electrical plug. As soon as the pump is heard to switch off, **pull off the electrical plug** and reduce the pressure at the bleeder valve of the lock solenoid valve. Slowly open the bleeder valve and hold the bleed hose firmly.
Important: A pressure of up to 180 bar is present in the system. Wear goggles and protective gloves.

5. If necessary, connect pressure gauge - special tool 9509 - to the pressure reservoir and check the switching points of the pressure warning switch and also for leakage in the differential lock hydraulics.
The exact work procedures and nominal values are stated on Pages D39-251 – D39-256.

Note

If necessary, top up the brake fluid level at intervals so that the brake fluid reservoir is not drained completely. The lock hydraulics must be at zero pressure when connecting and removing the pressure gauge.

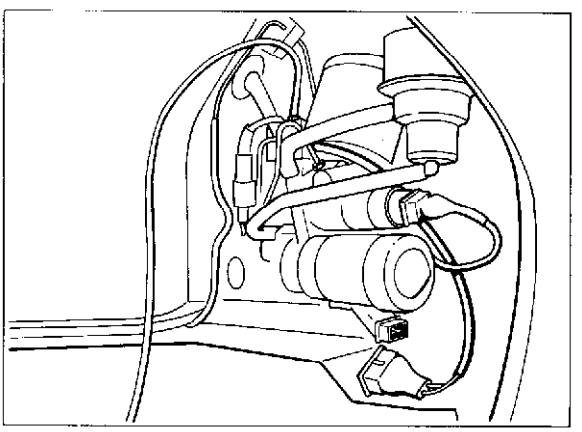
6. After the testing and assembly work has been completed, correct the brake-fluid level when the pressure reservoir is fully charged.

Removing and installing the pressure reservoir

Removal

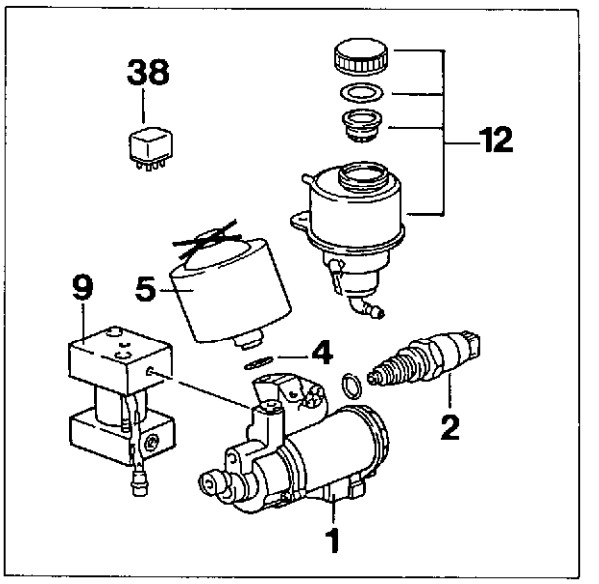
1. Pull off plug on the pump motor with the ignition key in position 0.

2. Completely depressurize the system. For this purpose, slowly open the bleeder valve on the lock solenoid valve and drain the brake fluid into a collection bottle.
Important: The system is under a pressure of up to 180 bar. Wear goggles and protective gloves.



2389-D39

3. Undo the pressure reservoir (No. 5). Use a universal filter wrench – e.g. Hazet 2171-2 – for this purpose.
Important: Never loosen at the filler screw X, as the gas pressure will escape abruptly in this case.



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Installation

1. Screw in the pressure reservoir (No. 5) with new O-Ring (No. 4) and carefully tighten it using a universal filter wrench (tightening torque 40 ... 46 Nm; damage is possible above a torque of approx. 70 Nm).
Never turn the filler screw when installing the pressure reservoir.
Hold the pump assembly in position when tightening the pressure reservoir.

Note

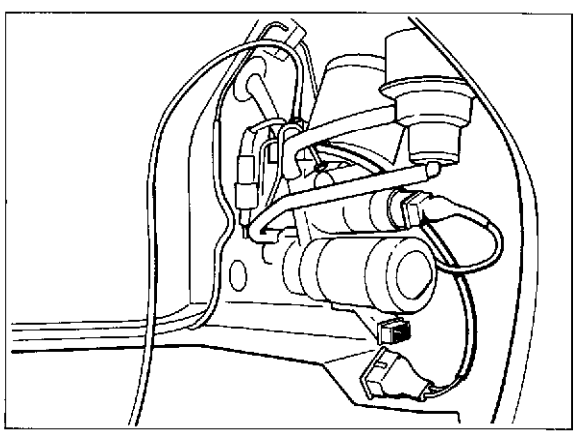
Wet the seal ring with brake fluid only. Never use brake-cylinder paste. Absolute cleanliness is essential. Use only lint-free cleaning cloths.

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2. **Bleed the pressure reservoir and lock solenoid valve as follows:**
   Open the bleeder valve on the lock solenoid valve. Push the electrical plug onto the pump with the ignition switched on. Pull off the electrical plug and close the bleeder valve as soon as the brake fluid emerges without air bubbles (use a collection bottle).
   Now fully charge the pressure reservoir.
   Push on the electrical plug. As soon as the pump is heard to switch off, **pull off the electrical plug** and reduce the pressure at the bleeder valve of the lock solenoid valve to zero (slowly open the bleeder valve / use a collection bottle).
   Important: The system is under a pressure of up to 180 bar. Wear goggles and protective gloves.

Note

If a filling and bleeding unit is not connected, always check the level in the fluid reservoir between bleeding processes and top up with brake fluid if necessary.



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3. **Repeat the last process (fully charging the pressure reservoir and then reducing the reservoir pressure to zero) approx. 1-2 times (brake fluid must be free from air bubbles).**

4. **Bleed lock cylinder and pressure lines.**
   For this purpose, the lock solenoid valve is pulsed with system tester 9288. The high pressure present at the solenoid valve thereby enters the pressure lines in pulses and reaches the lock cylinder via the non-return valve.
   Drain off brake fluid at the bleeder valve of the lock cylinder until no more air bubbles appear.

5. After completing the assembly and bleeding work, correct the brake fluid level
   – with the pressure reservoir fully charged.

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TECHNICAL DATA

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Suspension	Independent suspension, double control arm with coil spring and internal damper.
Springs	1 coil spring per wheel
Dampers Make/installation	Double-action hydraulic dampers See page 40 - 51
Stabilizers	
until end of model year 79	dia. 26 mm
80 models onward	dia. 28 mm x 4 (tubular stabilizer)
86 models onward	dia. 28 mm x 4 (tubular stabilizer) with modified knuckle

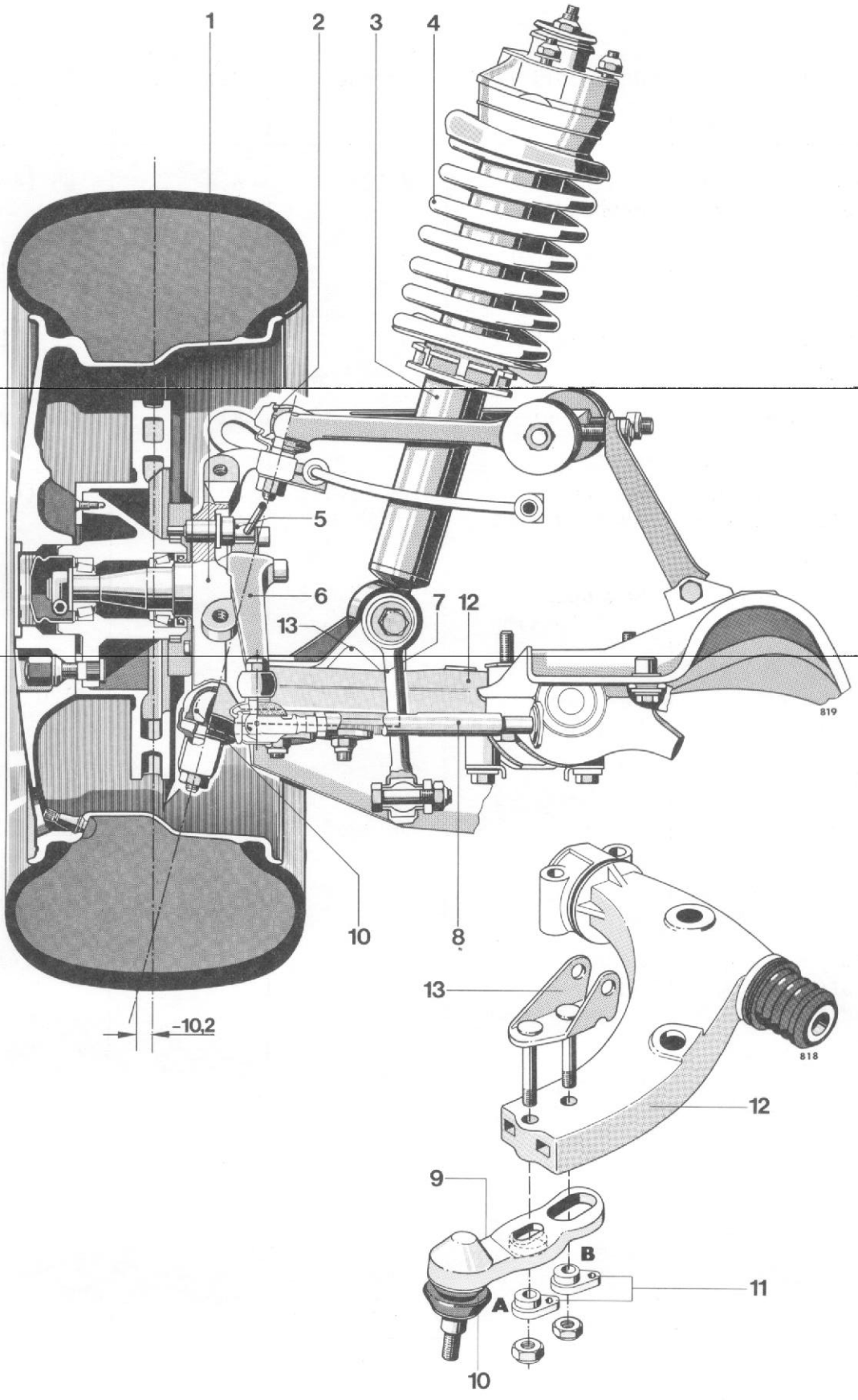
TIGHTENING TORQUES FOR FRONT AXLE

Location	Description	Thread	Material	Torque Nm (ftlb)
Upper control arm to body	Self-locking hex nut	VM 14x1.5	8	140 (103)
Lower control arm to body, rear	Hex bolt	M 12x1.5	10.9	120 (88)
Lower control arm to body, front	Hex bolt	M 12x1.5	8.8	85 (62)
Guard to longitudinal member	Self-locking hex nut	VM 10	8	46 (33)
Spring strut to body	Self-locking hex nut	VM 10	8	46 (33)
Spring strut and stabilizer linkage to lower control arm	Self-locking hex nut	VM 12x1.5	8	85 (62)
Stabilizer clamp to longitudinal member	Hex bolt	M 10	8.8	46 (33)
Stabilizer linkage to stabilizer	Self-locking hex nut	VM 12x1.5	8	85 (62)
Upper and lower control arms to steering knuckle	Flange locknut	M 12x1.5	8	65 (47)
Guard to steering knuckle	Hex bolt	M 7	8.8	15 (11)
Cable holder to steering knuckle	Hex bolt	M 7	8.8	15 (11)

Location	Description	Thread	Material	Torque Nm (ftlb)
Brake caliper to steering knuckle	Hex bolt Panhead bolt	M 12x1.5	8.8	85 (62)
Brake disk to wheel hub	Countersunk bolt	M 6	8.8	10 (7)
Panhead bolt to clamping nut	Panhead bolt	M 7	10.9	15 (11)
Wheel to wheel hub	Wheel nut	M 14x1.5	A1	130 (95)
Steering track rod to steering arm	Hex nut, self-locking	VM 12x1.5	8	65 (47)
Rubber bushing of piston rod of spring strut	Hex nut, self-locking	VM 12x1.5	8	60 (44)
Ball joint, (mounting) to lower control arm	Hex nut, self-locking	VM 12x1.5	10	120 (88)
Support plate on steering axle (upper control arm)	Hex nut, self-locking	VM 12x1.5	8	85 (62)
Roadspeed sensor to steering knuckle	Panhead bolt	M 6	8.8	10 (7)

NOTES ON FRONT AXLE, 86 MODELS ONWARD

New front wheel suspension

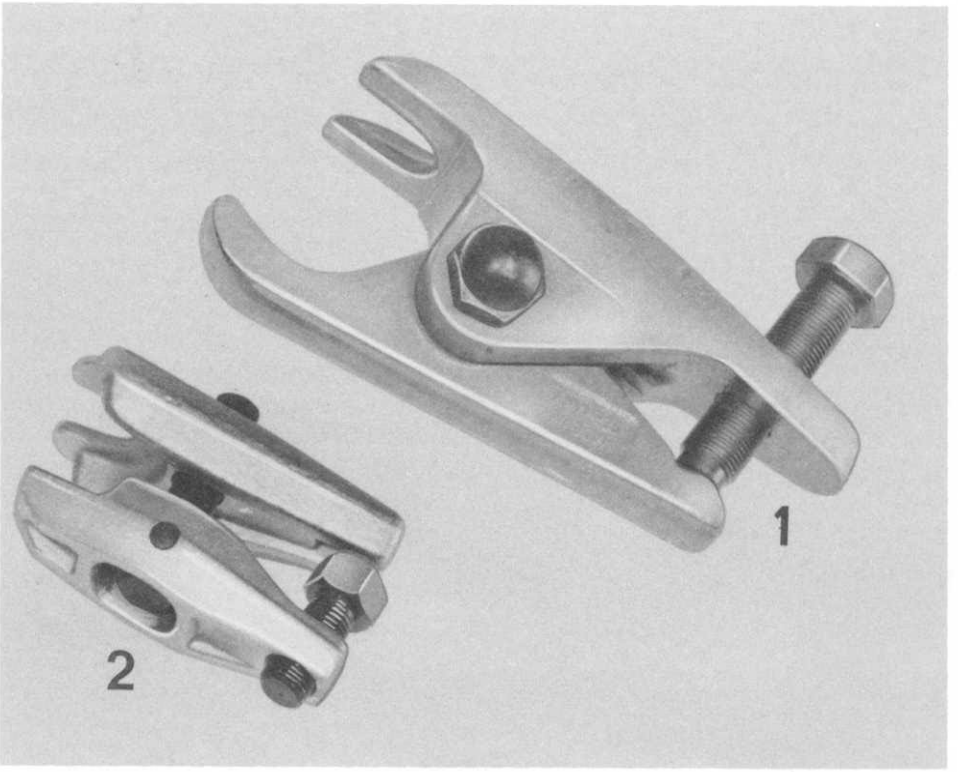


Front Axle Modifications, 86 Models Onward

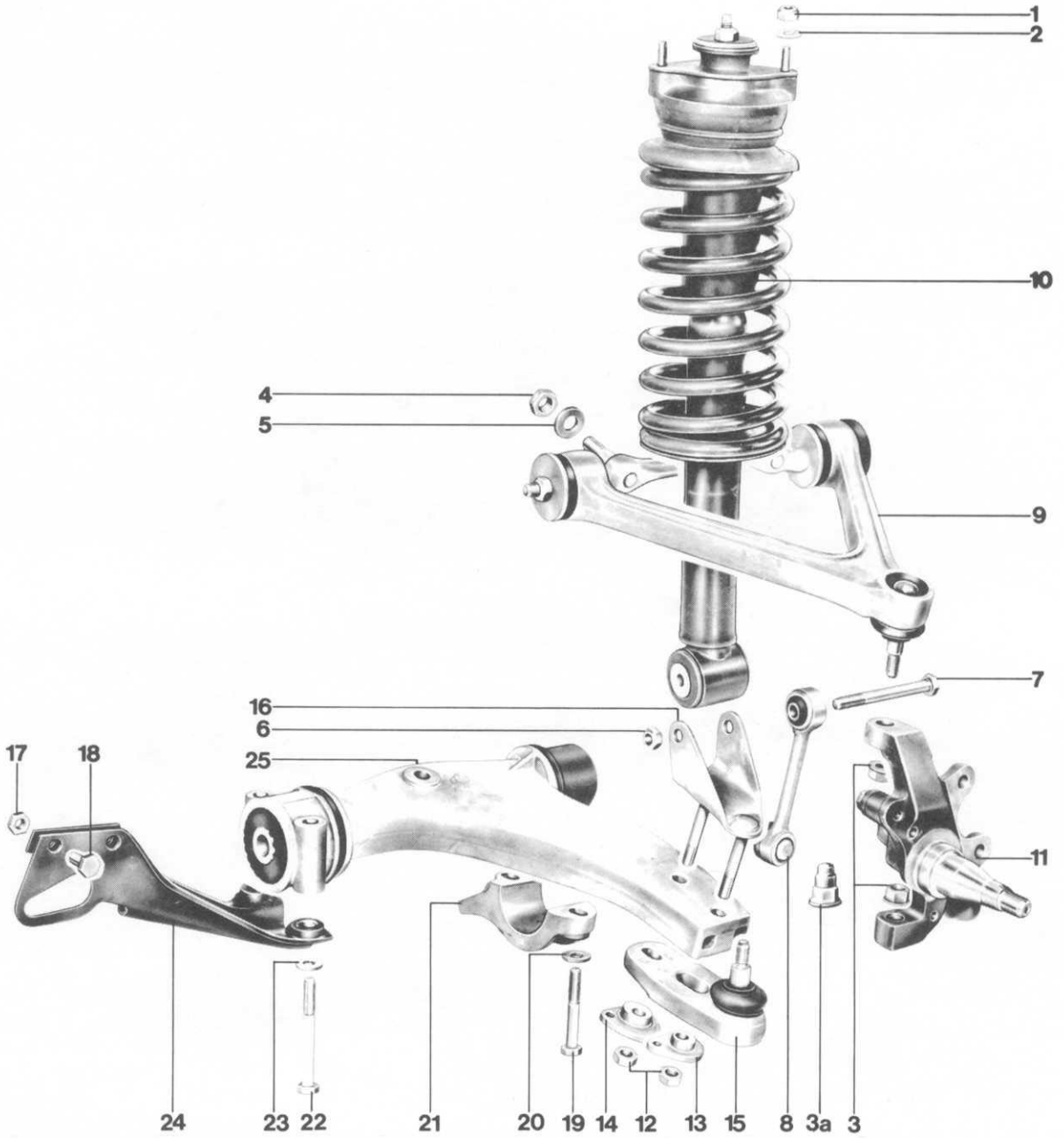
No./Description	Most Important Modifications	Remarks
1 Steering knuckle	Attachment points for brake caliper	Four-piston fixed caliper, 86 models onward
	Studs for wheel bearing (clearance and diameter for outer bearing)	
	Locator for ball joint No. 10 of the mounting	
- Wheel bearing	Outer wheel bearing larger. Distance between bearings increased	Adjust as before (every 20000 km)
- Steering offset	- 10.2 mm before - 16 mm	For braking system (four-piston fixed caliper)
		Heights and wheel geometry unchanged
2 Upper control arm	Shorter than before. Ball joint inclined outward	Distinguishing feature, P. 40 - 16/17
3 Dampers	Adjustment	Table P. 40 - 51
	2-pipe gas-filled dampers (Boge) standard and optional previously standard: 2-pipe pressureless (Boge) optional: 1-pipe gas-filled (Bilstein)	Combination with coil springs up to 86 models impermissible

No./Description	Most Important Modifications	Remarks
4 Coil springs	spring rate increased	Only for Boge gas dampers. Combination with dampers up to 86 models or Bilstein dampers impermissible P. 40 - 46
7 Stabilizer linkage	longer than before	P. 40 - 16/ 40 - 18
- Stabilizer	modified knuckle	P. 40 - 16/18
8 Steering track rods	approx. 10mm shorter than before	P. 40 - 16/17
9 Mounting (steel)	upright ball joint (previously trailing ball joint)	P. 40 - 19 to 40 - 21
11 Camber and caster eccentrics (same parts)	external contour smaller	External eccentric A = camber eccentric Internal eccentric B = caster eccentric P. 40 - 21
12 Lower control arm	shorter than before	Distinguishing feature/code P. 40 - 16/17
13 Spring strut stirrup	modified mounting point for spring strut, because control arm shorter but strut position same as in cars earlier than 86 models	Distinguishing feature/code P. 40 - 19 to 40 - 21

TOOLS



No.	Description	Special Tools	Remarks
1	Press-out tool	VW 267 a	
2	Track rod puller		e.g. Nexus 168 - 1


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No.	Description	Qty	Note When: Removing	Installing
1	Locknut	3		renew, torque: 46 Nm (33 ftlb)
2	Washer	3		
3	Flange locknut (for steering knuckles without push-off lug for ball joint)	2	load ball joint by exerting pressure on upper control arm	renew, torque: 65 Nm (47 ftlb). Exert pressure on upper control arm to load ball joint
	or			
3	Flange locknut	1		
3a	Cap locknut (on steering knuckles with push-off lug for the lower ball joint). (See page 40 - 25)	1		
4	Locknut	2	to ease installation, see removing as for 86 models onward (p. 40 - 8)	renew, torque: 140 Nm (103 ftlb)
5	Washer	1		only on rear pin of control arm
6	Locknut	1		renew, torque: 85 Nm (62 ftlb)
-	Washer, 928 S only (floating caliper brake)	1		
-	Air guide plate, 928 S (floating caliper brake)	1		

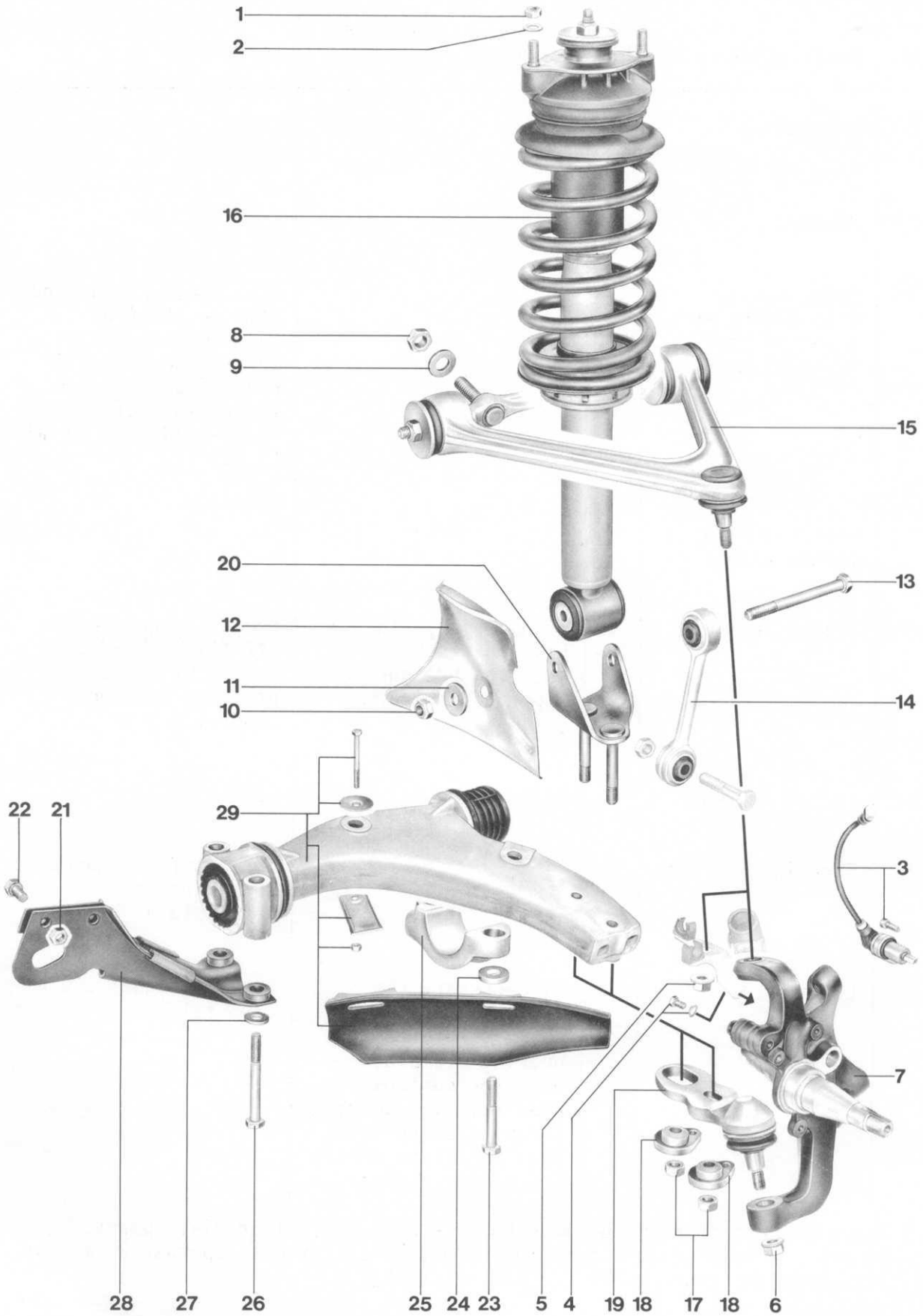
No.	Description	Qty	Note When: Removing	Installing
7	Hex bolt	1		
8	Stabilizer linkage	1		when replacing, do not confuse with version for 86 models onward. Installation overview, pages 40 - 16 to 40 - 18
9	Upper control arm	1		inspect, renew if necessary, reworking is impermissible
10	Spring strut	1		
11	Steering knuckle	1		inspect for damage, reworking is impermissible See page 40 - 25
12	Locknut	2		renew, torque: 120 Nm (88 ftlb)
13	Caster/camber eccentrics	1		lubricate sliding surfaces of eccentric adjustment range with Optimoly TA. Cover ball joint slots. See pages 40 19, 40 - 20 and 40 - 23
14	Camber/caster eccentric	1		see pages 40 - 19 and 40 - 20 for position and types.
15	Ball joint (mounting)	1		inspect, renew if necessary. Cover slot, see pages 40 - 19, 40 - 20 and 40 - 23

No.	Description	Qty	Note When: Removing	Installing
16	Clamp	1		see pages 40 - 19 and 40 - 20
17	Locknut	2		renew, torque: 46 Nm (33 ftlb)
18	Hex bolt	2		
19	Hex bolt (10.9, 80 mm long)	2		Coat threads with Optimoly HT (do not apply Optimoly HT to bolt shank).* Screw in until only 2 threads are visible. Do not tighten to 120 Nm (88 fltb) until assembly is completed and springs have settled
20	Washer approx. 6 mm thick, dia. approx. 30 mm	2		do not mix up with washer No. 23
21	Bearing clamp	1		inspect for damage. Tighten to specified torque
22	Hex bolt (100 mm long)	2		Coat thread with Optimoly HT. (Do not apply Optimoly HT to bolt shank).* Torque: 85 Nm (62 ftlb)

* See notes on page 40 - 14

No.	Description	Qty	Note When: Removing	Installing
23	Washer approx. 4 mm thick dia. approx. 25 mm	2		do not mix up with washer No. 20
24	Guard	1		
25 - - - -	Lower control arm with* spoiler securing bolts cup washers securing brackets locknuts	1		renew if damage suspected. No reworking is permissible. Tighten bolts No. 19 of bearing clamp No. 21 as specified. When replacing, do not confuse with control arm for 86 models onward. Installation overview, Pages 40 - 16 to 40 - 18

* 928 S only (floating caliper brakes)


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No.	Description	Qty	Note When: Removing	Installing
1	Locknut	3		Renew, torque: 46 Nm (33 ftlb)
2	Washer	3		
3	Speed sensor with O-ring and mounting bolt	1		coat speed sensor and hole in steering knuckle with Molykote Longterm 2. Renew O-ring of speed sensor. Tightening torque for Allen-head bolt 10 Nm (7 ftlb)
4	Hex bolt with spring washer	1		
5*	Flange locknut	1	If necessary, load ball joints by exerting pressure on upper control arm	renew, torque: 65 Nm (47 ftlb). Load ball joints by exerting pressure on upper control arm
6	Flange locknut	1	As No. 5	As No. 5
7	Steering knuckle	1		inspect for damage. No reworking is permissible.
8	Locknut	2	If necessary (to increase working space), remove bearing clamp No. 25 of lower control arm. When removing bearing clamp, slacken lock-nuts No. 17 on caster and camber eccentrics.	renew, torque: 140 Nm (103 ftlb)

* There is no difference between No. 5 and No. 6 (collar dia. approx. 24 mm). In some cars, a nut (No. 5) with a collar dia. approx. 26 mm was fitted to the upper joint (to use up stock).

No.	Description	Qty	Note When: Removing	Installing
9	Washer	1		only on rear control arm mounting
10	Locknut	1		renew, torque: 85 Nm (62 ftlb)
11	Washer	1		
12	Air guide plate	1		
13	Hex bolt	1		
14	Stabilizer linkage	1		when replacing, do not confuse with version for cars earlier than 1986. Spare part number on linkage. Tightening torque for upper and lower mountings : 85 Nm (62 ftlb). Install right way round. Cranked end at top (at spring strut mounting) and tilted forward (no difference bewteen left-hand and right-hand parts).
15	Upper control arm	1		inspect, renew if necessary. No reworking is permissible. Attachment to body: lubricate thread and shank with Optimoly HT.
16	Spring strut	1		Coil spring page 40-46 Damper installation overview, page 40-51

No.	Description	Qty	Note When: Removing	Installing
17	Locknut	2	only slacken if part of control arm with clamp and ball joint (mounting) must be replaced	renew, torque: 120 Nm (88 ftlb)
18	Caster or camber eccentric (outer eccentric - camber	2		coat sliding surfaces of eccentric adjustment range with Optimoly TA. Cover slots of ball joints, page 40 - 23. When replacing, note page 40 - 21.
19	Ball joint (mounting)	1		inspect, renew if necessary. Close slot, page 40 - 23
20	Clamp	1		when replacing, do not mix up with version for cars earlier than model year 86. See page 40 - 21. After inserting in lower control arm, coat thread with Optimoly HT. Do not allow Optimoly HT to touch shank of bolt or to penetrate hole in light-alloy member (see page 40 - 14).
21	Locknut	2		renew, torque: 46 Nm (33 ftlb)
22	Hex bolt	2		

No.	Description	Qty	Note When: Removing	Installing
23	Hex bolt (10.9/ 80 mm long)	2		coat thread with Optimoly HT (Optimoly HT on bolt shank is impermissible).* Screw in until only 2 threads are visible. Do not tighten to 120 Nm (88 ftlb) until assembly is completed and springs have settled.
24	Washer approx. 6 mm thick, dia. approx. 30 mm	2		do not mix up with washer No. 27
25	Bearing clamp	1		check for damage. Tighten as specified.
26	Hex bolt (100 mm long)	2		coat threads with Optimoly HT (Optimoly HT is not permissible on bolt shank)* Torque: 85 Nm (62 ftlb)
27	Washer approx. 4 mm thick, dia. approx. 25 mm	2		do not mix up with washer No. 24
28	Guard	1		

* See note page 40 - 14

No.	Description	Qty	Note When: Removing	Installing
29	Lower control arm with spoiler securing bolts cup washers securing brackets locknuts	1		Renew if damage suspected. No reworking is permissible. Tighten bolts No. 23 of bearing clamp No. 25 as specified. When replacing, do not mix up with control arm for cars earlier than model year 86. Part marked "Porsche" (before 86 model years, without Porsche inscription). Installation overview, see pages 40 - 16/ 40 - 17

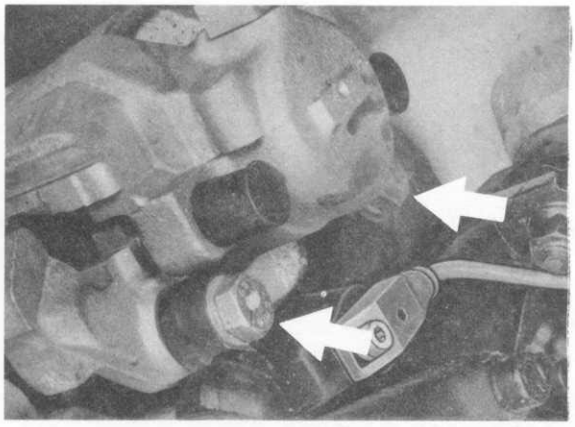
INSTRUCTIONS FOR ASSEMBLY AND DISASSEMBLY

D i s a s s e m b l i n g

1.Unbolt brake caliper and move aside without imposing strain on brake hose.

Mounting: until end of model year 85

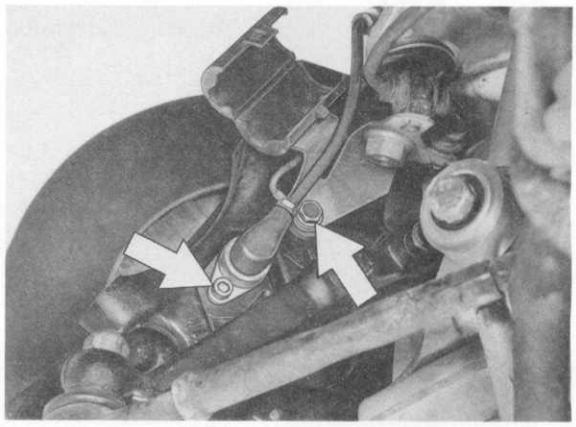




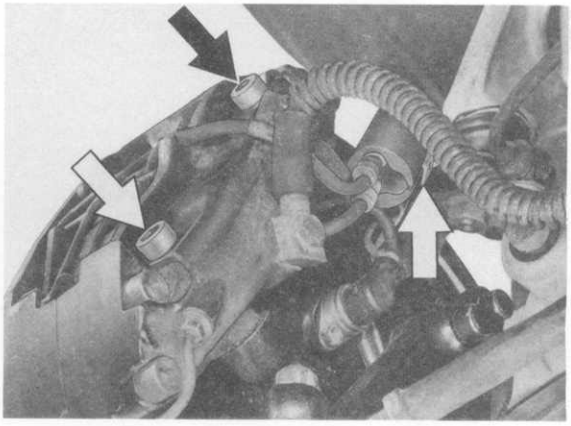
2.Disconnect ground lead (86 models onward). Remove speed sensor.

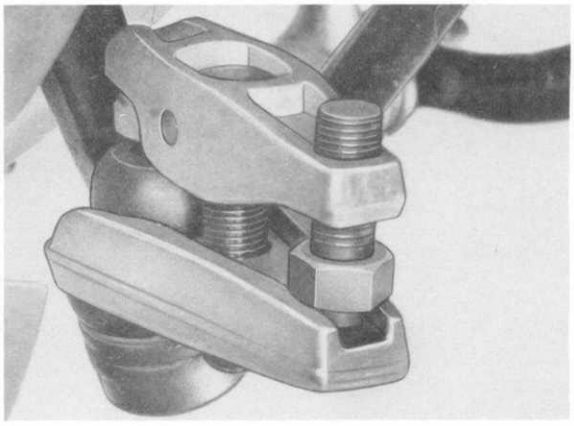
Mounting: 86 models onward

Beforehand, open plug-in connector of ABS and brake-pad wear cable and disconnect.

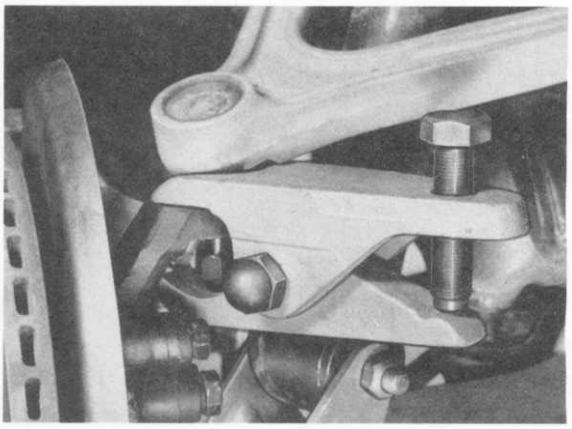


3.Press out track rod with extractor, e.g. Nexus 168-1.

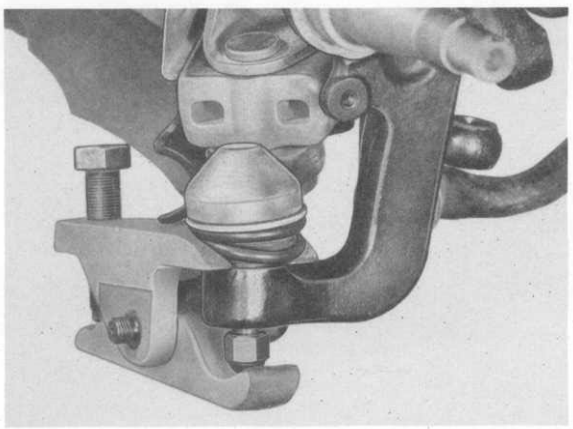




4.Use VW 267a to press out ball joint. Take care not to damage protective caps of joints. (Steering knuckle with cap nut, see page 40 - 25). If collar nuts difficult to remove, see Installing, Item 3.



Wheel suspension, 86 models onward (lower ball joint).



I n s t a l l i n g

N o t e :

When using Optimoly HT or TA assembly paste, note the following:

Optimoly HT (copper-colored)

For steel-steel threaded connections and contact surfaces of assembly parts.
Never use Optimoly HT on contact surfaces of steel to light alloy, as moisture will produce corrosion.
When applied to threads, this lubricant has no effect on tightening torques.

Optimoly TA (aluminum color)

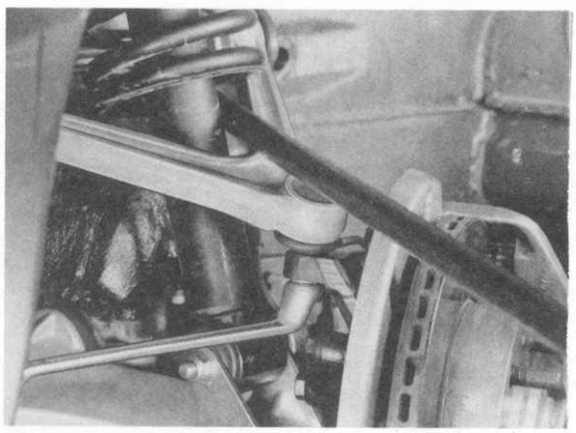
For all connections with aluminum or with magnesium, for corrosion protection.
When applied to threads, this lubricant has a slight effect on tightening torques.

1.Subject all parts to visual inspection, if necessary, compare with new part.
If replacement parts are fitted, check installation overview, see pages 40 - 16 to 40 - 21

2. When installing lower control arm, screw bolts of rear bearing clamp into body until only 2 threads are visible.

   Do not tighten the two bolts to specified torque until assembly is completed and springs have settled. This keeps front of car down.

3. To prevent ball pins turning and to allow installation of collar nuts (also for disassembly), apply pressure to upper control arm to load ball joints.



N o t e :

Spray adjustment plate on lower control arm with eccentrics, threaded section of track rod, threaded pins in upper bearing joint and threaded pins in lower bearing joint with Tectyl-UL 846 (Valvoline). This prevents corrosion of the threaded elements, thus facilitating maintenance and repair work.

Close slots for outer cams (page 40 - 23).

WHEEL SUSPENSION COMPONENTS - INSTALLATION OVERVIEW*

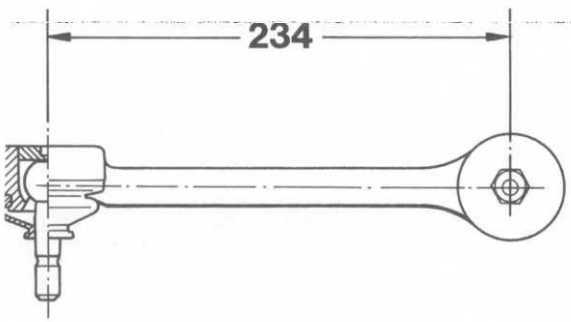
Fig. No.	Description	Identification - Distinguishing Features** Version A until end of model year 85	Version B 86 models onward
1	Upper control arm	longer than 86 models onward, ball joint at right angle to suspension link	shorter than until end of model year 85, ball joint inclined outward
2	Lower control arm	longer than 86 models onward, no identification marking	shorter than until end of model year 85, bears "Porsche" inscription
3	Track rod	longer than 86 models onward	shorter than until end of model year 85
4	Stabilizer linkage	shorter than 86 models onward, marked with spare-part number	longer than until end of model year 85, marked with spare-part number
5	Stabilizer	stabilizer knuckle shorter and less cranked than 86 models onward (until end of model year 79, solid stabilizer, 80 models onward, tubular stabilizer)	stabilizer knuckle longer and more cranked than until end of model year 85

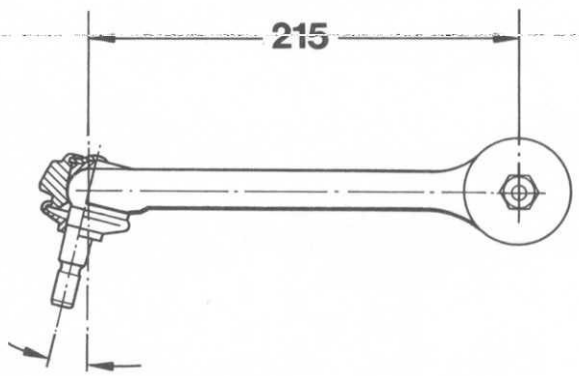
* Mounting, clamp, camber and caster eccentrics, pages 40 - 19 to 40 - 21

** Dimensions, see pages 40 - 17 and 40 - 18.

Version A until end of model year 85	Version B 86 models onward

1 Upper control arm

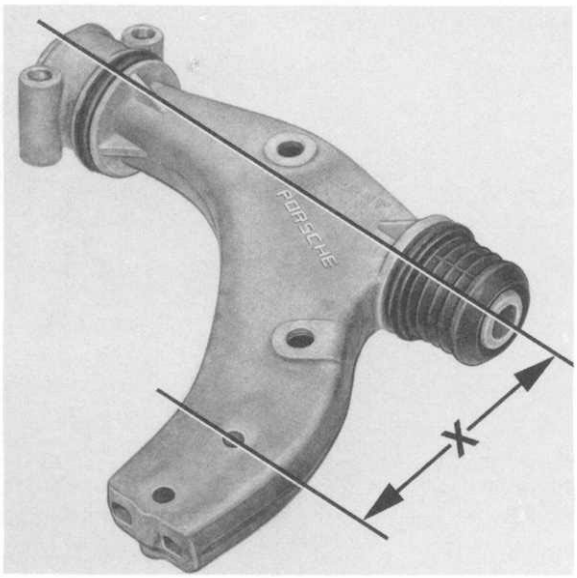




2 Lower control arm

No "Porsche" inscription

Dim. X = 191 mm



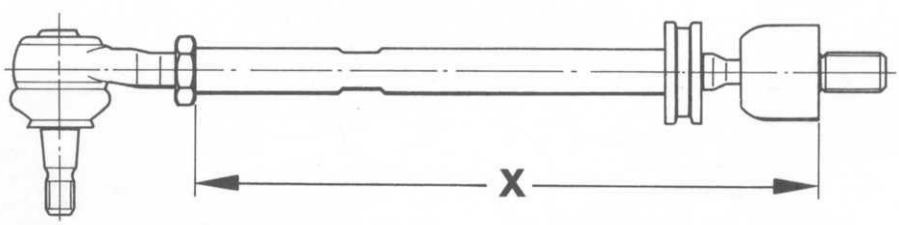
With "Porsche" inscription

Dim. X = 179 mm

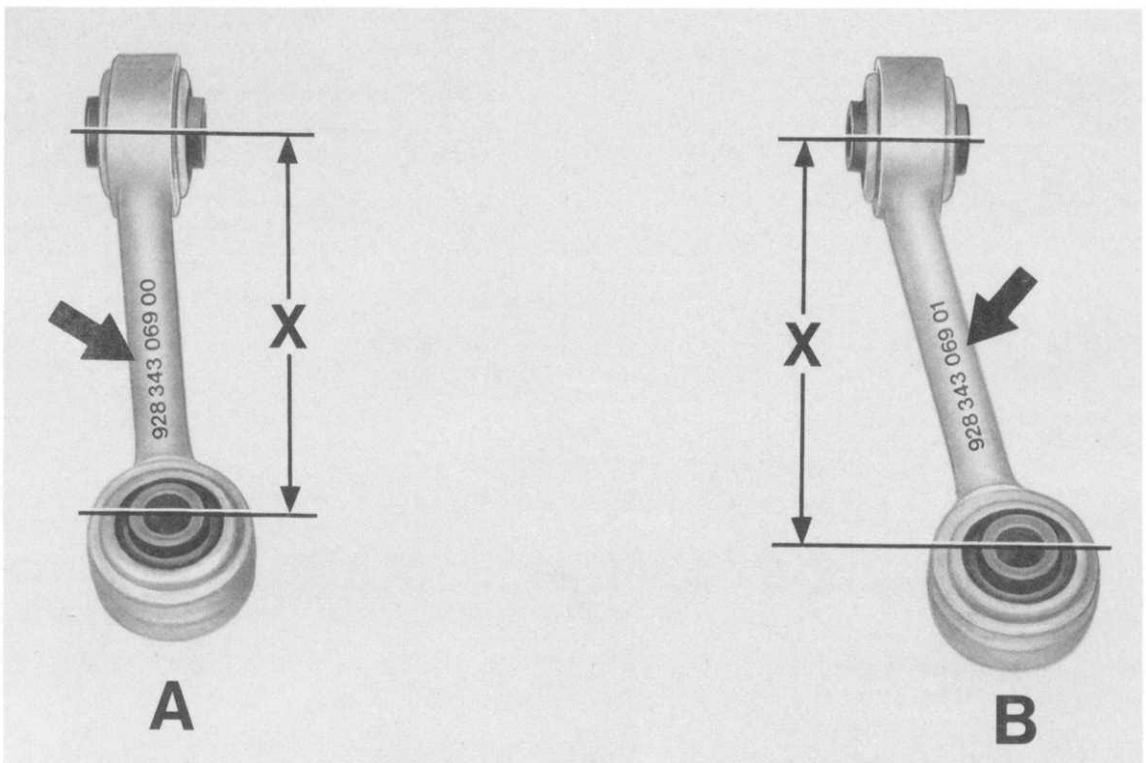
3 Track rod

Dim. X approx. 245 mm

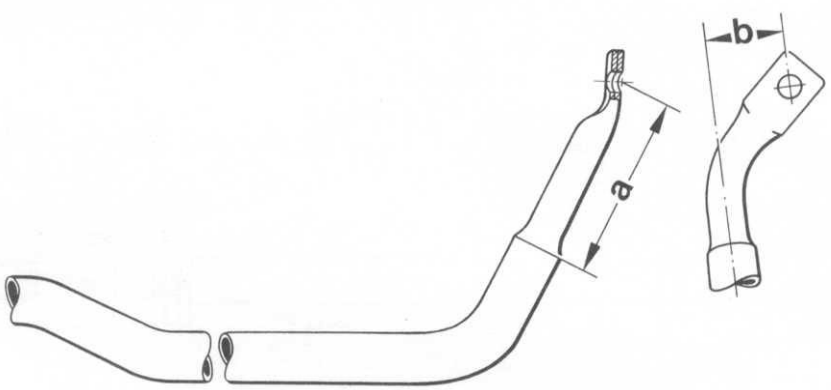
Dim. X approx. 235 mm



Version A until end of model year 85	Version B 86 models onward
4 Stabilizer linkage	
Spare Part No. (arrow) 928 343 069 00 Dim. X approx. 135 mm	Spare Part No. (arrow) 928 343 069 01 Dim. X approx 142 mm



5 Stabilizer	
Dim. a = 95 ± 3 mm Dim. b = 38 ± 1 mm	Dim. a = 102 ± 3 mm Dim. b = 43 ± 1 mm



MODIFICATIONS TO MOUNTINGS/NOTES FOR REPLACEMENT

Until end of model year 85, mountings with trailing ball joints were installed on the front axle. As of September 1983, steel mountings were used instead of aluminum.
This change also necessitated a modification of the camber and caster eccentric retaining clamps. The caster and camber eccentrics installed with the steel mountings are identical parts and are distinguished from the earlier versions by the stamped part No. 928 341 466 00.

Steel mountings with upright ball joints were installed from model year 86 onward (modified wheel suspension). This modification included redesigning retaining clamps and camber and caster eccentrics (retaining clamp with modified mounting point for spring strut, as control arm shorter but same strut position as in cars earlier than model year 86). There is no difference between caster and camber eccentrics, which are distinguished from the original and modified versions by the stamped part No. 928 341 466 01.

Mountings until End of Model Year 85

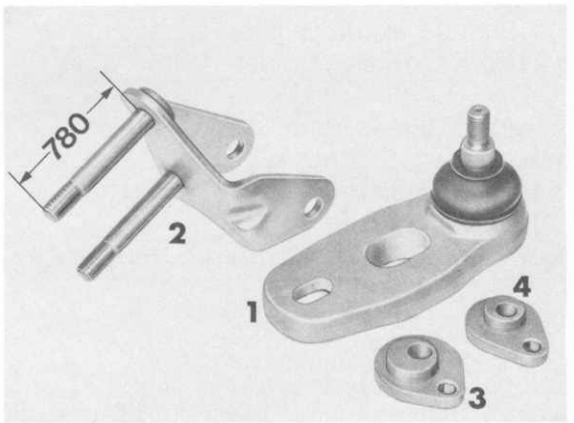
Parts Overview:

Fig. Item*	Description	Original Version	Modified Version
1	Mounting	928.341.049.10	928.341.049.12
2	Left-hand clamp	928.341.091.03	928.341.091.05
2	Right-hand clamp	928.341.092.03	928.341.092.05
3	Caster eccentric	928.341.453.00	928.341.466.00
4	Camber eccentric	928.341.455.00	928.341.466.00

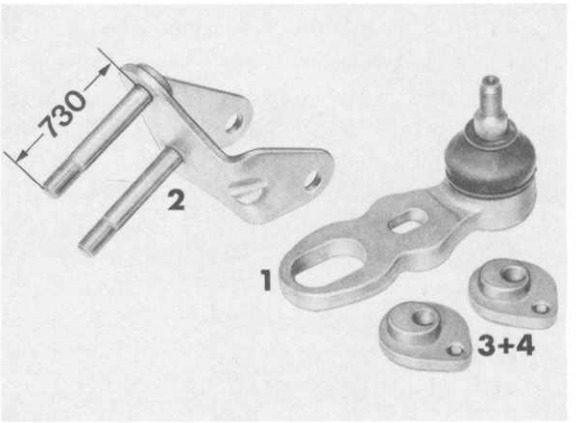
* See Fig. on page 40 - 20

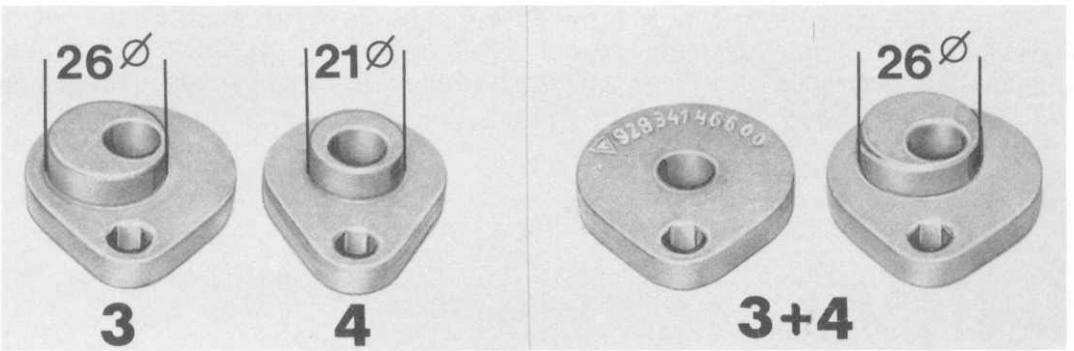
Mountings until End of Model Year 85
(Parts Overview, page 40 - 19)

Original Version



Modified Version





The position of the eccentrics has been changed to suit the modified mountings. Caster is now set at the inner and camber at the outer eccentric.

The original type of mounting has now been discontinued. The modified versions may be retrofitted to these cars.

Original and modified parts are not interchangeable. This means that when a modified mounting is installed in an older car for the first time, new clamps and eccentrics must also be used.

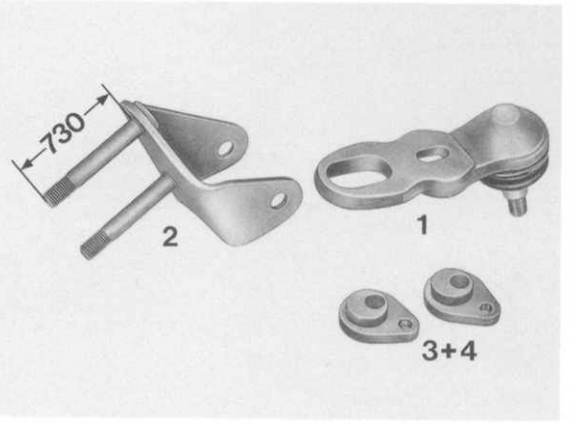
It is permissible to install a modified mounting on one side only.

Under no circumstances may clamps for cars of model year 86 onward be used (danger of confusion, see note on page 40 - 6e).

Mountings, 86 Models Onward

Parts Overview

Fig. Item No.	Description	Parts No. new/current version
1	Mounting	928.341.049.08
2	Clamp, left	928.341.091.06
2	Clamp, right	928.341.092.06
3+4	Camber and caster eccentrics	928.341.466.01



As with the steel mountings in cars earlier than model year 86, the caster is set at the inner and the camber at the outer eccentric.

It is essential to ensure that incorrect parts are not installed. There is a danger of mixing up modified and new/current parts. Example: if the wrong clamp is mounted, the installation position of the spring strut is incorrect and the clearance between spring strut and upper control arm may be impaired.

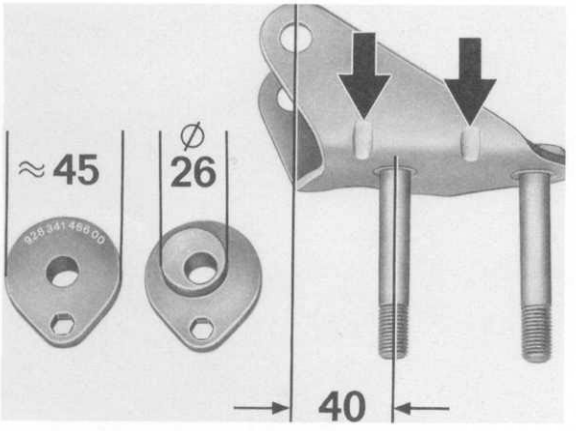
Distinguishing Features, Identification Marking of the Modified and New/Current Components

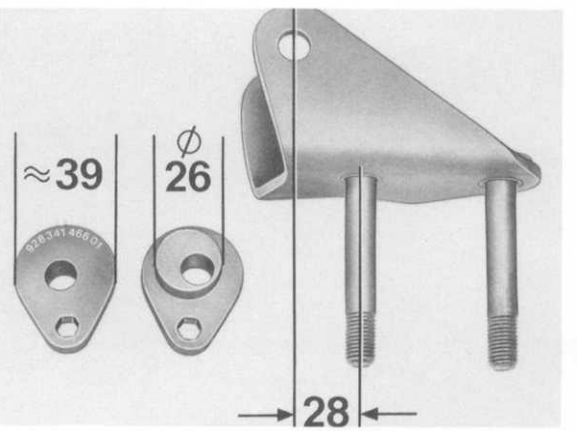
Modified version (until end of model year 85)

Clamp: 2 beads at front (arrows)
Eccentric: stamped part No. 928.341.466.00

New/current version, 86 models onward

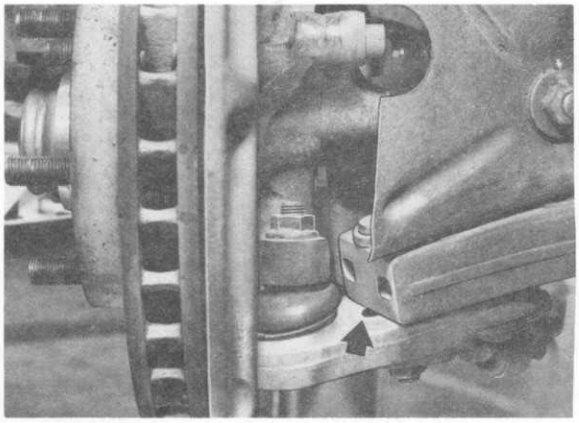
Clamp: No beads at front
Eccentric: stamped part No. 928.341.466.01

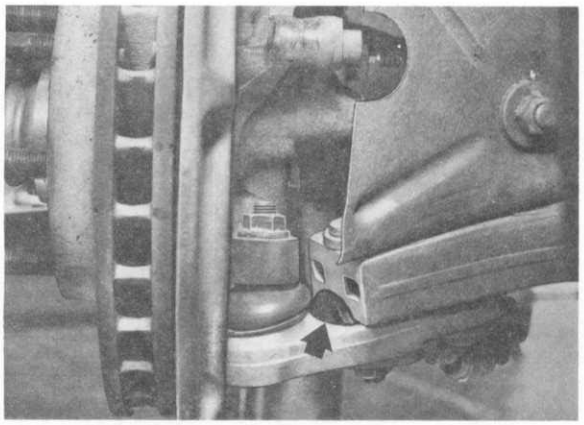




CLOSING SLOTS IN BALL JOINTS

As of September 1982, plastic sealing cord is used to close the slots for the outer setting eccentrics of the front-axle ball joints of new cars. In this way, dirt is prevented from penetrating the joint, making the eccentric easier to operate when servicing.

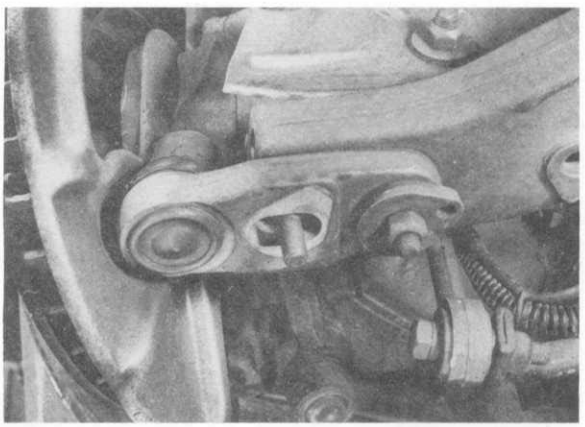




If work has been carried out on the front axle, and especially after realignment of the wheels, close the slots for the outer eccentrics with permanently-elastic sealing material on all cars (arrows). The sealing cord, part No. AKD 522.009, used to seal the 924 and 944 taillamps is suitable for this application.

Before sealing, ensure that slots are dry and free of grease.

If eccentric does not move freely (dirt in slot) we recommend removal of the outer eccentric, cleaning of the slot and spraying with rust remover. Apply Optimoly TA to sliding surface of eccentric in adjustment area and reinstall eccentric.



I m p o r t a n t :

Never try to free eccentric by hitting ball joint. Impact may damage the rubber cap.

If the rubber cap of a ball joint is damaged, it is essential to replace the joint. See also "Inspecting Protective Caps of Ball Joints of Control Arms and Track Rods" (page 40 - 24).

INSPECTING PROTECTIVE CAPS OF BALL JOINTS ON CONTROL ARMS AND TRACK RODS

The rubber protective caps of the front-axle ball joints may be damaged by external influences, e.g. flying stones, or during assembly.
If a protective cap is damaged, the joint in question - upper or lower control arm, track rods - must be renewed, as the action of dirt or moisture will destroy the joint. For this reason, we also call attention to the routine listed in the vehicle maintenance plan:

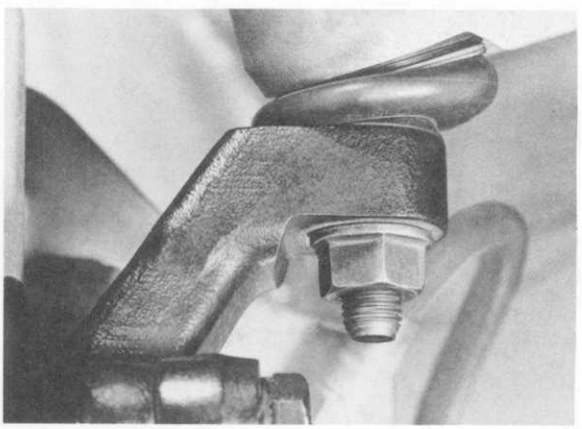
"Inspect seating and operation of all joints to steering gear, track rods, suspension links and joints, as well as the leaktightness of the protective caps".

We recommend that the protective caps of the joints be checked whenever work is carried out on the front axle (visual inspection).

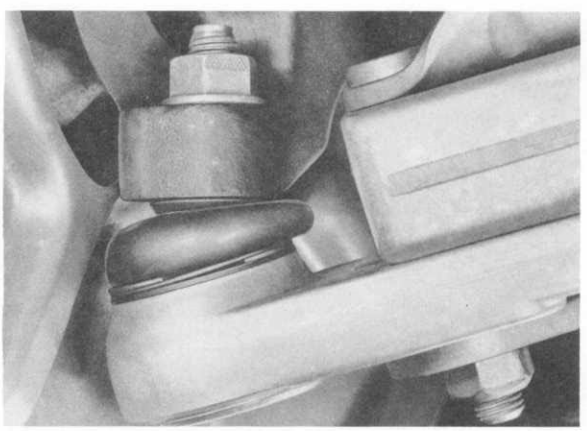
Inspecting Rubber Protective Caps of Control Arm Ball Joints:

1. Raise car on hoist, steering lock disengaged.
2. Turn front wheels to lock.
3. Inspect visible areas on left and right after cleaning. Concealed cracks are revealed by pinching the rubber cap with the fingers.
4. Turn front wheels to opposite lock and inspect other half of rubber caps.

In the vicinity of the brake cover plates, a small area cannot be inspected visually. Check this area by hand.



Upper ball joint



Lower ball joint

MODIFIED STEERING KNUCKLE, CARS WITH FLOATING BRAKE CALIPERS

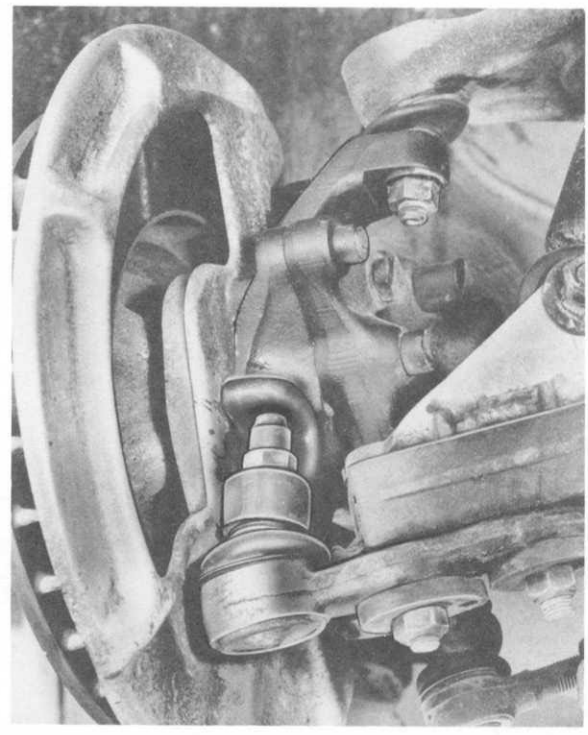
To avoid damaging the rubber boot of the lower ball joint (mounting) with a commercial puller, the steering knuckle has a press-off lug (only steering knuckles for floating brake calipers).

Steering knuckles without press-off lug have been discontinued and are no longer available as spare parts.
It is permissible to install the newest steering knuckle on one side only.

D i s a s s e m b l y

L o w e r B a l l J o i n t

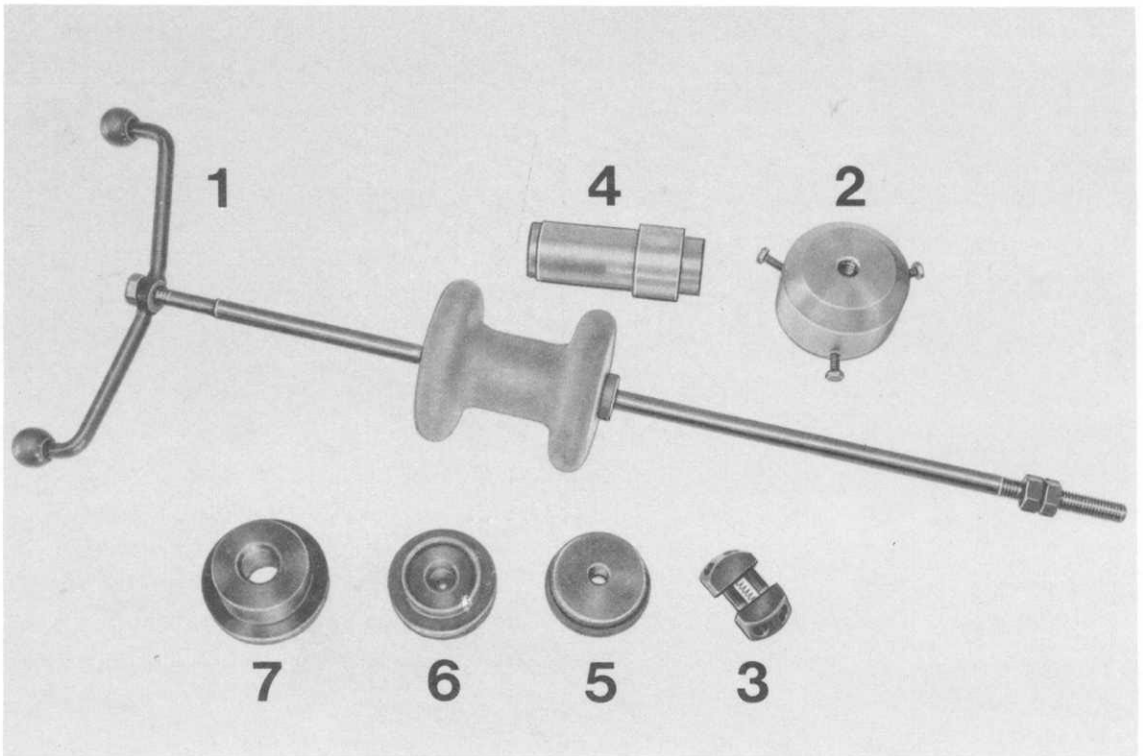
When the securing nut is slackened (cap nut - previously normal self-locking hex nut) the pin of the ball joint is pressed out of the steering knuckle, because the cap nut acts against the press-off lug.



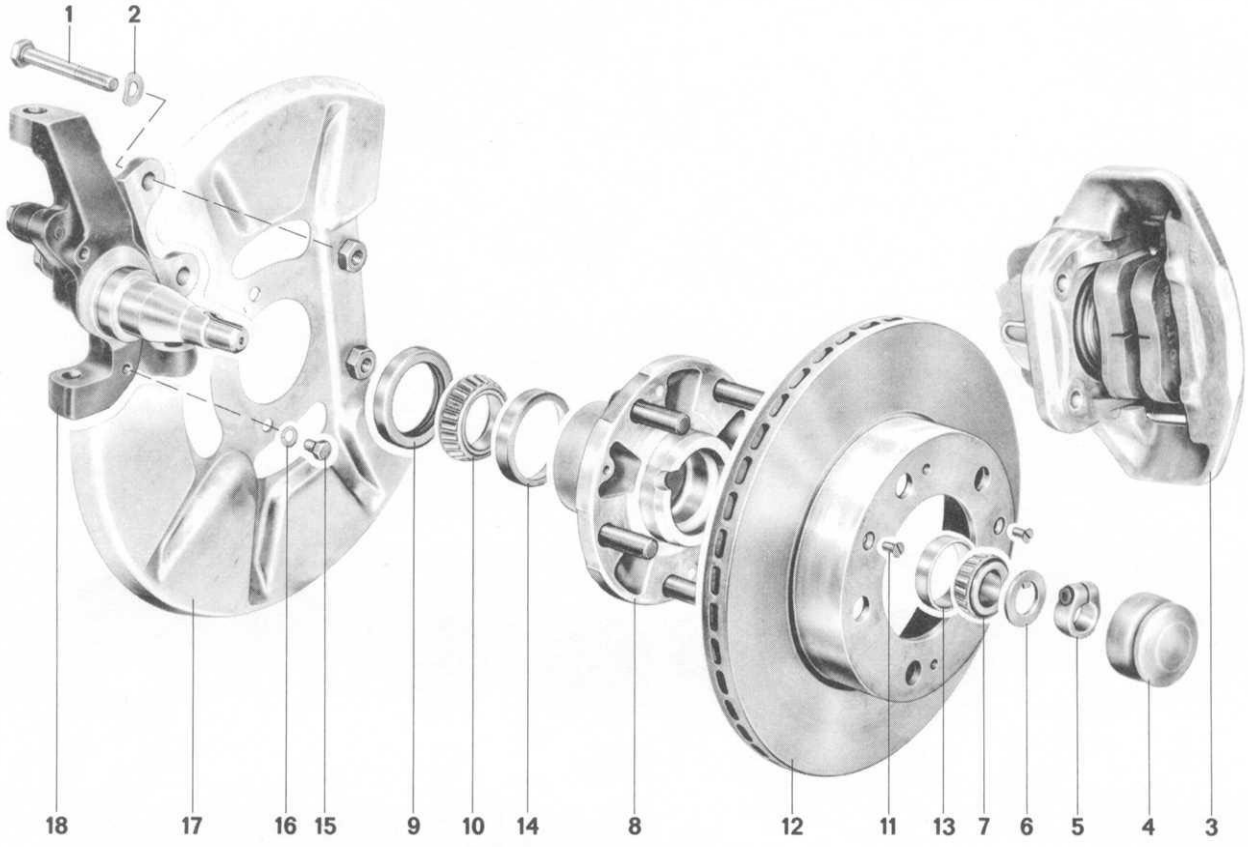
U p p e r B a l l J o i n t

Use VW 267 a to press off as before (page 40 - 14).

TOOLS



No.	Description	Special Tools	Remarks
1	Multi-purpose tool	VW 771	
2	Puller	9165	
3	Pressure piece	P 85	
4	Pressure piece	9154	
5	Pressure plate	VW 447 i	
6	Pressure piece	VW 433	
7	Pressure plate	VW 511	



N o t e s :

- The exploded drawing shows the front-wheel bearing arrangement of cars with sliding calipers.

- If the front axle is equipped with floating calipers, brake caliper, brake disk, guard and steering knuckle are of different appearance and size.

- The following components of four-piston fixed-caliper brakes differ in appearance and size: brake disk, brake caliper, mounting bolts for caliper, outer wheel bearing, wheel hub, guard and steering knuckle.

No.	Description	Qty	Note When: Removing	Installing
1	Mounting bolt (hex bolts for sliding and floating calipers) (Panhead bolts for four-piston fixed caliper)	2		Coat threads with Optimoly HT. Torque: 85 Nm (62 ftlb)
2	Spring washer or washer of four-piston fixed caliper	2		Renew if necessary
3	Brake caliper	1	Do not remove brake hose when working on front-wheel suspension, attach to suitable point with wire	
4	Hub cover	1	Drive out with multi-purpose tool VW 771 and 9165	
5	Clamping nut with Allen bolt	1		Adjust play in wheel bearing. Tighten Allen bolt, torque: 15 Nm (11 ftlb)
6	Thrust washer	1		
7	Outer wheel bearing (larger as of 86 models)	1		Inspect, renew if necessary, apply coating of Shell Retinax A multi-purpose grease

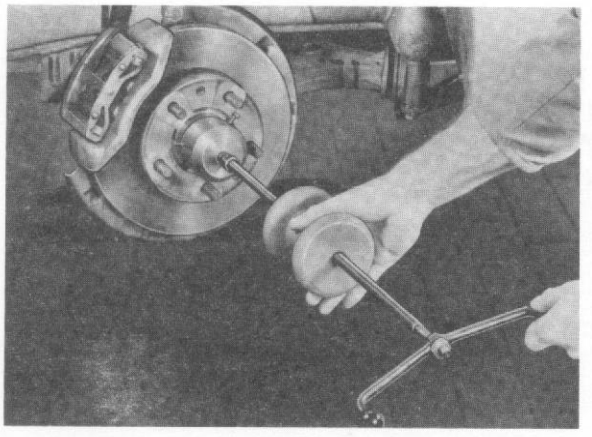
No.	Description	Qty	Note When: Removing	Installing
8	Front-wheel hub (modified wheel bearing, 86 models onward. No. of teeth on impulse ring for ABS: 45 instead of 90).	1		Clean centering surface for brake disk and apply thin coat of Optimoly TA assembly paste. Pack wheel bearing and wheel hub with Shell Retinax A
9	Radial seal	1	Press out with screwdriver. Take care not to damage seat and impulse ring (vehicles with ABS)	Renew. Press in with VW 433 and 9154. Place VW 511 under wheel hub as support. Pack recess with Shell Retinax A
10	Wheel bearing, inner	1		Inspect, renew if necessary, apply coat of Shell Retinax A
11	Countersunk bolt	2		
12	Brake disk	1	If difficult to remove, see P. 46-11	
13	Bearing race for outer wheel bearing	1	Heat wheel hub to 120 to 150°C	Heat wheel hub to 120 to 150°C
	Models earlier than end of 85		Press out with pressure piece 9154. Place pressure plate VW 511 beneath wheel hub as support	Place in position, press in with pressure piece 9154
	86 models onward		Drive out by placing drift in each of the grooves in turn	Place in position, press in with suitable pressure piece, e.g. VW 432

No.	Description	Qty	Note When: Removing	Installing
14	Bearing race for inner wheel bearing	1	Heat wheel hub to 120 to 150°C. Press out with P 85 and 9154. As of 86 models, the race can also be removed using a drift placed in the grooves.	Heat wheel hub to 120 to 150°C. Place in position and press in with pressure plate VW 447 i and pressure piece 9154. Use VW 511 as support.
15	Hex bolt of - sliding caliper - floating caliper - four-piston fixed caliper	 2 4 4		Torque: 15 Nm (11 ftlb). Coat thread with Optimoly HT.
16	Spring ring or spring washer	2-4		Renew if necessary
17	Guard (depending on brake system)	1		
18	Steering knuckle (design depends on brake system)	1		Inspect front wheel bearing for 15 wear. Remachining is impermissible

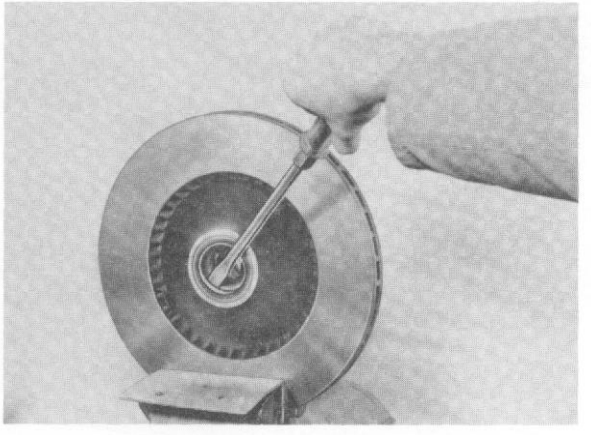
NOTES ON DISASSEMBLY AND ASSEMBLY

D i s a s s e m b l i n g

1.Drive off hub cover with multi-purpose tool VW 771 and 9165.



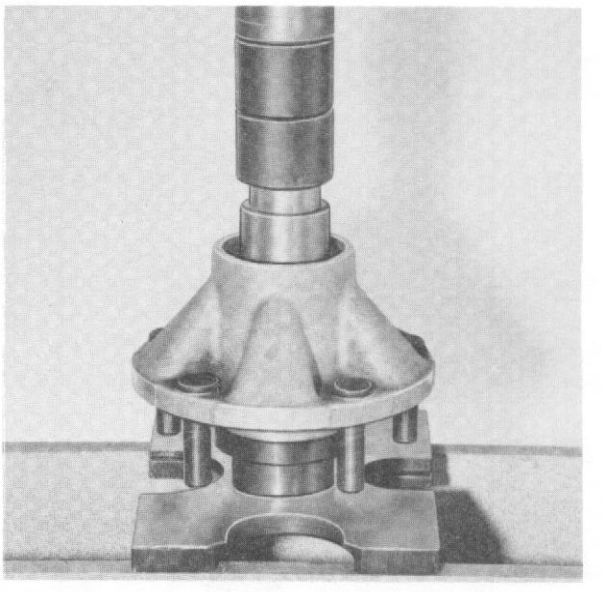
2.Use a large screwdriver to lever off radial seal. Take care to avoid damaging the seat of the seal and the impulse ring of cars with ABS.



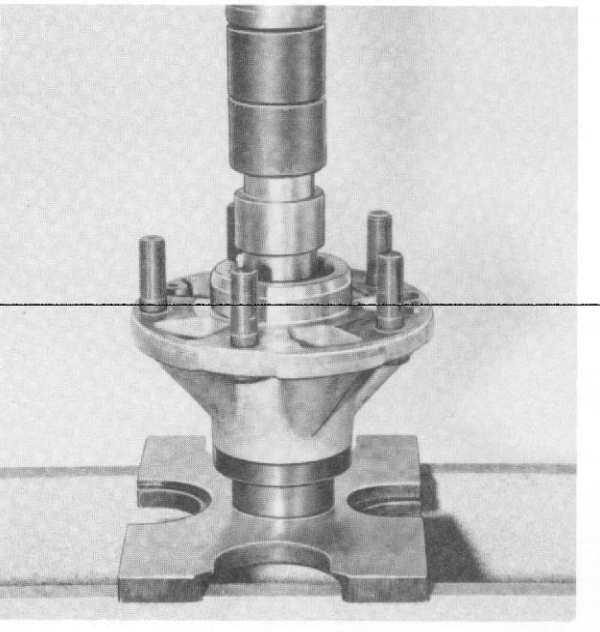
3.Separate brake disk and wheel hub. Heat wheel hub to 120-150°C.

4a.Cars earlier than end of model year 85: press bearing races out of wheel hub.

Bearing race for outer wheel bearing



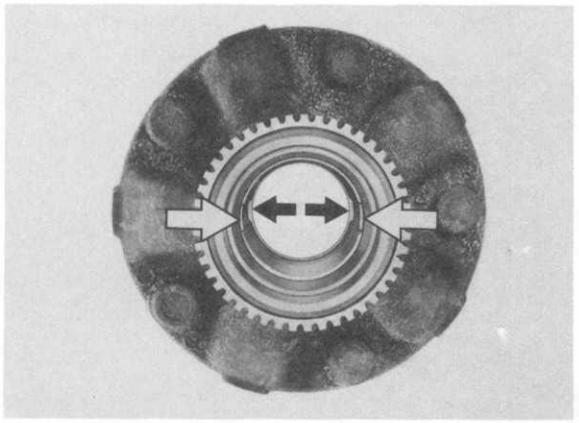
Bearing race for inner wheel bearing



4b.86 models onward: place drift in each of the grooves in turn and drive bearing races out of hub.

N o t e :

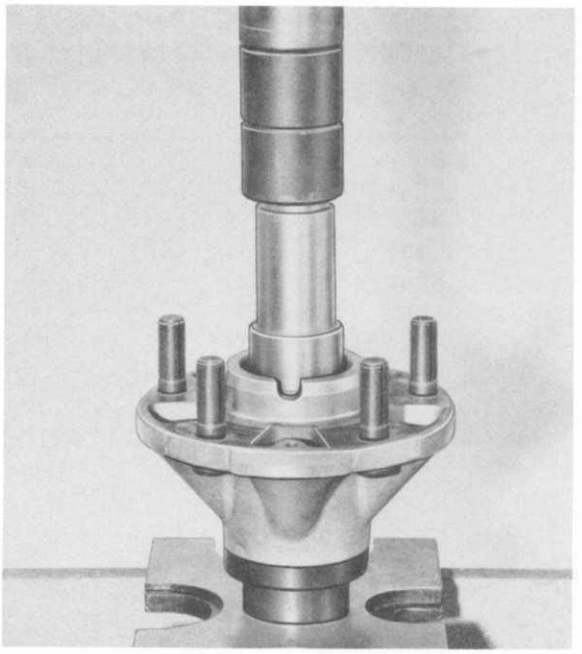
The bearing race for the inner wheel bearing can be pressed out using P 85 and 9154 as before (cars earlier than 86).



A s s e m b l i n g

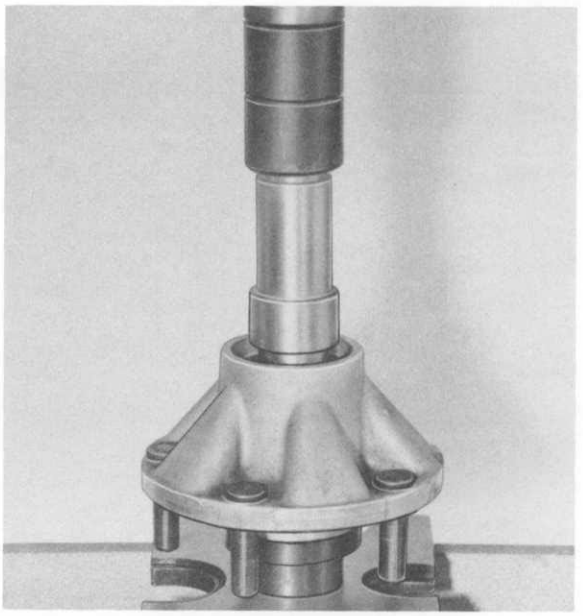
1.Heat wheel hub to 120-150°C.

2a.Install outer bearing race and (cars earlier than end of 85) press in until seated with pressure piece 9154.

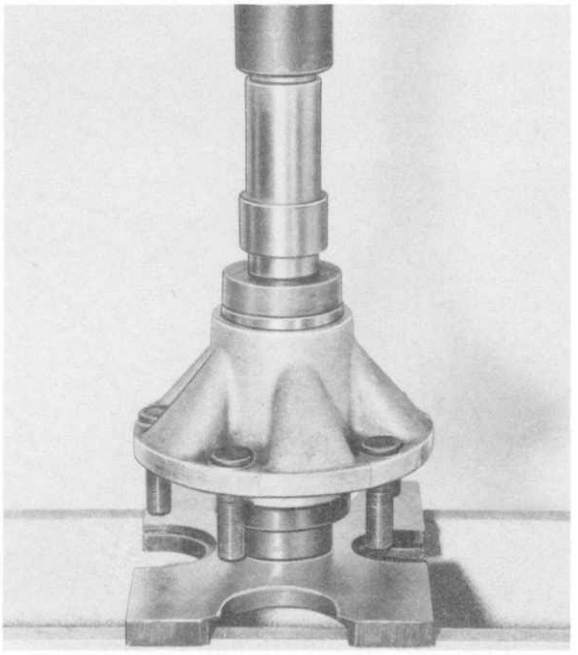


2b.86 models onward: place the outer bearing race in the wheel hub and press in until seated with suitable pressure piece, e.g. VW 432.

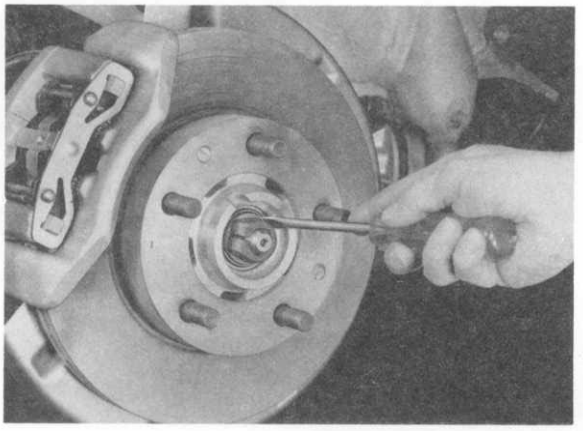
3. Position inner bearing race and press in until seated with pressure piece 9154 and pressure plate VW 447 i. Place VW 511 beneath wheel hub as support.



4.Press in radial seal until flush with hub.



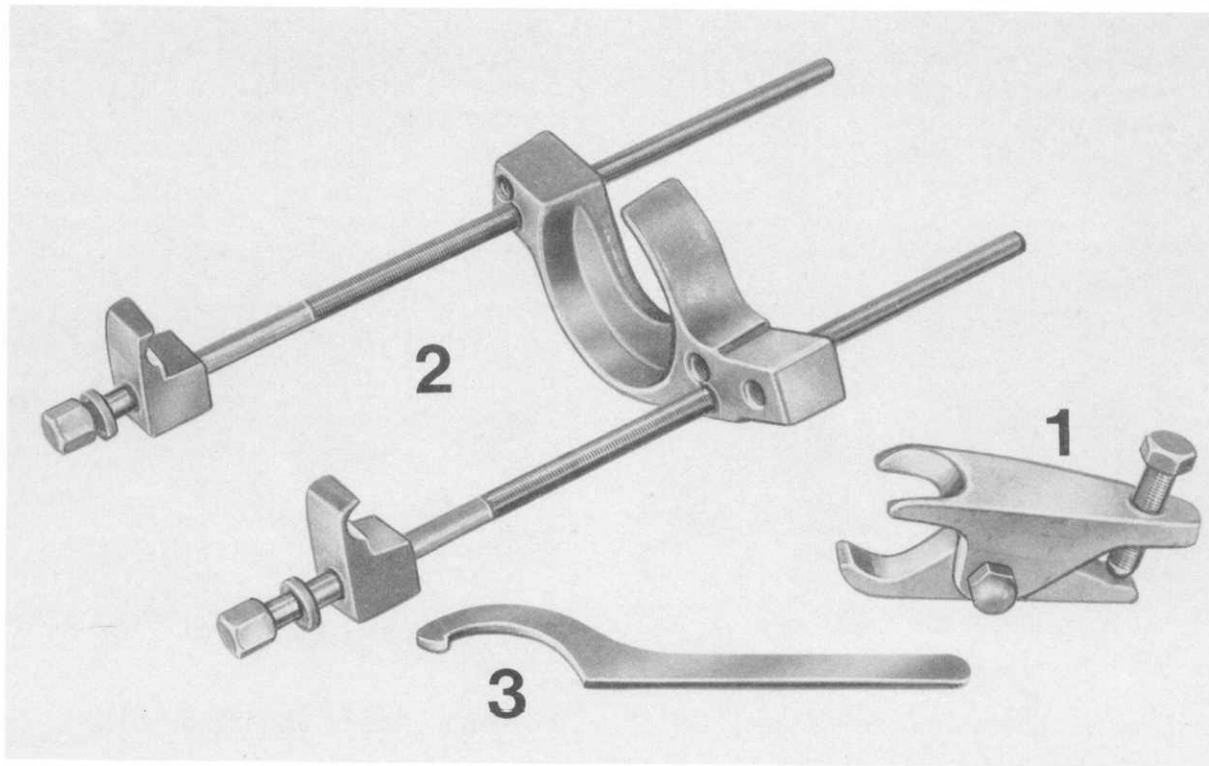
5.Adjust front wheel bearing, noting the following points: Tighten clamping nut slightly, turning the hub. Slacken clamping nut until the thrust washer can just be moved with a screwdriver under finger pressure. Do not use hub as a lever for screwdriver.



6.Tighten cap bolt of clamping nut to 15 Nm (11 ftlb), without turning the clamping nut.

7.Recheck setting by moving thrust washer, readjust if necessary.

TOOLS

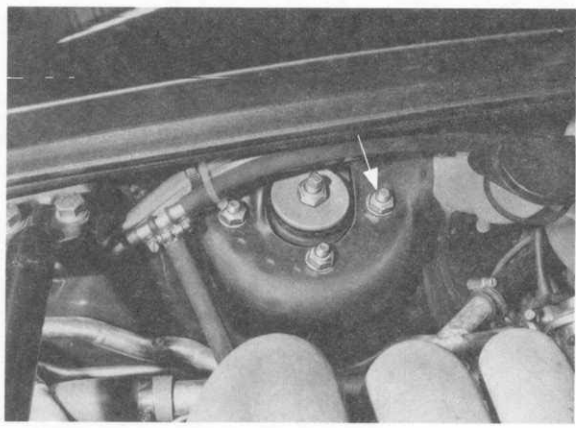


No.	Description	Special Tools	Remarks
1	Press-out tool	VW 267 a	
2	Tensioning device or	VW 340	
-	Tensioning device		Porche version manufactured by Klann, desription/supplier see Workshop Manual (Workshop Equipment 3, Group 4).
3	Sickle wrench DIN 1810 dia. 80/90		Commercially available, e.g. Saltus

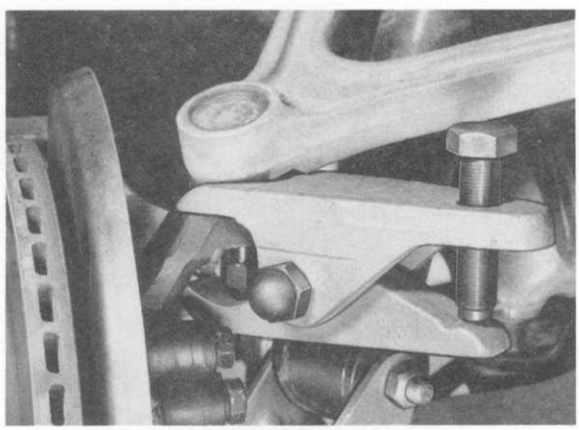
REMOVING AND INSTALLING SPRING STRUT

Removing

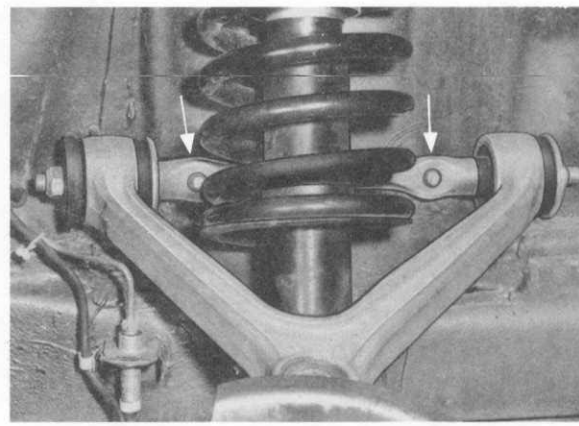
1. Working from engine compartment, remove three self-locking nuts on wheel arch.



2. Remove wheel, unscrew flange lock nut and press off upper ball joint with VW 267 a



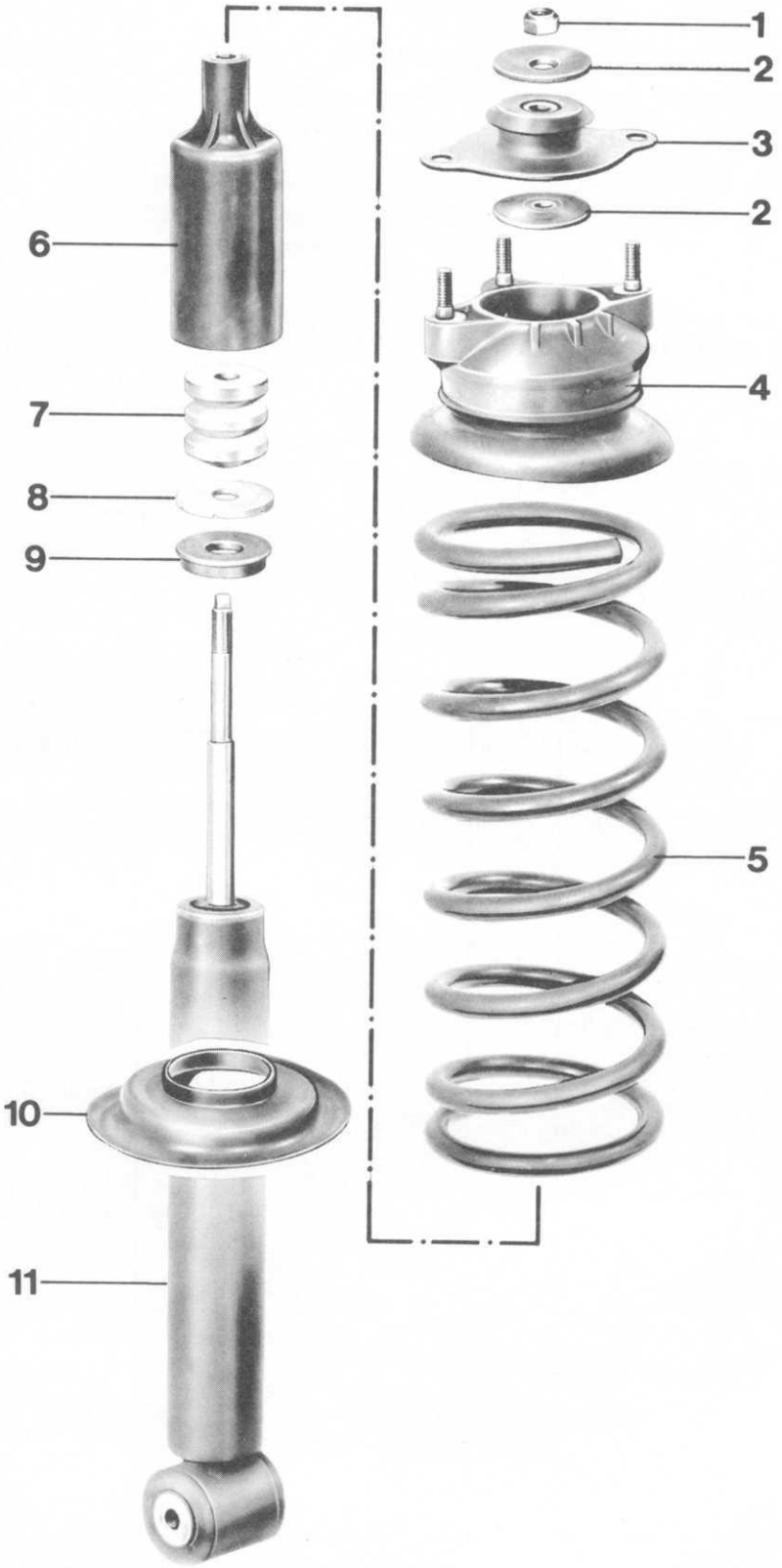
3. Unscrew self-locking nuts from upper control arm (inside engine compartment).



4. Remove damper mounting bolt.

Installing

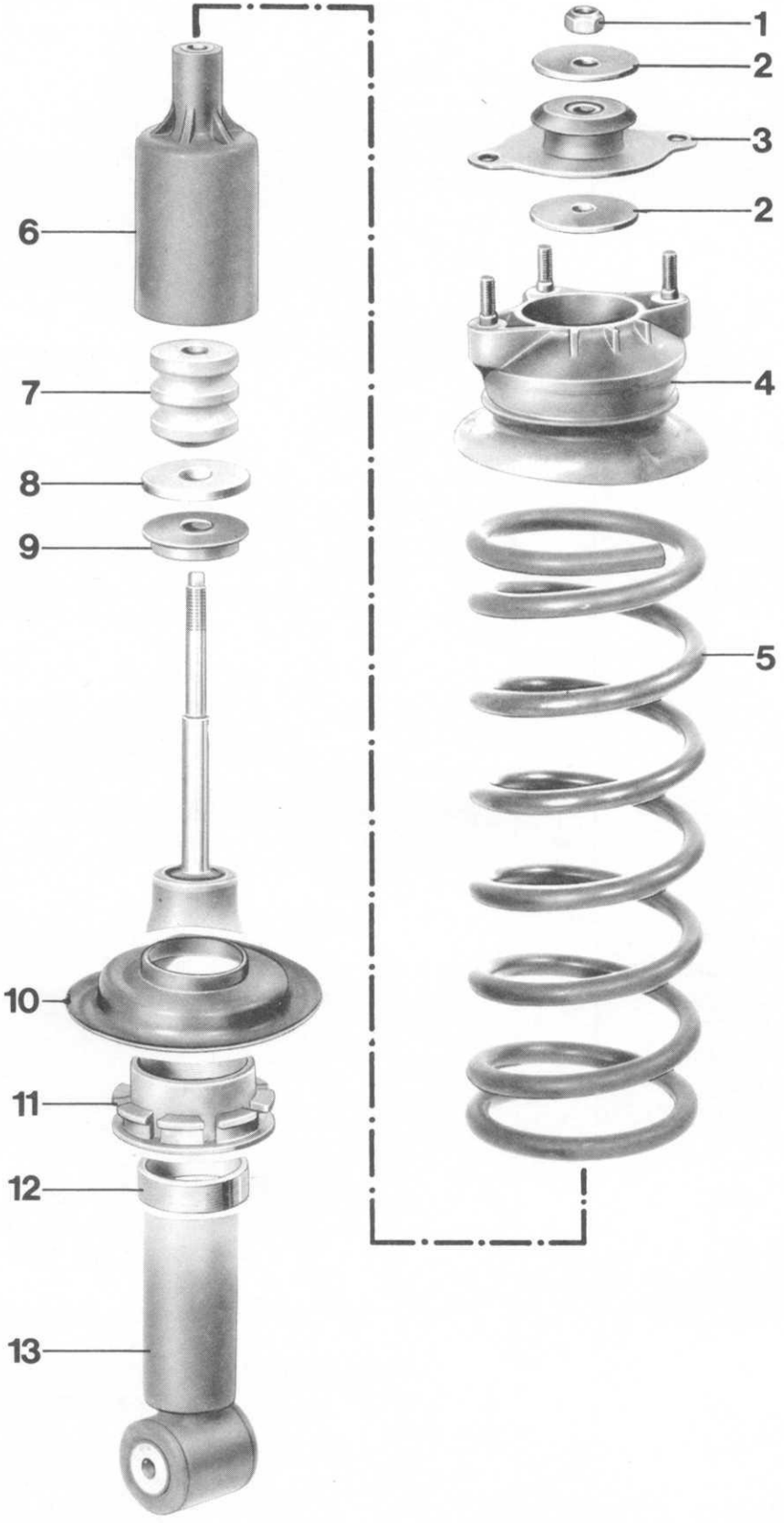
Renew all self-locking nuts. Coat rubber bush in mounting eye with Molykote U.


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No.	Description	Qty.	Note When: Removing	Installing
1*	Self-locking hex nut	1	Extend coil spring with VW 340 or Klann KL - 0014	Renew and tighten to 60 Nm (44 ftlb)
2*	Washer	2		
3*	Damper mounting, upper	1		Coat rubber bush with Molykote U
4	Spring plate, upper	1		
5	Coil spring	1		Note arrangement and assembly instructions
6	Protective tube	1		Overall length approx. 170 mm
7**	Booster spring	1		Note installation position
8*	Stop washer	1		Install with grooves down
9*	Supporting cover	1		Boge only
10	Spring plate, lower	1	Mark installation position	Install right way round
11	Damper	1		Check efficiency, renew if necessary. Standard: Boge (black)** Optional: Bilstein (green)

* Same parts as those used in adjustable spring strut

** Same parts as those used in adjustable spring struts earlier than end of model year 1985



2 Stop washers No. 8 in 928 S 4 "Club Sport-Version"

No.	Description	Qty.	Note When: Removing	Installing
1*	Self-locking hex nut	1	Extend coil spring with VW 340 or Klann KL-0014	Renew and tighten to 60 Nm (44 ftlb)
2*	Washer	2		
3*	Damper mounting, upper	1		Coat rubber bush with Molykote U
4	Spring plate, upper	1		
5	Coil spring	1		Note arrangement, tolerance group and assembly instructions. Different spring rates (spring hardness)
6	Protective tube	1		Overall length approx. 150 mm
7	Booster spring, up to end of Mod. yr. 85* natural color (35 mm spring travel) 86 models onward black (39 mm spring travel)	1		Note installation position
8*	Stop washer	1 (2)		Install with grooves down,2 washers in 928 S4 "Club Sport Version"
9*	Supporting cover	1		Boge only
10	Spring plate, lower	1	Mark installation position	Install right way round. Boge: black Bilstein: yellow

* Same parts as used in non-adjustable spring strut.

No.	Description	Qty.	Note When: Removing	Installing
11	Adjustment nut	1		Grease thread, recess and contact surface for spring plate with Optimoly TA Boge and Bilstein are different
12	Threaded ring	1		Boge only. Install with inner bevel down. Coat thread with Optimoly TA
13	Damper	1		Damper design modified, 86 models onward Damper installation overview P. 40 - 51 Spring installation overview, note P. 40 - 46

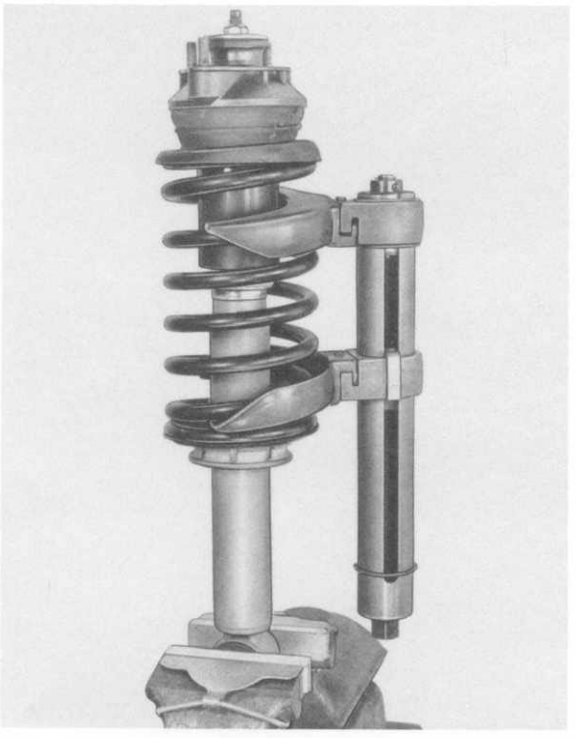
NOTES ON DISASSEMBLY AND ASSEMBLY

D i s a s s e m b l i n g

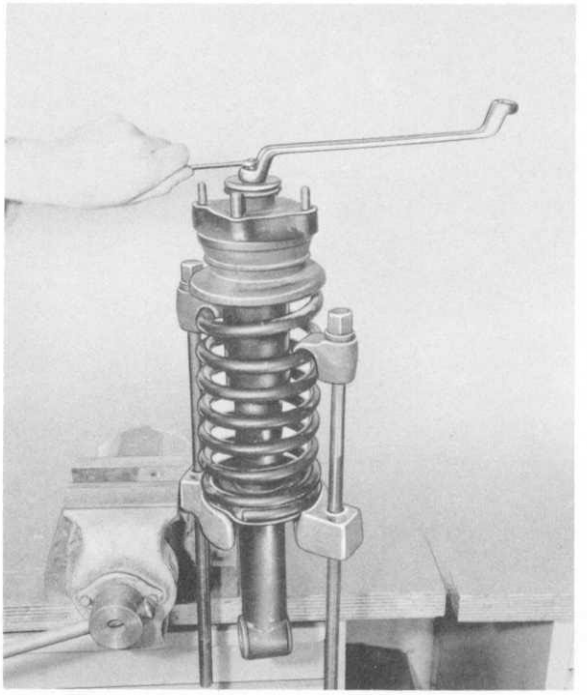
1. Mark position of lower spring plate relative to damper for reinstallation.

2. Using Porche version Klann spring tensioning device (see Workshop Manual) or VW 340, extend coil spring.
Remove self-locking nut from piston rod.
Remove washer and upper damper mounting.

KL - 0014 (Klann)



VW 340



3. When using special tool VW 340, release coil spring by unscrewing each of the expansion bolts in turn.

N o t e :

A great deal of caution is required when working with the extremely powerful coil spring.

Testing Dampers

Dampers can only be tested properly on a testing machine. Dampers which no longer perform adequately cannot be identified by visual inspection or function testing, which will, however, identify completely defective units.

Note:

Differences between dampers, P. 40 - 51

Boge Pressureless Damper

With damper in installation position, extend and compress by hand. The damper must move smoothly and with uniform resistance throughout its travel. The extension and compression stage damping must be clearly perceptible up to the limit positions. Dampers which have been stored for an extended period should be operated several times in their installation position. Renew leaking dampers

Boge Gas-pressure Dampers

With damper in installation position, extend and compress by hand. The damper must move smoothly throughout its travel. The expansion and compression stage damping must be clearly perceptible up to the final position.

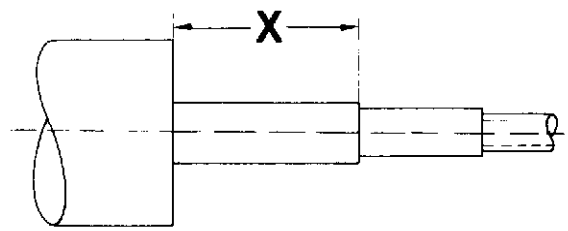
Because of the gas pressure, resistance increases as the piston rod moves further into the damper. Dampers which have been stored for lengthy periods should be operated several times in their installation position.

Renew leaky dampers.

Dampers in which the gas pressure has diminished (damper does not return automatically to the extension-stage stop), but which bear no indication of oily leaks and which fulfill all other requirements can be reused. Dampers which show traces of oil loss and which have depressurized must be renewed.

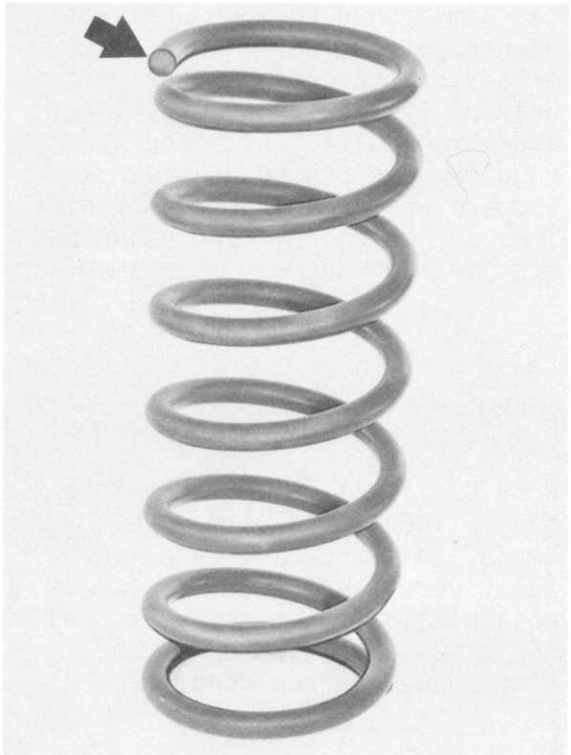
Bilstein Dampers

Worn Bilstein Dampers can be identified with ease. Measure distance X with damper fully compressed (i.e. as far as possible). If distance X exceeds 35 mm (29.5 mm when new), the damper must be replaced.



A s s e m b l i n g

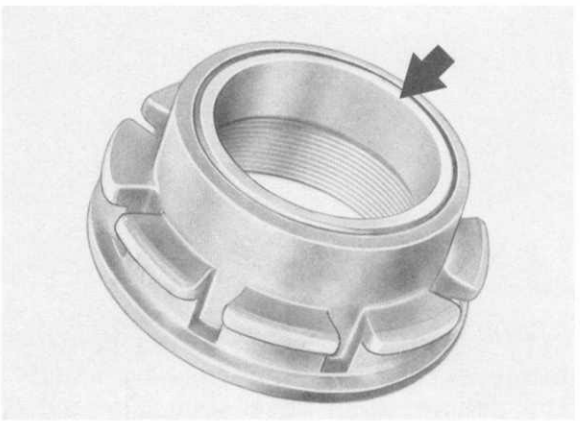
1. Note arrangement of coil springs.
   See P. 40 - 46 for adjustable spring strut.
   See pp. 40 - 47 to 40 - 49 for non-adjustable spring struts.
   End of coil spring points toward upper spring plate.



2. If parts which affect the height setting of adjustable spring struts have been replaced, begin by moving the adjuster nut to its original position. After installation, readjust height setting as necessary, see Item 5. Lubricate threaded ring or thread and adjuster nut and recess with Optimoly TA.

N o t e (for information only)

During original assembly of the struts, the adjuster nut is mounted as follows:
Boge spring strut: threaded ring flush with adjuster nut at top (arrow) or threaded ring approx. 5 mm lower.
Bilstein strut: adjuster nut screwed down to bottom.

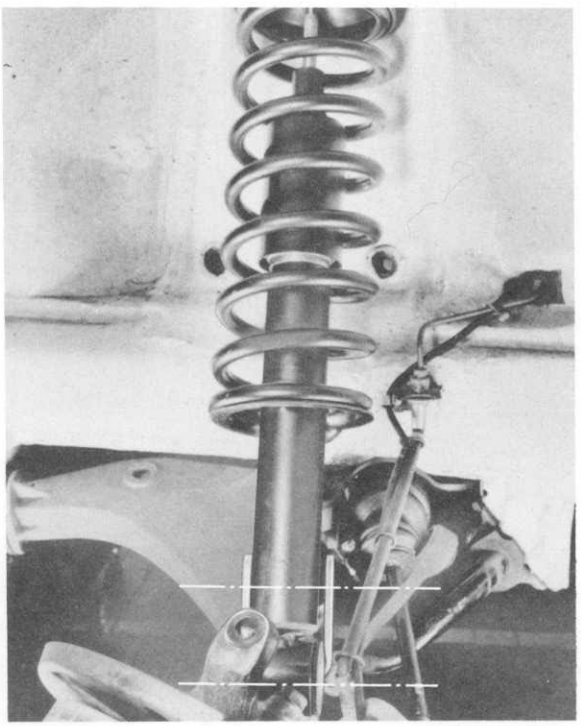


3. To avoid dislocation of the lower spring plate of non-adjustable spring struts, only 2 spacers may be used per strut for height adjustment. When converting from Bilstein to Boge dampers (pressureless), the white/green spring can be reused if a spacer is installed (P. 40 - 47 to 40 - 49).

4. Because of the 14° offset of upper spring plate to mounting eye (of control arm) when the strut is installed, it may be necessary to determine the position of the lower spring plate as follows when the strut is assembled:

   Mount upper spring plate on car. With lower spring plate and coil spring at damper installation position, set damper on lower control arm.

   Move end of coil spring to upper spring plate stop. Turn lower spring plate until the spring touches the lower stop as well. Mark position of lower spring plate to damper. Assemble struts as marked.



N o t e :

- Adjustable spring struts can also be brought to their installation positions by turning the adjuster nut (hold strut at bottom). Turn nut in the direction which allows end of spring to remain against spring-plate stop.

- If a Klann spring tensioner is used (no vise required) the strut can be brought to its installation position with the spring pre-tensioned. Screw self-locking nut onto piston rod (risk of accident).

5. Adjust height setting of adjustable spring struts as neccessary.

N o t e :

Moving the adjuster nut (spring pre-load) through 5 mm adjusts the vertical setting by approx. 10 mm.

In this context, note the following:
Any one-sided height adjustment also changes the wheel loading. When the load on any one wheel is changed the loads on the other wheels also change.
If no wheel-load meter is available, the 2 height adjuster nuts on a common axle should be changed by the same amount to keep the wheel- load difference from left to right within permissible limits. (Difference from left to right per axle, max. 20 kg).

COIL SPRINGS FOR ADJUSTABLE SPRING STRUTS

Two types of front-axle springs are available. The springs have different spring rates (spring hardness). The springs are color-coded.

The springs with green and brown codes are subdivided in tolerance groups.

When repairs are carried out, always install springs with the same color code. As the vehicle height can be adjusted, it is not necessary to select spring groups to suit certain models (e.g. left-hand or right-hand drive).

C o i l S p r i n g P a r t N o . 928 343 511 06 (green)

Used in: 928 S with pressureless Boge dampers from September 1983 to end of model year 85.
928 S with Bilstein dampers from February 1984 onward.

Group	Color code	Spring force F where length L_1 = 191 mm	Ordering index	Free length (new springs)
1	1 x green	6377 - 6573 N	201	approx. 350 mm
2	2 x green	6574 - 6769 N	202	approx. 350 mm
3	3 x green	6770 - 6965 N	203	approx. 350 mm

C o i l S p r i n g P a r t N o . 928 343 511 09 (brown)

Used in: 928 S with Boge gas-pressure dampers as standard and optional extra (sport)
- 86 models onward

Group	Color code	Spring force F where length L_1 = 191 mm	Ordering index	Free length (new springs)
1*	1 x brown*	6375 - 6570 N	401	approx. 340 mm
2	2 x brown	6571 - 6766 N	402	approx. 340 mm
3	3 x brown	6767 - 6963 N	403	approx. 340 mm

COIL SPRINGS FOR NON-ADJUSTABLE SPRING STRUTS

Three types of front-axle springs are available. The different types are color-coded - blue, white, white/green.

The springs with blue and white coding are subdivided in tolerance groups.

When repairs are carried out, always install springs with the same color coding. As the car tends to settle in the course of its service life and installation of a single spring could upset the vehicle height, we recommend replacement in pairs.

C o i l S p r i n g P a r t N o . 928.343.511.01 (blue)

Used in: 928/982 S with Boge dampers
As of start of range up to following chassis numbers:

92 A0 80 0645 928 Europe/rest of the world/Japan
92 A0 81 0714 928 USA
92 A0 82 0127 928 S

Group	Color code	Installed in	Spring force F where length L_1 = 217 mm	Ordering index
1	1 x blue	Vehicles without air conditioner	6377...6573 N	301
2	2 x blue	Vehicles with air conditioner	6574...6769 N	302
3	3 x blue		6770...6965 N	303

For a brief period, group 1 springs with spacers were installed in vehicles equipped with air conditioners.
Group 2 and 3 springs without spacers can be installed in these vehicles.

Coil Spring Part No. 928.343.511.03 (white)

Used in: 928/928 S with Boge dampers
as of following chassis numbers:

92 A0 80 0646 928 Europe/rest of the world/Japan
92 A0 81 0715 928 USA
92 A0 82 0128 928 S

Group	Color code	Installed in	Spring force F where length L_1 = 211 mm	Ordering index
1	1 x white	L-H drive cars	6377...6573 N	901
2	2 x white	R-H drive cars	6574...6769 N	902

Group 1 springs with spacers have also been installed in right-hand drive cars. Refer to table when replacing.

Springs with 3 white dots (discontinued) were installed in a small number of cars. Use group 2 springs as replacements.

Coil Spring Part No. 928.343.511.04 (white/green)

Used in: 928/928 S with Bilstein dampers for all cars.

Group	Color code	Installed in	Spring force F where length L_1 = 205 mm	Ordering index
1	1 x white/ green	all cars	6377...6630 N	none

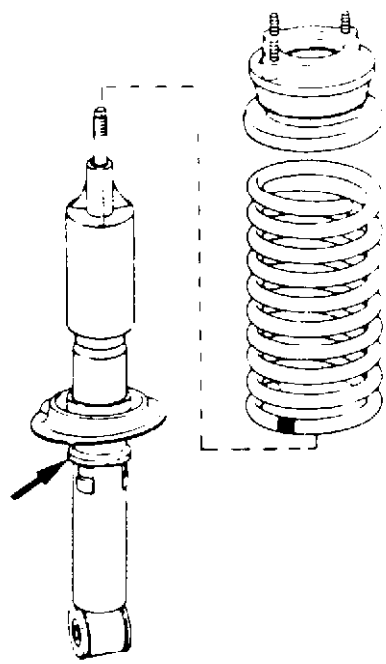
Effect on Height of Front Axle

1. Front Axle Springs

Springs with approx. 200 N more force at a standard test length (e.g. tolerance group II springs as opposed to group I) increase the height of the front axle by approx. 5 - 15 mm.

2. Spacer

Placing a spacer beneath the lower spring plate increases the height of the front axle by approx. 10 mm. A maximum of 2 spacers per spring strut is permissible.



3. Gas-pressure Dampers (Bilstein)

If Boge dampers are replaced by Bilstein dampers and no further changes implemented, i.e. the same coil springs are reused, the front axle is raised by approx. 10 mm because of the gas pressure in the latter dampers. We recommend use of springs Part No. 928.343.511.04 in conjunction with the gas-pressure dampers.

DAMPERS - INSTALLATION OVERVIEW, IDENTIFICATION AND DISTINGUISHING FEATURES

Non-adjustable front-axle spring strut	Front axle	Rear axle	Single pipe	Double pipe	Pressureless	Gas pressure	Boge	Bilstein		Paint coding, Identification
928/928 S	X			X	X		X			black*
standard		0		0	0		0			black**
928/928 S	X		X			X		X		green
optional extra		0	0			0		0		green
Adjustable front-axle spring strut										
928 S standard	X			X	X		X			black*
until end of model		0		0	0		0			black**
year 85										
928 S optional	X		X			X		X		gold
extra until end of		0	0			0		0		gold
model year 85										
928 S standard	X			X		X	X			grey
86 models onward		0		0		0	0			grey
928 S optional extra	X			X		X	X			red
86 models onward		0		0		0	0			red
alternative	X		X			X		X		gold
		0	0			0		0		gold

*/** Identical parts

N o t e :

O p t i o n a l E x t r a = S p o r t T u n i n g

When removed, the pressureless damper will remain in any desired position. When the gas pressure damper is removed it extends to the expansion stage stop.

Technical Data

Rear Axle

Wheel suspension	Independent wheel suspension with lower diagonal suspension links and upper wishbones, coil springs and internal dampers.	
Springs	1 coil spring per wheel	
Dampers Make/Installation	double-action hydraulic dampers page 42 - 18 d	
Stabilizers	Ø 21 mm Ø 22.5 x 3.5 mm (tubular stabilizers) modified in course of model year 1981	
Spacers	standard up to end of MY '91 "Club-Sport"-Version standard as of MY '92	---------- 17 mm per wheel 38 mm per Rad

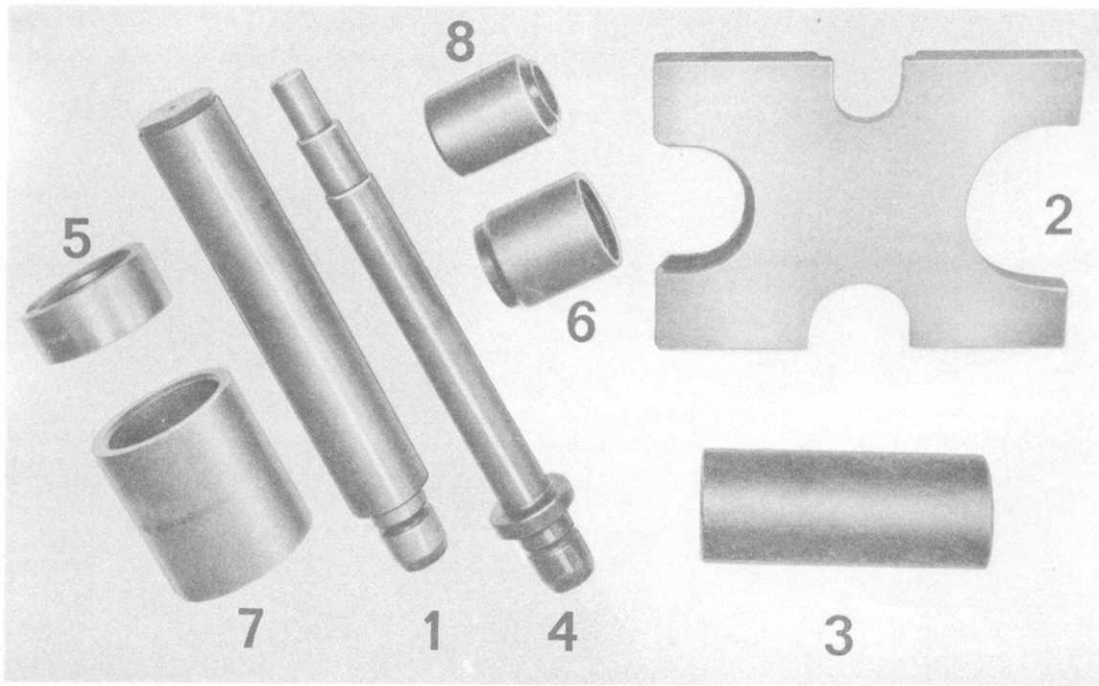
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TIGHTENING TORQUES FOR REAR AXLE

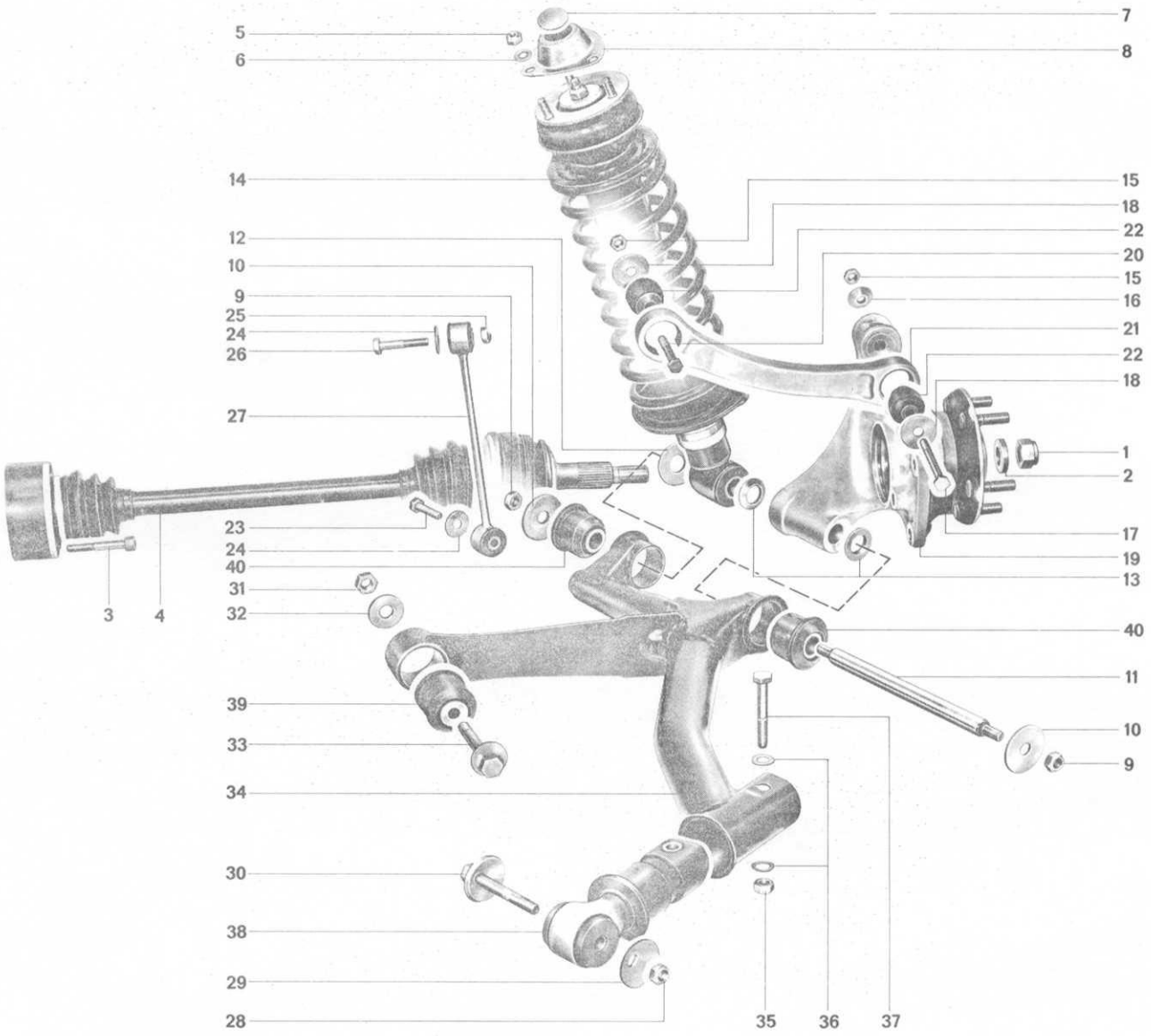
Location	Description	Thread	Material	Torque Nm (ftlb)
Tranverse member to body	Hex bolt	M 10	8.8	46 (33)
Light alloy casting (suspension link bearing) for lower control arm (86 models onward) to body	Hex bolt	M 10		46 (33)
Lower suspension link to transverse member (camber eccentric)	Locknut	VNM 14 x 1.5	10	200 (146)
Lower suspension link to body or light-alloy casting (track eccentric)	Locknut	VNM 12 x 1.5	10	120 (88)
Bearing link to lower suspension link	Locknut	VNM 12 x 1.5	8	85 (62)
Brake caliper to wheel carrier	Hex bolt	M 12 x 1.5	8.8	85 (62)
Wheel carrier to lower suspension link	Locknut	VNM 14 x 1.5	8	140 (103)
Upper suspension link to transverse member, upper suspension link to wheel carrier	Locknut	VNM 10	8	46 (33)
Propshaft or rear axle to wheel hub	Locknut	VHM 22 x 1.5	8	460 (322)
Propshaft to differential and input shaft	Cap bolt	M 10	12.9	81 (59)
Wheel to wheel hub	Wheel nut	M 14 x 1.5	AL	130 (94)
Spring strut to body	Locknut	VNM 10	8	46 (33)

Location	Description	Thread	Material	Torque Nm (ftlb)
Rubber bushing on piston rod (spring strut)	Locknut	VNM 12 x 1.5	8	58 (42)
Transmission bearing to rear-axle transverse member	Hex bolt	M 12 x 1.5	8.8	85 (62)
Stabilizer bearing to body	Hex bolt	M 10	8.8	46 (33)
Stabilizer linkage to lower suspension link	Hex bolt	M 10	8.8	46 (33)
Stabilizer linkage to stabilizer	Locknut	VNM 10	8	46 (33)
Speed sensor to wheel carrier	Cap bolt	M 6	8.8	10 (7)
Angle bracket to wheel carrier	Hex bolt	M 6	8.8	10 (7)
Angle bracket to transverse member	Locknut	VM 6		6 (4)
Guard to wheel carrier	Locknut Hex bolt	VEM 8 M 6	8 8.8	23 (17) 10 (7)

TOOLS



No.	Description	Special Tool	Remarks
1	Punch	VW 407	
2	Thrust plate	VW 402	
3	Tube	VW 415 a	
4	Punch	VW 408 a	
5	Support ring	VW 440	
6	Thrust tube	VW 455	
7	Remover/installer	VW 459/2	Part of VW 459
8	Thrust tube	P 263	


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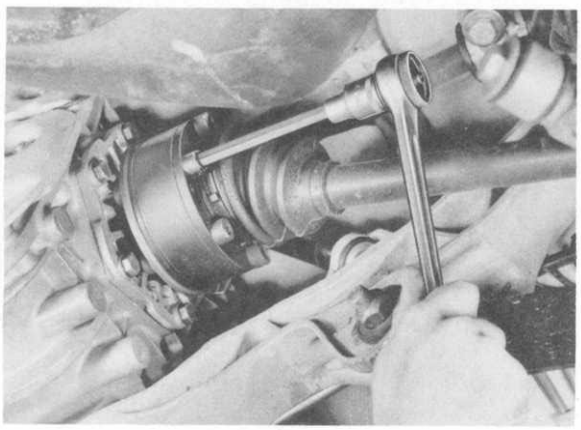
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Self-locking nut	1		Replace if necessary. Tighten to specified torque	
2	Washer	1			
3	Socket head bolt	6		Tighten to specified torque	
4	Axle shaft	1		Check for damage	
5	Locknut	3		Replace, tighten to specified torque	
6	Washer	3			
7	Plug	1			
8	Cover	1			
9	Locknut	2		Replace, tighten to specified torque	
10	Washer	2			
11	Pivot pin	1			
12	Washer	1			
13	Cone washer	2			
14	Spring strut	1		If necessary, replace seal on mounting plate	
15	Locknut	2		Replace, tighten to specified torque	
16	Cone washer	1			
17	Bolt	1			
18	Cone washer	2			
19	Hub assembly	1			Straightening not permitted
20	Bolt	1			

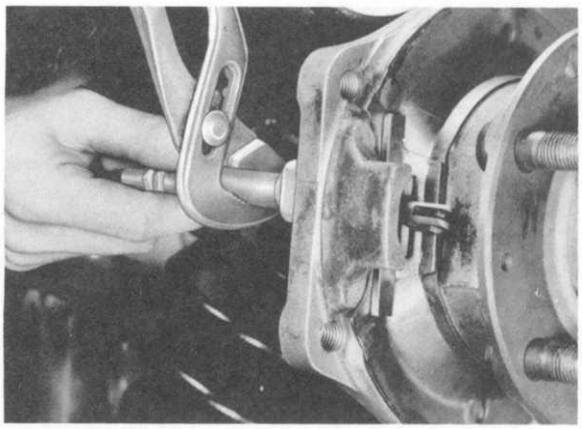
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
21	Upper control arm	1			Straightening not permitted
22	Upper arm mount	2		Position correctly	
23	Bolt	1		Tighten to specified torque	
24	Washer	2			
25	Locknut	1		Replace and tighten to specified torque	
26	Bolt	1			
27	Stabilizer suspension	1		Check for damage	page 42 - 6
28	Locknut	1		Tighten to specified torque	
29	Eccentric disc	1			
30	Eccentric bolt	1			
31	Locknut	1		Tighten to specified torque	
32	Washer	1			
33	Eccentric bolt	1		Lubricate with MoS_2 grease	
34	Lower control arm	1		Check for damage	Left and right sides not interchangeable, welding and straightening not permitted
35	Locknut	1		Replace and tighten to specified torque	
36	Washer	2		Replace if necessary	
37	Bolt	1			
38	Mount	1		Position correctly	
39	Rubber mount	1			page 42 - 6
40	Rubber mount	2			page 42 - 6

NOTES ON DISASSEMBLY AND ASSEMBLY

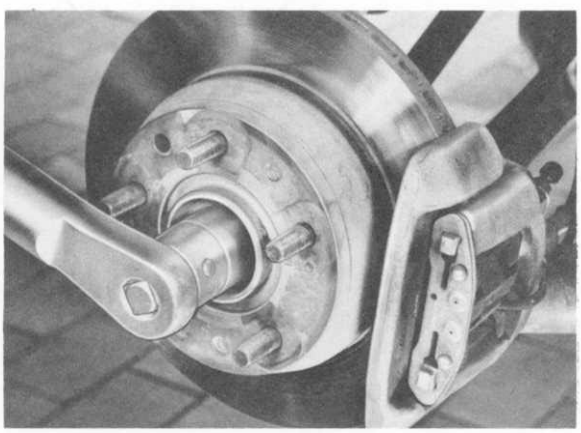
D i s a s s e m b l i n g

1.Remove propshaft with drive shaft.





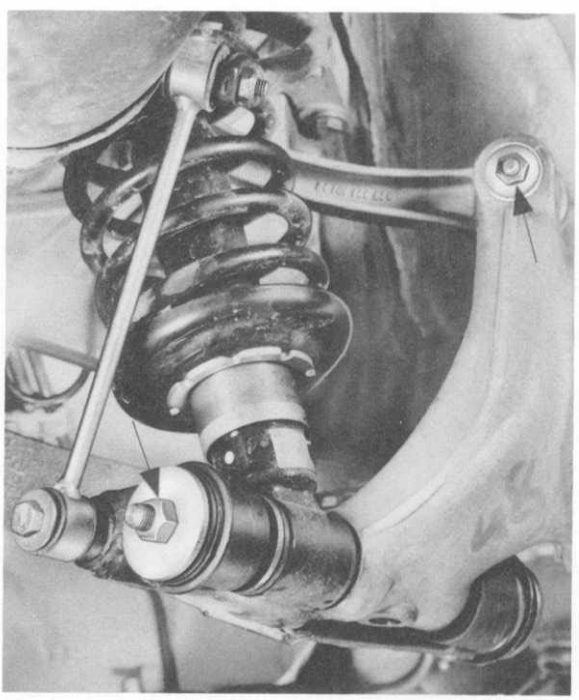
5.Remove wheel carrier.



2.Remove brake caliper.

3.Take off brake disk after removing two countersunk screws.

4.Remove parking brake shoes and expansion lever. Pull parking brake cable out of its guide in wheel carrier.



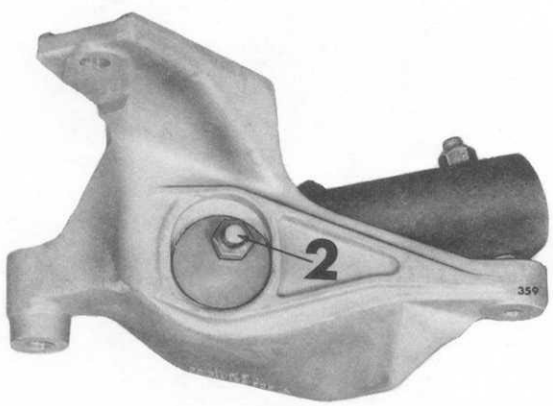
6.Unscrew eccentric bolts and stabilizer linkage bolt and remove lower diagonal suspension link.

N o t e s o n W h e e l S u s p e n s i o n , 8 6 M o d e l s O n w a r d.

The exhaust system has been modified as of model year 86. Two secondary mufflers are mounted near the control arms, one on each side.

This modification has necessitated modification of the following components:

- Rear axle transverse member
- Bearing link of lower suspension link mounted on a removable light-alloy casting (instead of directly on body).
- The length of the track eccentric bolt (2) has been changed to suit the modified bearing (bolt shank approx. 10 mm longer).



A s s e m b l i n g

1. Inspect parts for damage, compare suspect parts with new parts. Do not mix up left-hand and right-hand lower diagonal suspension links (otherwise spring travel is impaired).

2. Coat shanks of camber and track eccentric bolts with Optimoly TA (instead of multi-purpose grease with MoS_2) and coat thread with Optimoly HT. Apply a coating of Molykote U to rubber bushing of stabilizer linkage and rubber bushings No. 39 and 40 of lower control arms (page 42 - 2) before installing suspensions links in car.

   See Table of Consumables (Technical Information Group X) for further lubrication notes and specifications.

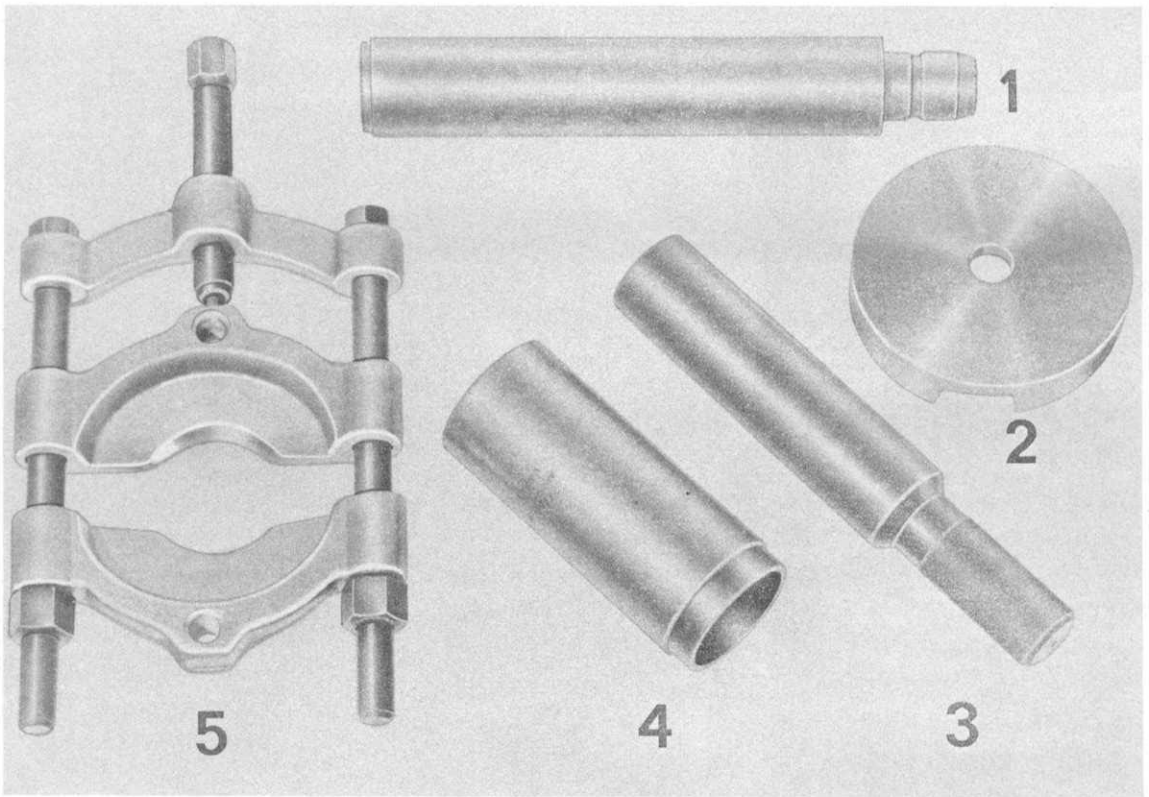
N o t e :

Spray toe-in eccentrics and camber eccentrics on both sides, adjustment for spring plate on damper and ends of bearing bolt threads (wheel carriers) with underbody wax such as Tectyl - UL - 846 manufactured by Valvoline. This precaution prevents corrosion of the threaded connections, thus facilitating future maintenance and repair work.

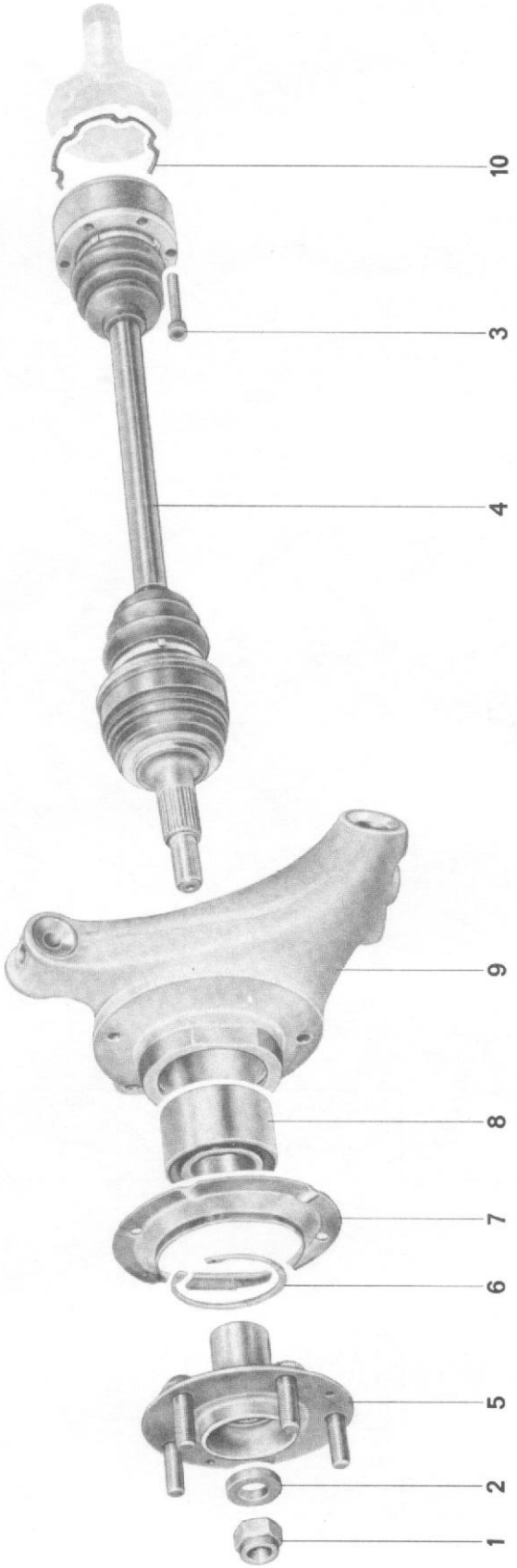
3. Tighten bolts and nuts to specified torque.

4. Align axles.

TOOLS



No.	Description	Special Tool	Remarks
1	Punch	VW 407	
2	Base plate	VW 441	
3	Drive sleeve	VW 244 b	
4	Tube	VW 415 a	
5	Extractor	-	Standard

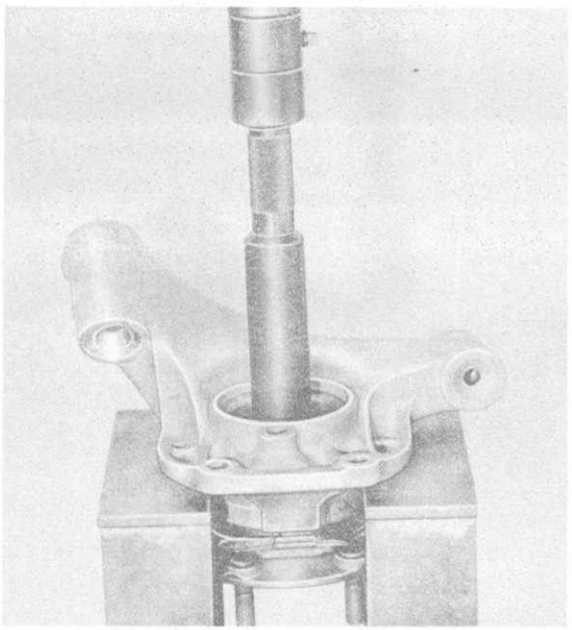

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Self-locking nut	1		Replace if necessary, tighten to specified torque	
2	Washer	1			
3	Socket head bolt	6		Tighten to specified torque	
4	Axle shaft	1		Check for damage	
5	Wheel hub	1	Press off with VW 244 b and suitable base plates	Press on with VW 244 b, whereby ball bearing inner race must be on VW 415 a	
6	Circlip	1		Replace if necessary	
7	Brake backing plate	1		Insert wheel hub in ball bearing before pressing in	
8	Ball bearing	1	Heat hub carrier to 120 - 150° C (248 - 302° F), Press out with VW 415 a	Heat hub carrier to 120 - 150° C (248 - 302° F). Install new bearing. Place VW 441 underneath hub carrier and press on lightly with VW 415 a, being careful that inner races do not fall out	
9	Hub carrier	1			
10	Gasket	1		Replace	

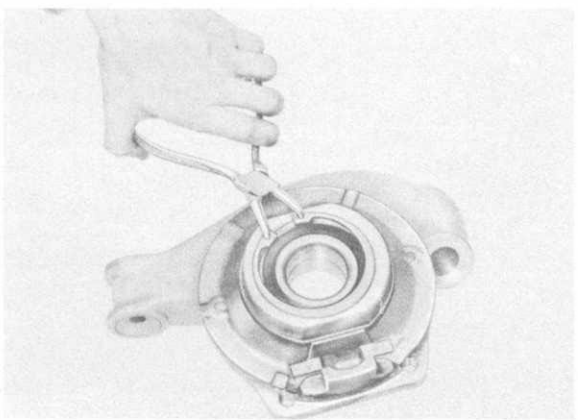
DISASSEMBLING AND ASSEMBLING HUB ASSEMBLY

Disassembling

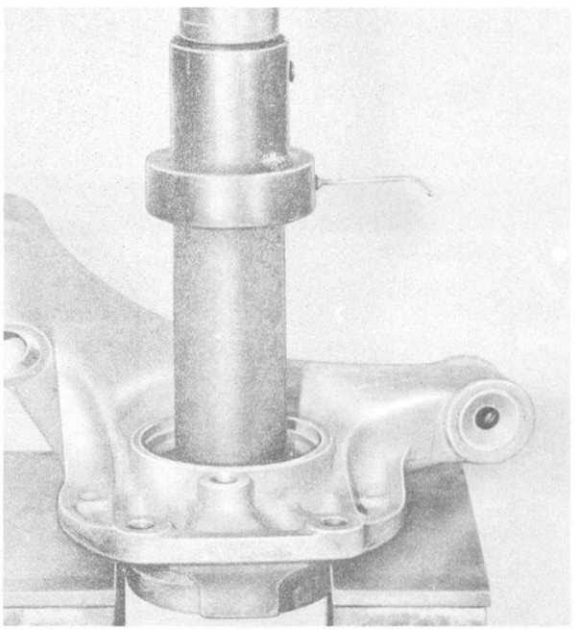
1. Press out wheel hub with VW 244 b and suitable base plates.



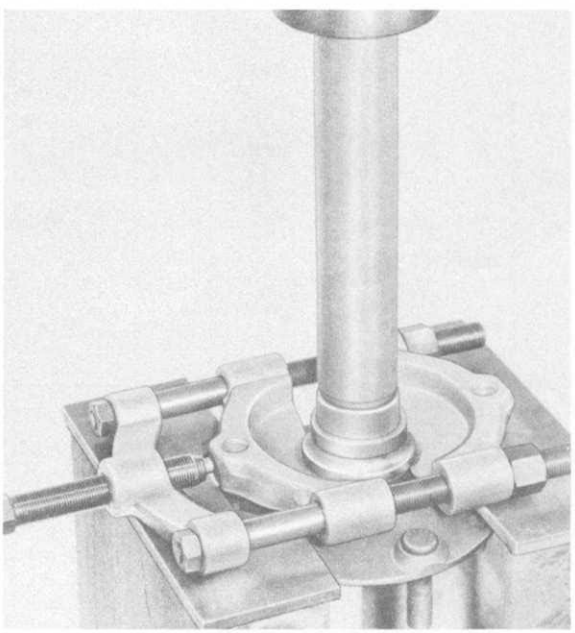
2. Remove circlip.



3. Press out ball bearing with VW 415 a after heating hub carrier to 120 - 150° C (248 - 302° F).

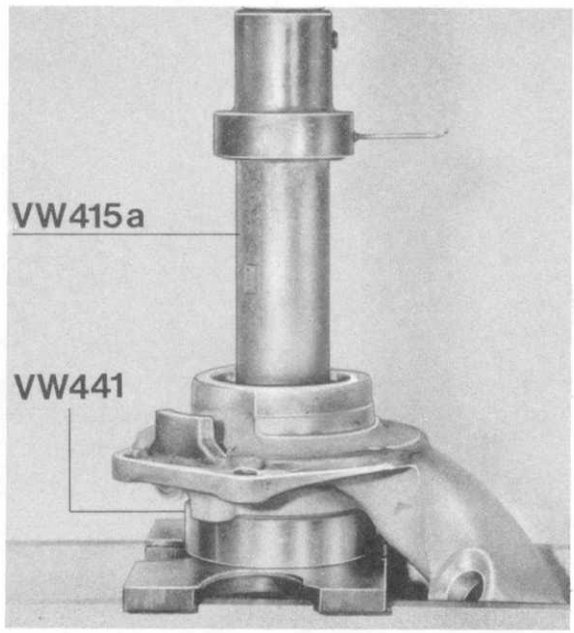


4. Press bearing inner race off of wheel hub with an extractor and Special Tool VW 407.

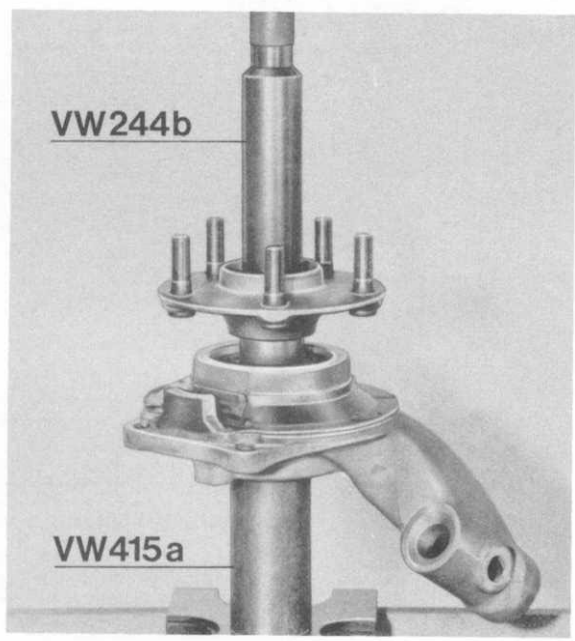


Assembling

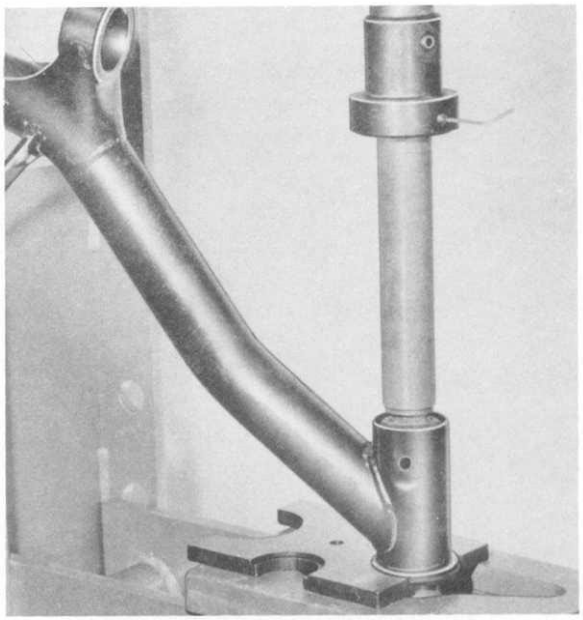
1. Heat hub carrier to 120 - 150° C (248 - 302° F), install ball bearing and then pres on slightly.



2. Press in wheel hub after installation of circlip and brake backing plate.



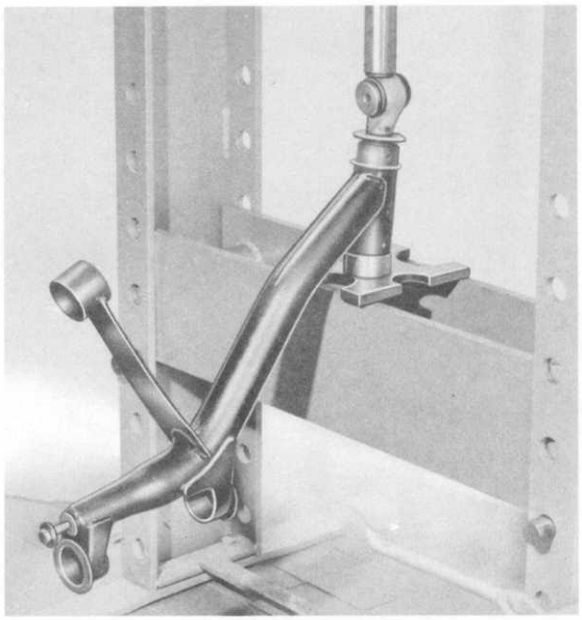
REPLACING LOWER DIAGONAL CONTROL ARM LINK PIN



Removing

1. Remove bolt from link pin.

2. Place lower control arm on Special Tool VW 402. Press out link pin with Special Tool VW 407.



Installing

1. Coat holder and link pin with waxfree Capella Oil B (Texaco). Install link pin by hand so that bend of link pin faces in toward lower control arm and holes for mounting bolt are aligned.

2. Press in link pin far enough so that bolt can be installed without applying force.

Note

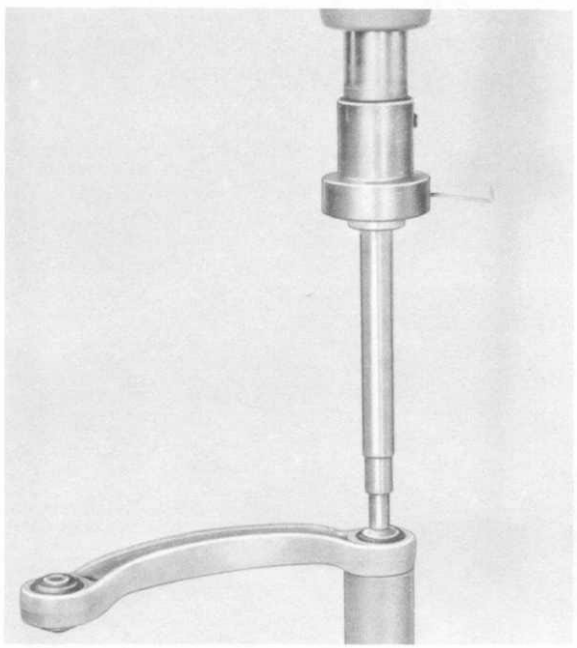
Rubber mounts used for lower control arms have a long service life, but if they do have to be replaced this can be accomplished with the following tools and application of waxfree Capella Oil B.

	Removal	Installation
Rubber mount for pivot pin of shock absorber and hub carrier	VW 459/2 VW 408 a P 263 First press out inner metal bushing.	VW 459/2 VW 455 Make sure that inner bushing is not displaced.
Rubber mount for camber eccentric bolt	VW 402 VW 407	VW 402 VW 407

REPLACING UPPER CONTROL ARM MOUNT

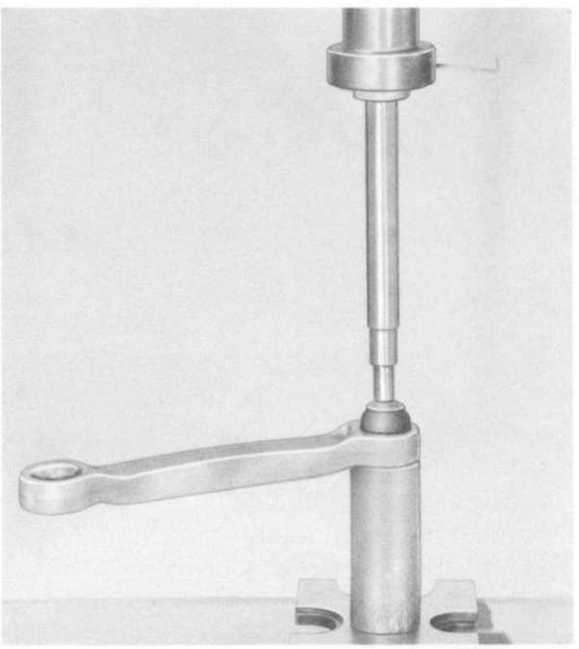
Removing

Press out mount with Special Tool VW 408 a, using Special Tool VW 415 a as a base.



Installing

Press in mount, using waxfree Capella Oil B (Texaco) and Special Tools VW 415 a and 408 a. Position correctly. Apply pressure pad to conical end of metal bushing to prevent any change in position between the metal bushing and rubber mount.



REMOVING AND INSTALLING SPRING STRUT

Removing

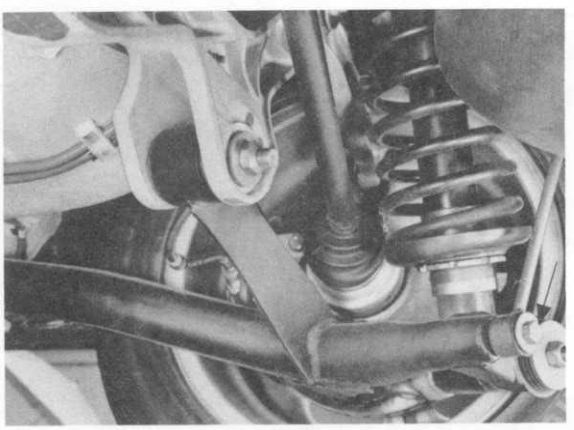
1. Unscrew three self-locking nuts from spring strut in luggage compartment.



2. Remove wheel.

3. Unscrew front nut on pivot pin of lower control arm, counterlocking and counter-holding the rear nut with a separate M 14 x 1.5 nut. Remove pivot.

4. Disconnect stabilizer bar link at control arm.

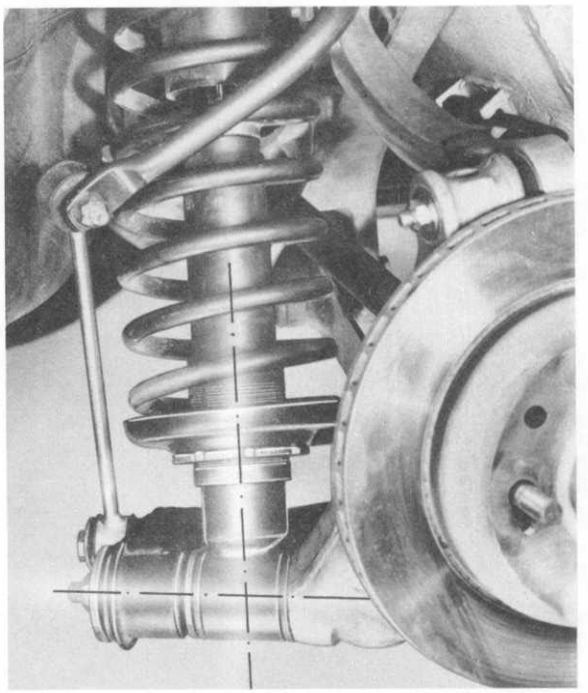


Installing

1. Replace self-locking nuts. Check spring strut seal, making a new permanently elastic seal on the mounting plate 300mm long and circular in shape with, for example, Prestik 4 mm dia., Item No. 0593 from Bostik. Coat rubber mount on mounting eye with Molykote U.

2. Tighten to specified torques.

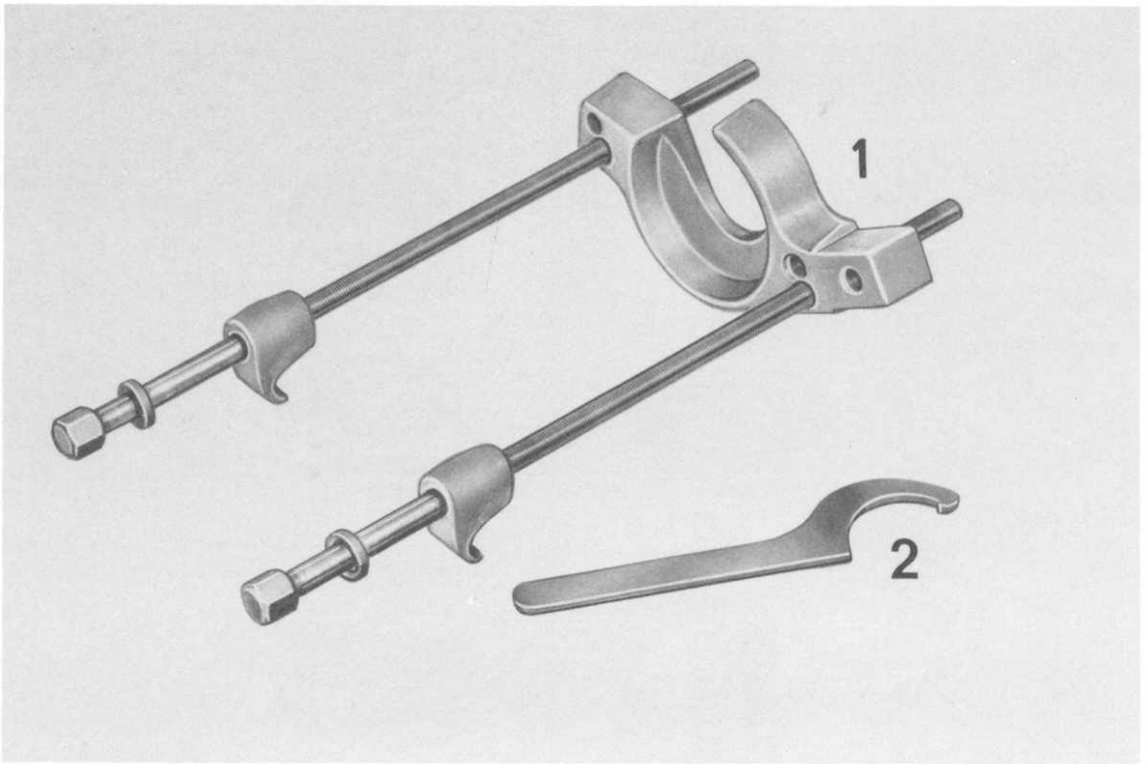
3. Note installed position of lower shock absorber.



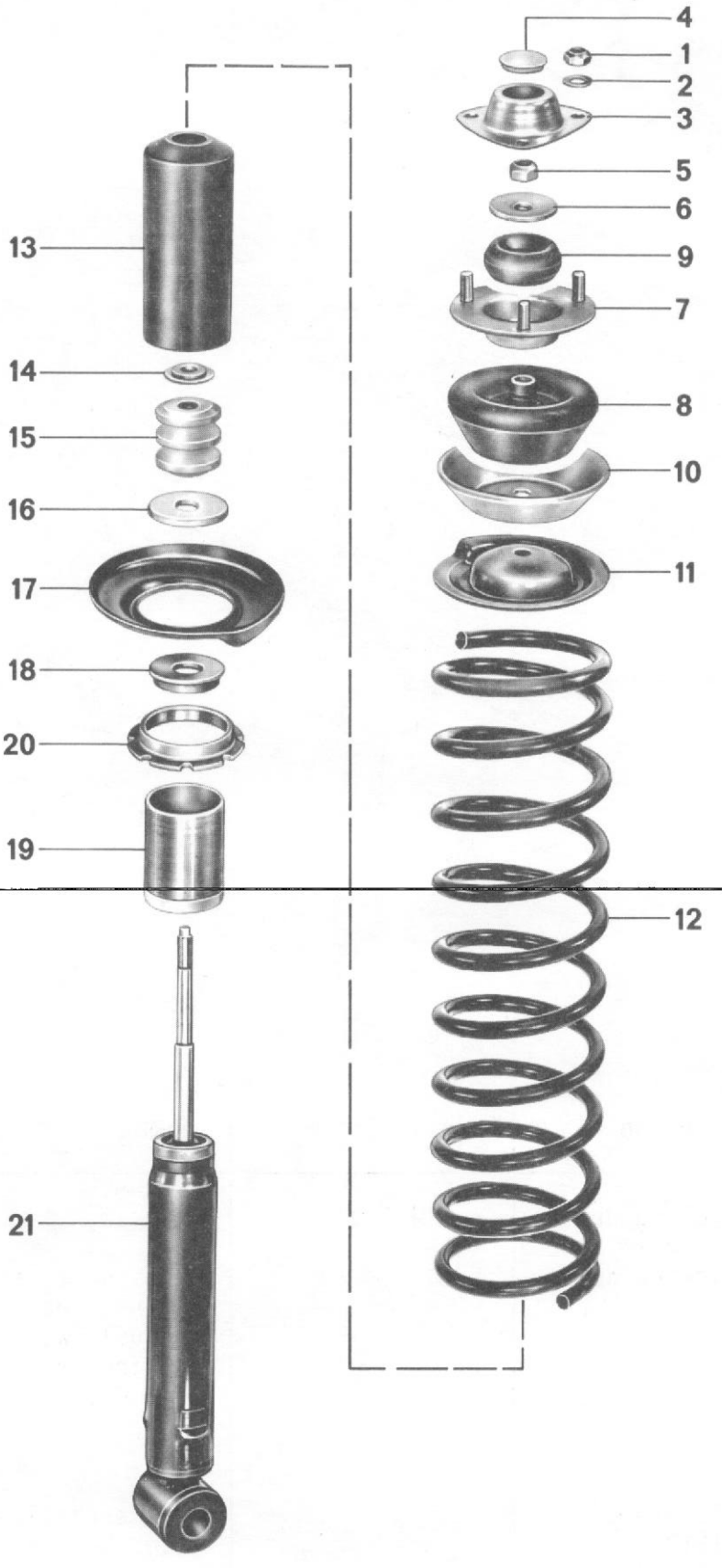
Note

Turn lower shock absorber to correct position with a hook wrench applied to adjusting nut.Select direction of turning so that stop of spring retainer remains on end of spring. Further the adjusting nut must not be turned against the threaded sleeve, so that the car height adjustment is not changed.

TOOLS



No.	Description	Special Tools	Remarks
1	Tensioning device or	VW 340	
-	Tensioning device		Porsche version by Klann, see Workshop Manual (Workshop Equipment 3, group 4) for description/ supplier.
2	Sickle wrench DIN 1810 dia. 80/90		commercially available, e.g. Saltus


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No.	Description	Qty	Note When: Removing	Installing
1	Locknut	3		renew, torque: 46 Nm (33 ftlb)
2	Washer	3		
3	Cover	1		
4	Dirt excluder	1		
5	Locknut	1	Stretch coil spring with VW 340 or Klann KL - 0014	renew, torque: 58 Nm (42 ftlb)
6	Washer	1		
7	Mounting plate	1		
8	Rubber support	1		coat with Molykote U
9	Damper bushing	1		coat with Molykote U
10	Support plate	1		see note on page 42 - 18c
11	Spring plate	1		see note on page 42 - 18c
12	Coil spring	1		note allocation, tolerance group and remarks on page 42 - 18b/c
13	Protective tube	1		

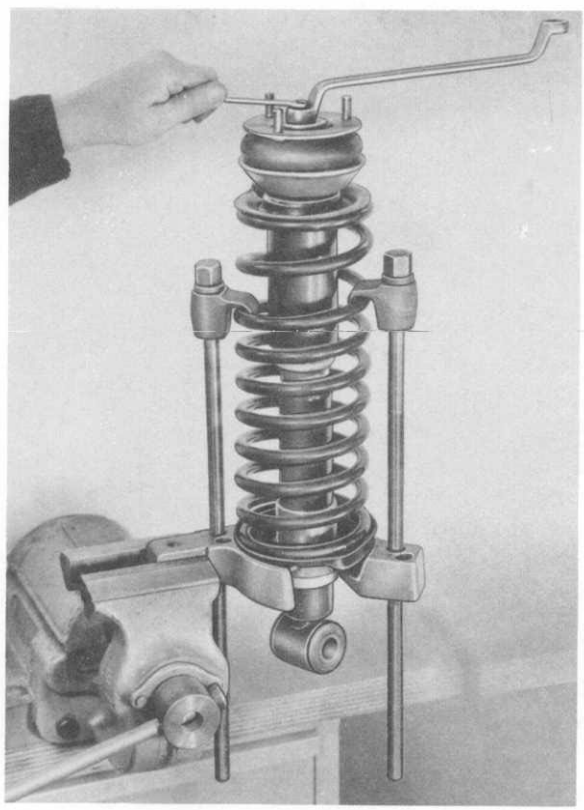
No.	Description	Qty	Note When: Removing	Installing
14	Circlip	1		
15	Secondary spring	1		Check installation position
16	Stop	1		Install with grooves down
17	Lower spring plate	1		Coat contact surface for adjuster nut with Optimoly TA. Note remarks on page 42 - 18c
18	Support cover	1		Boge only
19	Threaded sleeve	1		Coat thread with Optimoly TA. See remarks on page 42 - 18c
20	Adjuster nut	1		Check freedom of movement (to facilitate adjustment). Boge and Bilstein are different. See remarks on page 42 - 18c
21	Damper	1		Check efficiency, renew if necessary. Modified dampers as of model year 86. Damper installation overview, page 40 - 18d

NOTES ON DISASSEMBLY AND ASSEMBLY

D i s a s s e m b l i n g

1. Using Porsche-version Klann spring tensioning device (see Workshop Manual) or VW 340, stretch coil spring. Remove self-locking nut from piston rod. Remove mounting plate with support plate.

VW 340



2. If special tool VW 340 is used, relax tension on coil spring by screwing down each of the clamping bolts in turn.

T e s t i n g D a m p e r s

Dampers can only be tested properly on a test bench. Although inefficient dampers cannot be identified, a visual inspection or check of operation will identify completely defective dampers.

N o t e :

Distinguishing features of dampers, see page 42 - 18d.

B o g e D a m p e r s , P r e s s u r e l e s s

With damper in installation position, extend and compress by hand. The damper must move smoothly and with uniform resistance through its entire travel. The extension and compression-stage damping must be felt clearly right up to the final positions. Dampers which have been stored for an extended period of time should be pumped in and out several times in the installation position. Replace leaking dampers.

B o g e G a s P r e s s u r e D a m p e r s

With damper in installation position, extend and compress by hand. Damper must move smoothly throughout its travel. Extension and compression-stage damping must be felt clearly right up to final positions. Because of the gas pressure, the resistance of the

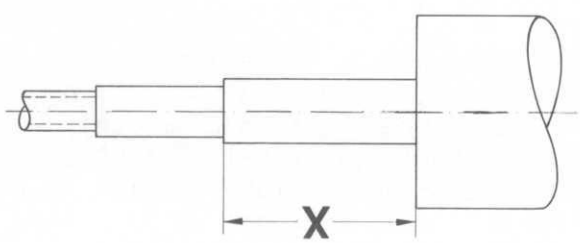
piston rod increases as the rod moves into the damper. If dampers have been stored for a long time, pump in and out several times in installation position.

Replace leaky dampers.

If dampers have depressurized (damper does not return automatically to expansion-stage and stop), but show no signs of escaping oil (oil stain) and fulfill the remaining requirements, they can be reused. Dampers which show traces of oil leaks and have lost their gas pressure must be replaced.

B i l s t e i n D a m p e r s

Worn B i l s t e i n d a m p e r s can be readily identified.
Measure dimension X with damper completely compressed (i.e. as far as possible). If dimension X is larger than 18 mm (new damper 8.5 mm), the damper must be replaced.



A s s e m b l i n g

Rear-axle springs are available in three versions. The versions are color-coded.

The springs with green, yellow and blue coding are further subdivided in tolerance groups.

When replacing, always install springs with the same color coding. Under no circumstances may yellow, green and blue springs be combined.

As car height is adjustable, it is not necessary to correlate spring groups with certain model types (e.g. with or without air conditioner, left-hand or right-hand drive).

Coil spring (green)
928, until end of model year 78
Part No. 928.333.531.09

Gr.	F where L_1 = 272 mm	Color code	Ordering Index
1	4719...4817 N	1 green	201
2	4818...4915 N	2 green	202
3	4916...5013 N	3 green	203

Coil spring (yellow)
928/928 S from 79 models until current 84 model year (see note below), Part No. 928.333.531.12

Gr.	F where L_1 = 253.5 mm	Color code	Order index
1	4710...4810 N	1 yellow	101
2	4811...4910 N	2 yellow	102
3	4911...5010 N	3 yellow	103

N o t e :

As of the following chassis numbers:

92 ES 840 416 928 S Europe/r.o.w
92 ES 849 568 928 S Japan
92 ES 860 562 928 S USA

in the current 84 model year, the coil springs, both spring plates of the supporting plate and the adjuster nut with threaded sleeve have been modified to reduce weight.

Coil spring (blue)
928 S, installed in the current 84 models as of the chassis numbers listed above, Part No. 928.333.531.14.

Gr.	F where L_1 = 249.8 mm	Color code	Order index
1	4680...4800 N	1 blue	301
2	4801...4920 N	2 blue	302
3	4921...5040 N	3 blue	303

DAMPERS - INSTALLATION OVERVIEW, IDENTIFICATION AND DISTINGUISHING FEATURES

Non-adjustable front-axle spring strut	Front axle	Rear axle	Single pipe	Double pipe	Pressureless	Gas pressure	Boge	Bilstein		Paint coding, Identification
928/928 S	X			X	X		X			black*
standard		0		0	0		0			black**
928/928 S	X		X			X		X		green
optional extra		0	0			0		0		green
Adjustable front-axle spring strut										
928 S standard	X			X	X		X			black*
until end of model		0		0	0		0			black**
year 85										
928 S optional	X		X			X		X		gold
extra until end of		0	0			0		0		gold
model year 85										
928 S standard	X			X		X	X			grey
86 models onward		0		0		0	0			grey
928 S optional extra	X			X		X	X			red
86 models onward		0		0		0	0			red
alternative	X		X			X		X		gold
		0	0			0		0		gold

*/** Identical parts

N o t e :

O p t i o n a l E x t r a = S p o r t T u n i n g

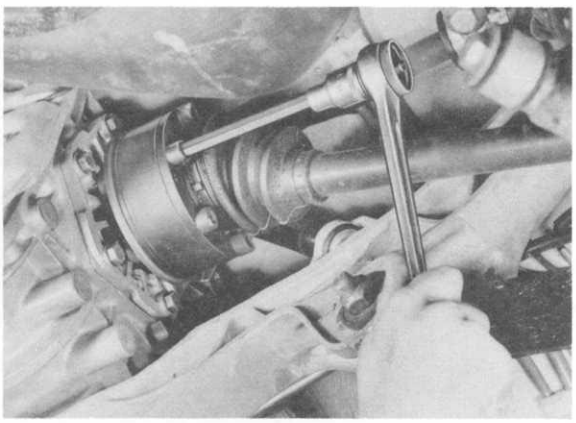
When removed, the pressureless damper will remain in any desired position. When the gas pressure damper is removed it extends to the expansion stage stop.

REMOVING AND INSTALLING AXLE SHAFT

Axle Shaft Bolted on Both Sides

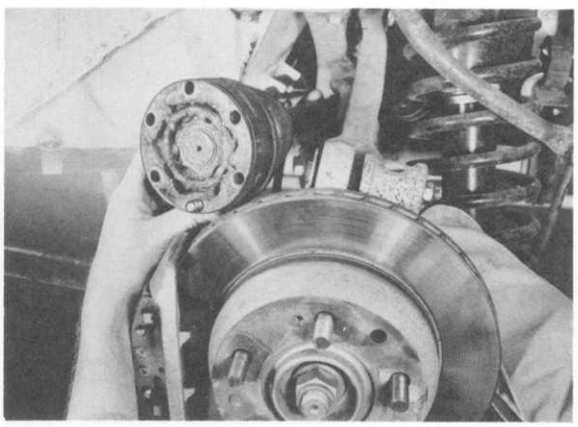
Removing

1. Remove cylinder head bolts on transmission and wheel ends.



2. Run out axle shaft on righthand side toward inside.

3. Run out axle shaft on lefthand side toward outside, after removal of rear wheel. Make sure that grease from constant velocity joint does not come on brake disc.



Installing

Clean axle shaft flange surfaces to remove grease.
Tighten bolts to 83 Nm.

Axle Shaft Welded on One Side

Removing

1. Remove socket head bolts on transmission end and self-locking nut on wheel end.

Note:

Self-locking nut is accessible after removing wheel cover.
Wheels do not have to be removed.

2. Run out axle shaft on right and left sides toward inside.
   Lower rear end of exhaust assembly on left side.

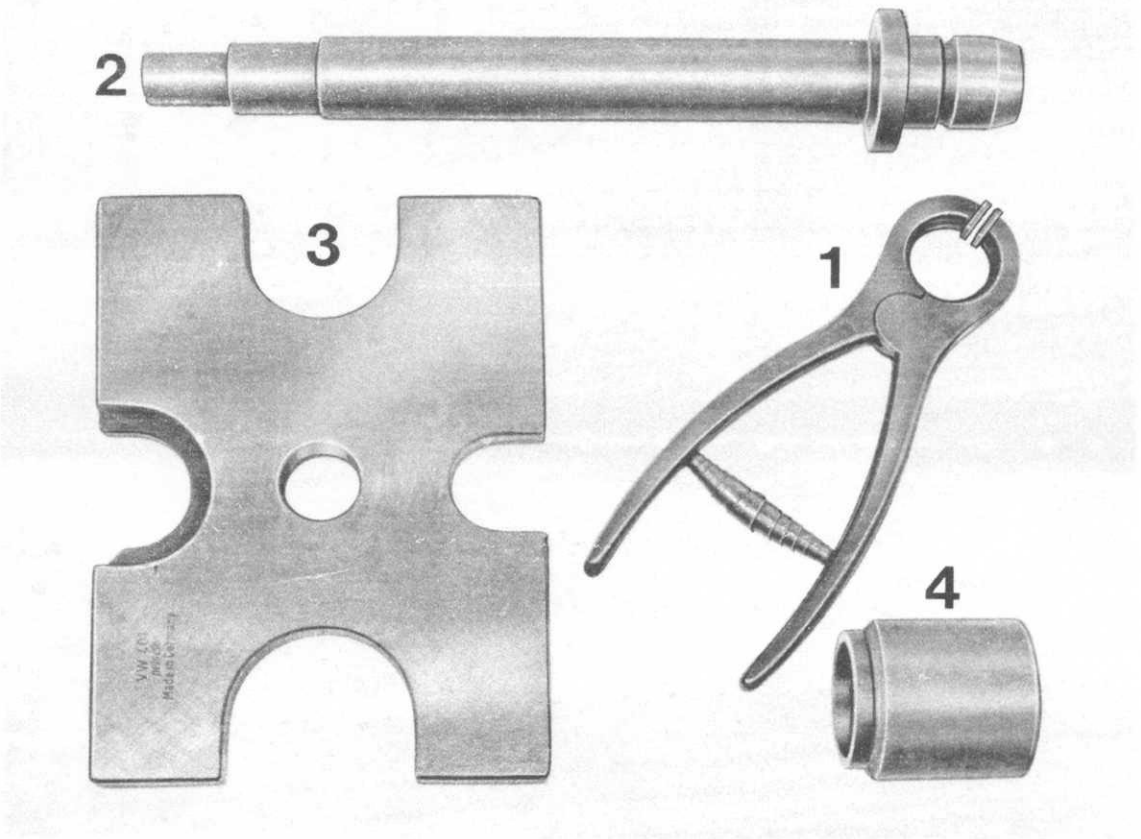
Installing

1. Run axle shaft into wheel hub on wheel end (lubricate splines and threads with Optimoly HT).

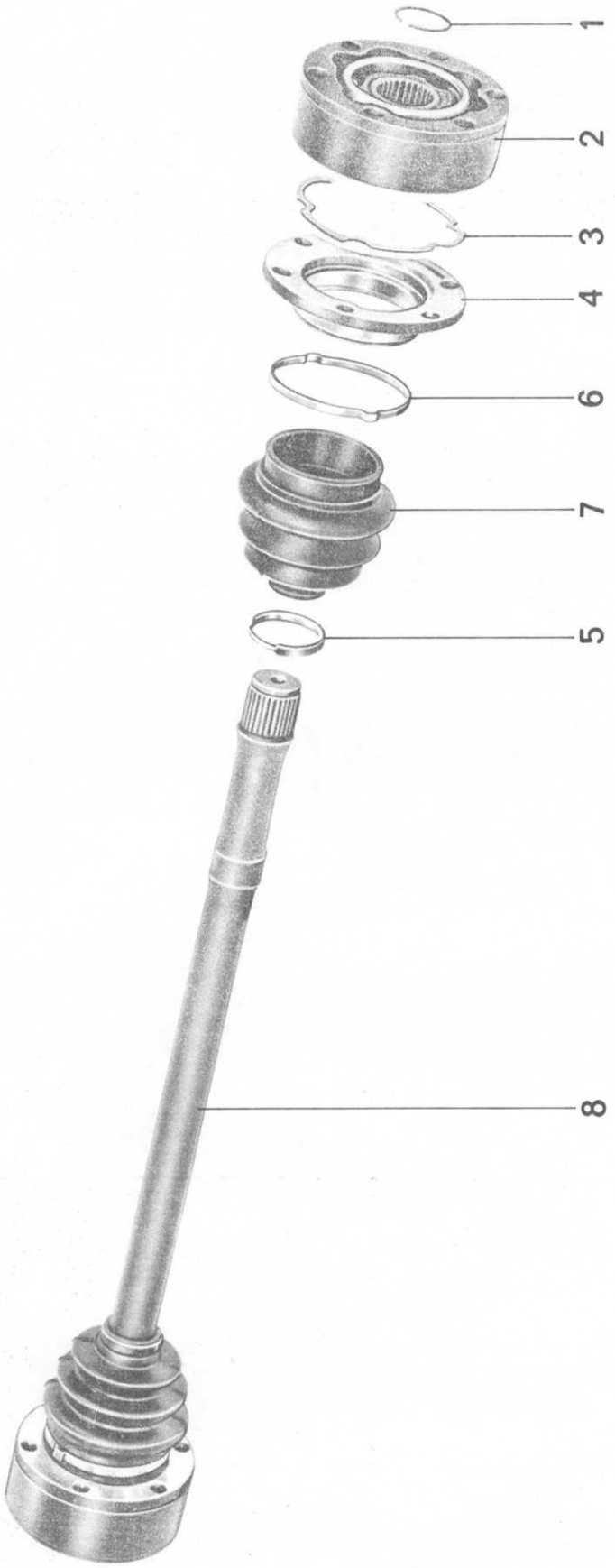
2. Install socket head bolts on transmission end (axle shaft flange surfaces must not have grease).

3. Tighten socket head bolts to 83 Nm and self-locking nut to 460 Nm.

TOOLS



No.	Description	Special Tool	Remarks
1	Circlip pliers	VW 161 a	
2	Punch	VW 408 a	
3	Plate	VW 401	
4	Sleeve	VW 455	


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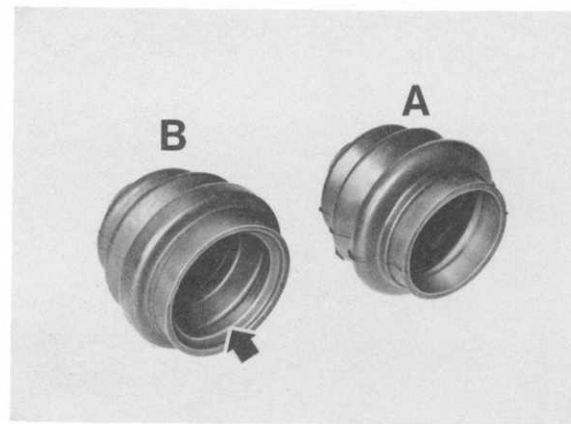
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Circlip	2		Replace, make sure of correct fit	
2	Constant velocity joint	2		Pack 80 grams of grease in each joint groove on outside diameter of joint to outside of propeller shaft. Grease quantity only valid for joints	Only special grease (spare part delivery)
3	Gasket	2		Replace	
4	Sealing flange	2		Bearing surface must be grease free	
5	Clamp	2			
6	Clamp	2	Cut open with side nippers	Install clamps between machined shoulders	
7	Dust boot	2		Replace, if necessary	
8	Shaft	1		Check runout	

Modified Axle Shaft

Axle shafts with welding on one side are installed since 1982 models. The transmission end shaft is still bolted as before, while on the weel end the axle shaft and drive shaft are welded.
Welded axle shafts can also be installed retroactively in older models. Bolted axle shafts on both ends, however, cannot be installed in cars after 1982 models on (would scrape on wheel carrier).

Dust Cover Versions

The welded axle shaft has a different dust cover with improved sealing. The dust cover has a bead (arrow) and the sealing flange a groove.



A For bolted axle shaft on both ends
B For welded axle shaft on one end

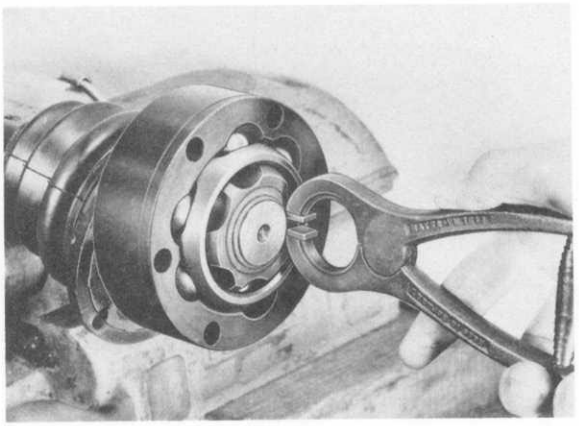
DISASSEMBLING AND ASSEMBLING AXLE SHAFT

Disassembling

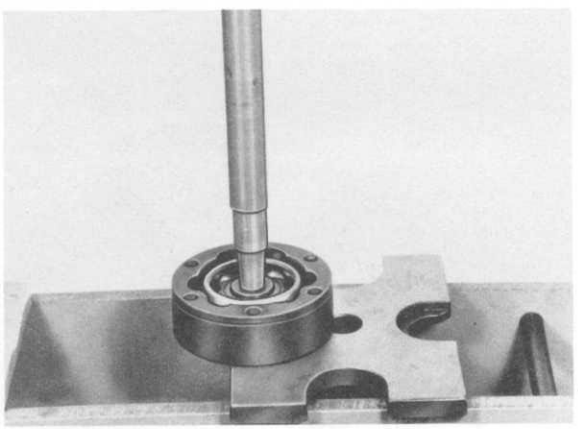
1. Clamp axle shaft in a vise fitted with soft jaws.

2. Remove clamp and push dust boot with sealing flange toward inside of axle shaft.

3. Remove circlip.



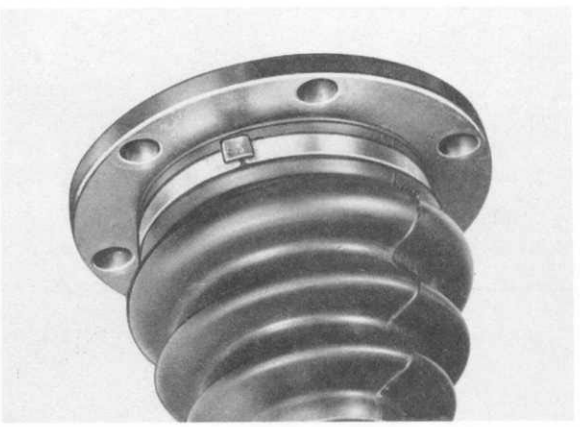
4. Press off constant velocity joint using special tools VW 401 and VW 408 a.



Assembling

1. Seal large diameter end of new dust boot with an adhesive. This requires that seats of sealing flange and boot be clean and free of grease.
Adhesive: 3 M Scotch Seal 750
(available in 5 oz. tubes)

2. Squeeze new clamp with a special pliers, e.g. VW 1275, between machined shoulders of sealing flange.

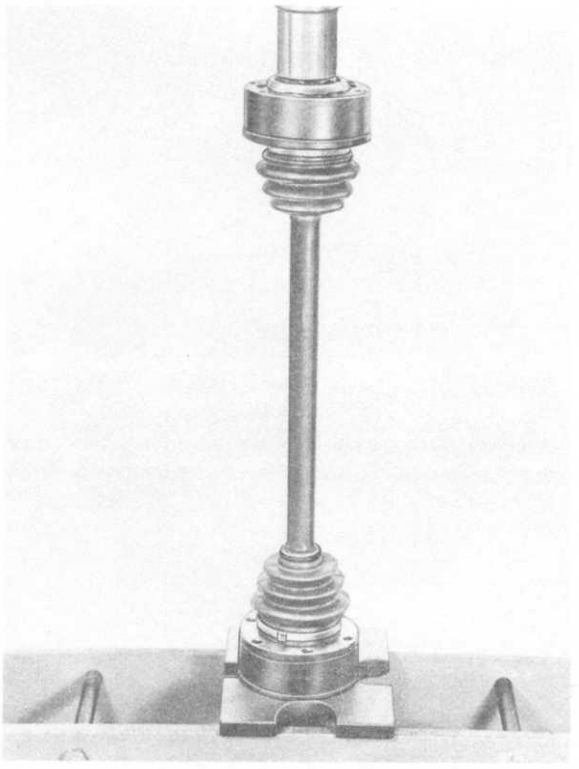


3. Replace gasket on flange cover.

4. Push dust boot with sealing flange on to shaft.

5. Pack constant velocity joint from each side with approx. 40 grams of special grease uniformly. Total quantity of grease: 80 grams. Special grease is only for joint. Never use grease in dust cover.
80 grams of special grease is delivered with each spare dust boot and each spare constant velocity joint.

Press constant velocity joint on to shaft. Install a new circlip.



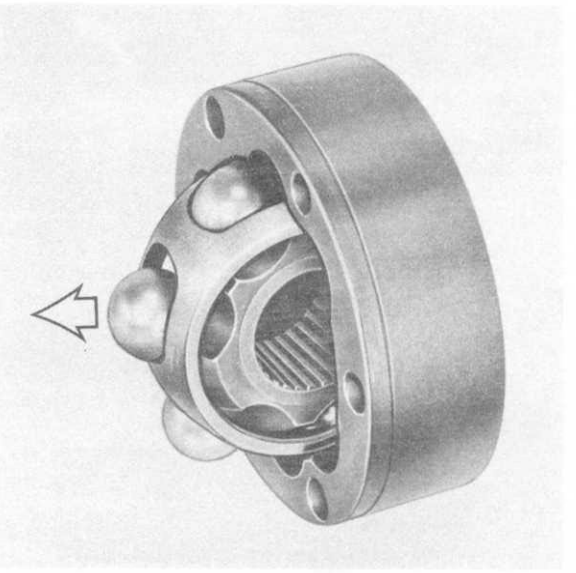
6. Position dust boot correctly. Install lamp.

Disassembling and Assembling Constant Velocity Joint

Disassembling

Joint must be disassembled to replace grease when seriously contaminated or when bearing surfaces and balls have to be inspected for wear or damage.

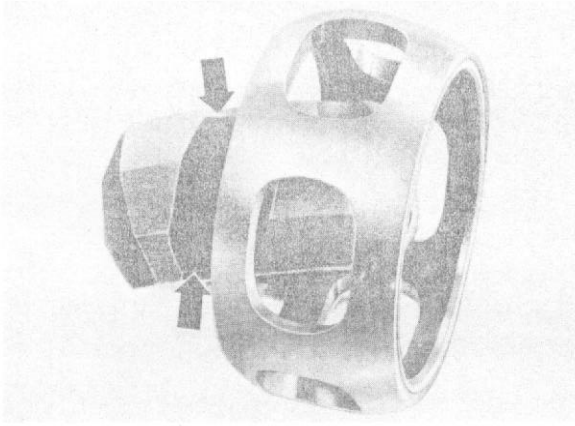
1. Swing out ball hub and ball cage from joint and press out in direction of arrow.



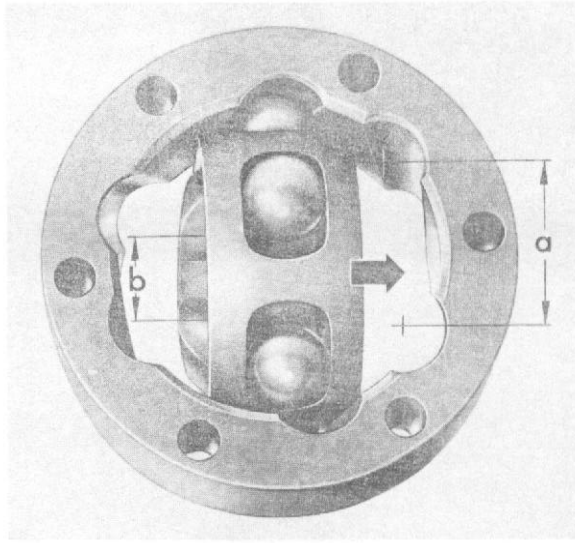
Note

Ball hub and joint are paired. Don't mix them up. The 6 balls for each joint also belong to one tolerance group.

2. Tilt ball hub out of ball cage via ball groove (arrows).



4. Install hub with cage and balls in joint pointing up. Make sure that after swinging in hub into joint one wide ball groove "a" on joint is together on one side with a narrow groove "b" of hub.

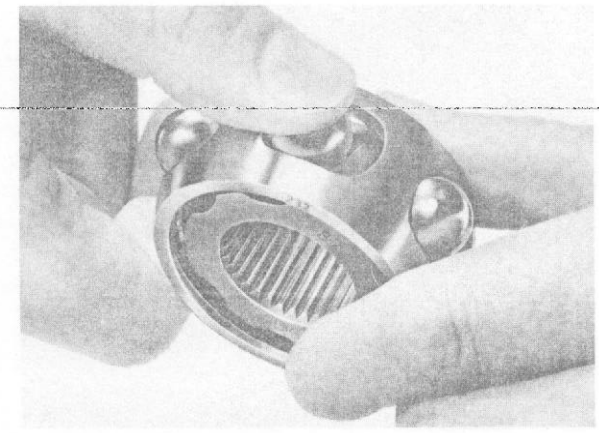


Assembling

1. Check joint, ball hub, ball cage and balls for pitting and scoring. Excessive radial play in joint will be noticed by knocking noises when accelerating/decelerating. Replace joint in such a case. Slight wear spots and tracks of balls are no reason to replace joint.

2. Place ball hub in ball cage. Any installed position is okay.

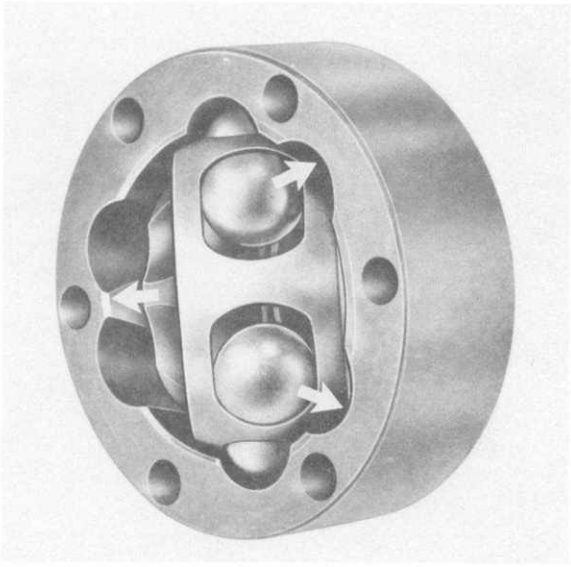
3. Press balls into cage.



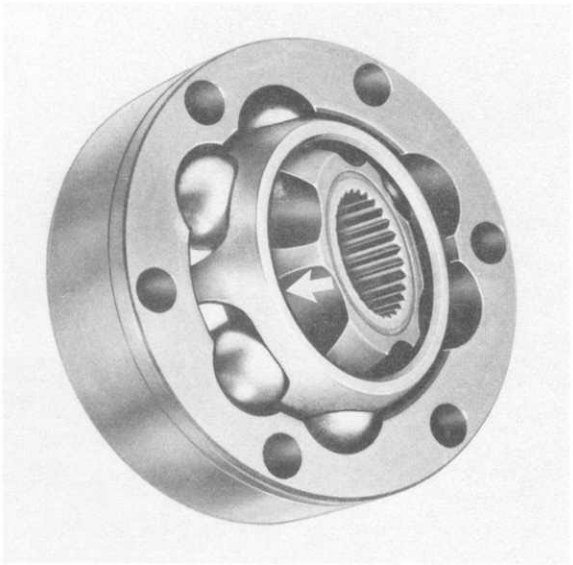
Note

Groove of ball hub and running around periphery of outside diameter on joint must face end of axle shaft.

5. Swing in ball hub with cage. To accomplish this, swing out hub from cage so far that balls are at same distance as orbits (arrows).



6. Press hub with balls into joint (arrow).

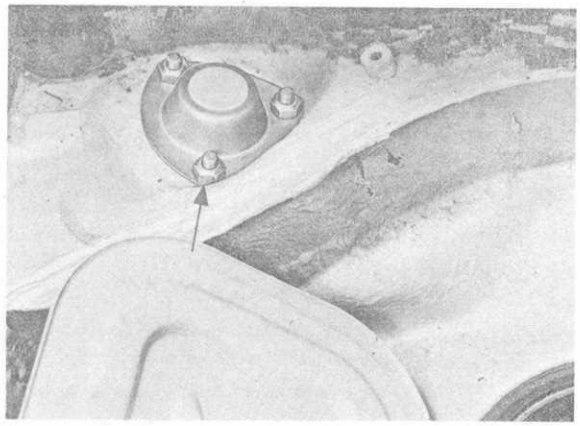


7. Check function of joint. Constant velocity joint has been assembled correctly, if ball hub can be pushed back and forth by hand over the entire axial compensation distance.

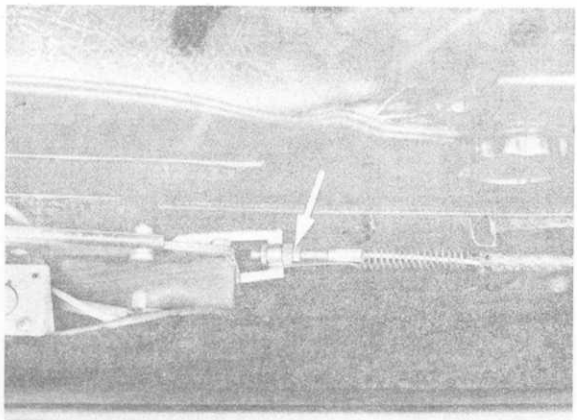
REMOVING AND INSTALLING REAR AXLE ASSEMBLY

Removing

1. Unscrew M 10 self-locking nuts (3 per side) from spring struts in luggage compartment. Remove rear wheels.



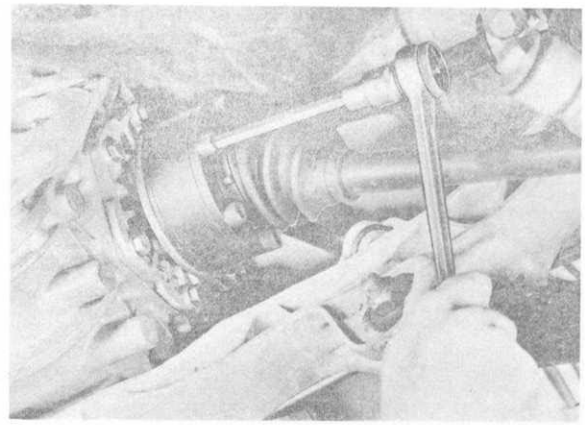
2. Disconnect parking brake cable at connector and pull back out of guide.



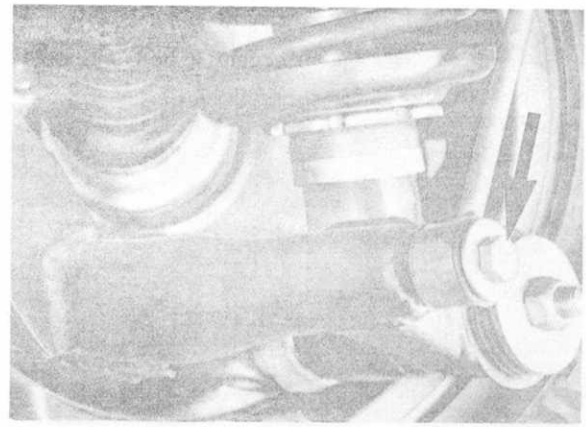
3. Detach brake calipers and suspend from piece of wire. Be sure that brake hoses are not too tight.

4. Remove exhaust system as far as necessary depending on version.

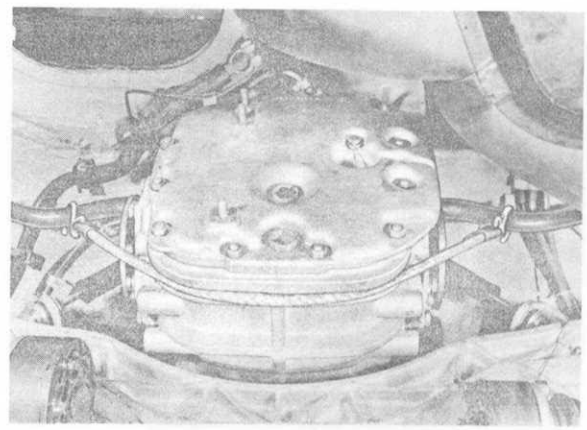
5. Disconnect axle shafts at transmission and suspend from wire in horizontal position on rear axle cross member.



6. Disconnect stabilizer at lower control arm.



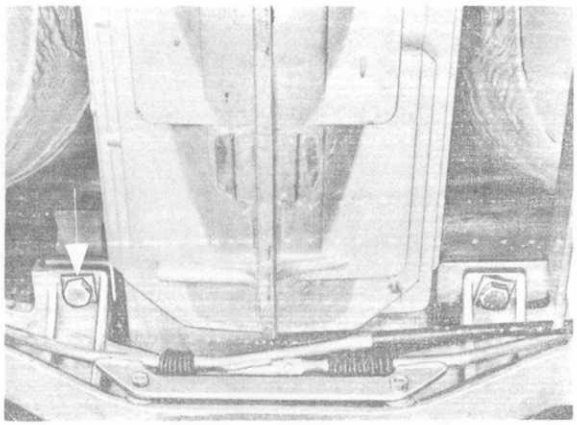
7. Support transmission from stabilizer bar with special tool US 8031.



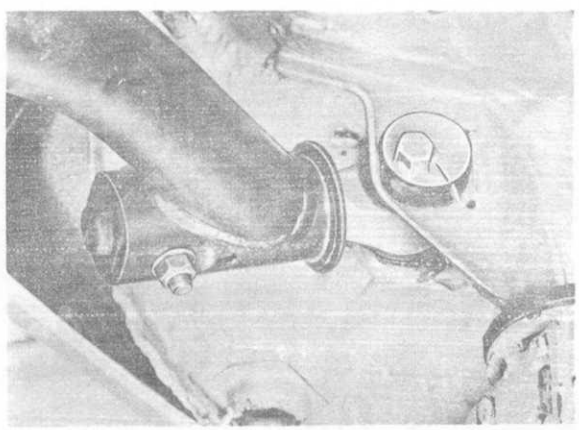
8. Unscrew two mounting bolts of rear axle cross member as well as two bolts of transmission mounts.

Note

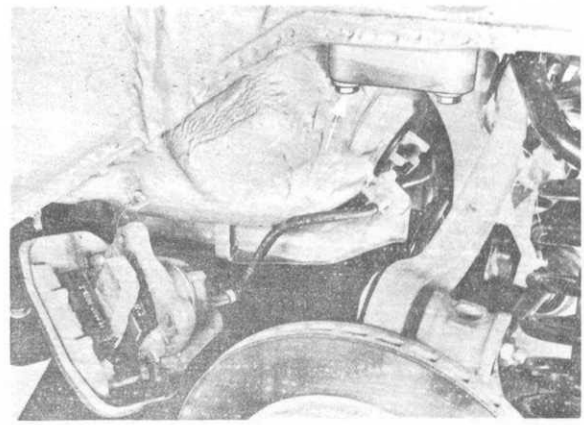
Since shims are installed between transmission mounts and the rear axle cross member, note quantity, thickness and location for installation later.



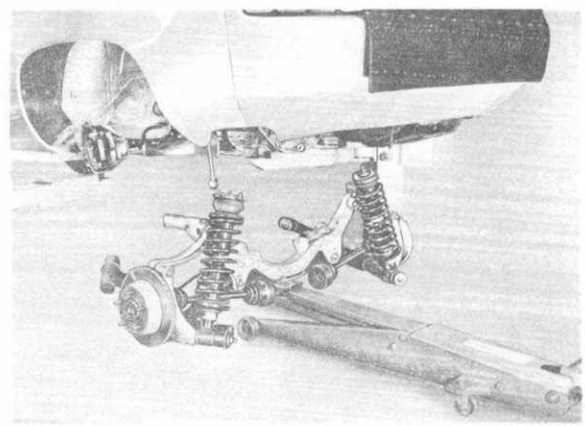
9. Mark position of (toe) eccentric bolts. Remove bolts from rear axle cross member.



10. Place floor jack underneath rear axle cross member. Mark position of rear axle cross member. Remove remaining 4 bolts of rear axle cross member.



11. Lower rear axle carefully and be careful not to twist the spring struts, control arms or rear axle cross member.



Installing

1. Check spring strut seal (seal between mounting plate and body). If necessary, make a new permanently elastic seal, e.g. 4 mm dia. Presik, Item No. 0593 from Bostik, 300 mm long, circle-shaped, on the mounting plate.

2. Move in rear axle. Install mounting bolts and align axle to original position as marked. Tighten bolts to specified torque.

3. Align transmission suspension (see point 8.). Refer to Group 34 if transmission suspension has to be completely aligned, using new parts.

Wheels and tires

Tire condition / tire pressure

Tires are safety-relevant items that are only capable of meeting the requirements applicable if they are run at the correct tire pressure and with sufficient tread depth.

The tire pressures indicated are minimum pressures. The tires must never be run at lower pressures since this affects roadholding in a negative manner and may lead to severe tire damage.

Valve caps protect the valve against dust and dirt and therefore help prevent leaks. Always screw on caps tightly and replace missing caps.

For safety reasons, do not limit tire checks to checking the tire pressure but also check for sufficient tread depth, ingress of foreign matter, pinholes, cuts, tears and bulges in the sidewall (cord breakage)!

Tire pressure of cold tires (approx. 20°C) (summer and winter tires)

15 and 16 inch

	Summer tires*	Winter tires
front	2.5 bar pos. pressure	2.5 bar pos. pressure
rear	3.0 bar pos. pressure**	3.0 bar pos. pressure

17 inch

	Summer tires	Winter tires
front	2.5 bar pos. pressure	2.5 bar pos. pressure
rear	2.5 bar pos. pressure	3.0 bar pos. pressure

Collapsible spare tire

front and rear	2.5 bar pos. pressure	for 8 PR 89 P / 92 P tires
front only	2.2 bar pos. pressure	for 4 PR 83 P tires

* Due to changes in standards and legislation, "V" and "ZR" tires require tire pressures that deviate from the values indicated in the Owner's Manual.
Always use the new tire pressures indicated above. Relevant adhesive labels are available from all official Porsche dealers.

** In some cases, only allowed up to 2.5 bar (36 psi) in the U.S.A. This depends on the tire in question since earlier tires have a sidewall lettering that limits the admissible tire inflation pressure (max. press) for North America to 36 psi (2.5 bar). Lettering for tire pressures of 3.0 bar = max. press 44 psi or 300 Kpa.

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Tire and wheel overview / tire specification character

For a tire and wheel overview for summer and winter tires, refer to the relevant Technical Information (TI), Group 4.

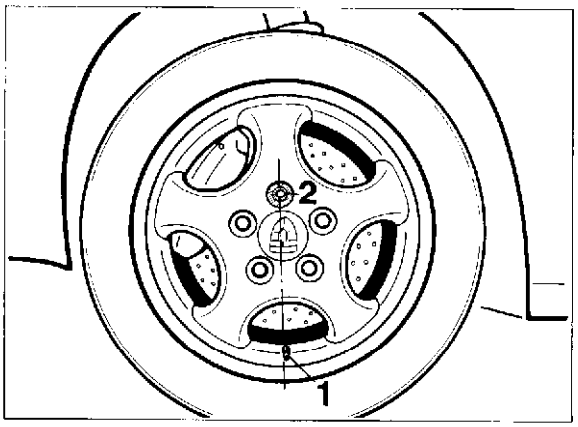
When replacing summer tires, check for the correct tire specification character. The specification characters N 0, N 1, or N 2, respectively, help to distinguish summer tires approved by Porsche from other versions of identical tire type and the same tire size. The tires approved by Porsche are also identified in the corresponding TI.
N0, N1 and N2 tires must not be mixed on one and the same vehicle, even if they are of the same make.

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Fitting the 17 Inch Wheels (Cup Design) to the Vehicle

On the 17" Cup Design wheels, the valve (No. 1) and the locking wheel nut cannot be arranged on the same side (as on previous models).

For correct installation, the valve (No. 1) must face the color-coded stud (No. 2). Be sure to fit the locking wheel nut to the color-coded stud (Nr. 2).



583-44

If required, mark the wheel stud located opposite the valve before removing the wheel.

For stationary balancing of the wheels (with step rings), turn the wheel in such a manner that the valve points to the bottom. Tighten the wheel in this position.
After balancing, mount the wheel to the vehicle in an identical position (valve faces to the bottom / color-coded wheel stud and locking wheel nut located on top).

Important note

Fitting (and tightening) procedures **of all other wheel types (16-inch Design 90 etc.)** for stationary balancing **remain unchanged.**

This means: Coded stud, valve and locking wheel nut are located on the same side. When tightening, valve must point up (same position as on balancing equipment).
It is recommended to add an extra referenceto the modified assembly in the "Wheel balancing and General notes on fitting tires" chapter.

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Wheel alignment measuring data

The following values apply at empty weight in accordance with German DIN 70020 standard (car with full fuel tank, spare wheel and tools).

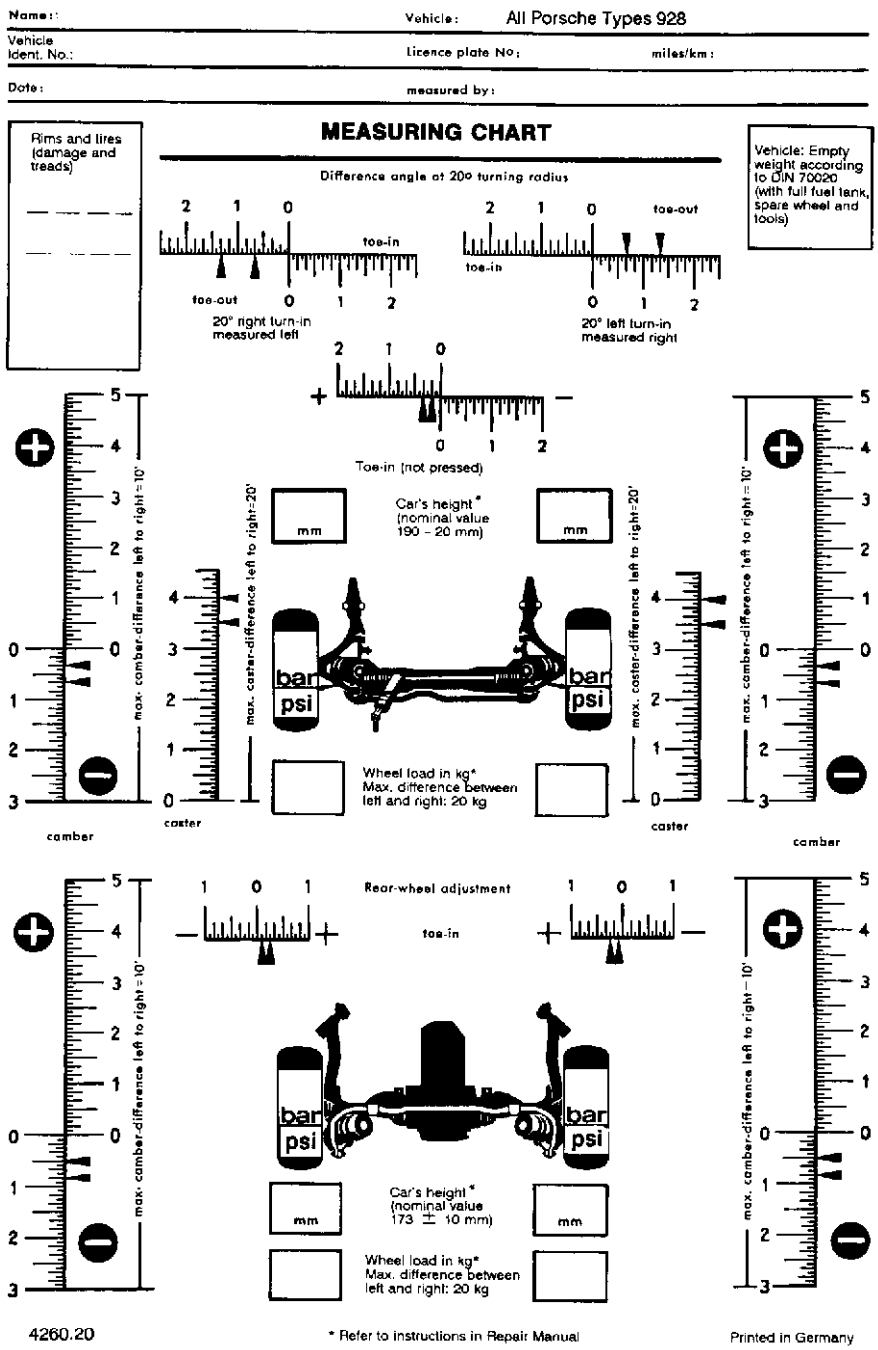
		Adjustment values and tolerance	Max. difference between left/right
Front axle			
Height adjustment: From wheel contact patch to Measuring surface on rear control arm pivot		180 ± 20 mm*	10 mm
Toe-in, no pressure applied		+ 15' ± 5'	
Toe-out on turns at 20° steering lock		- 1° ± 20'	Can only be varied by renewing steering arms
Camber		- 30' ± 10'	10'
Caster	1990 models inclusive	3° 30' + 30'**	20'
	From 1991 models on	4° + 1°**	20'
Rear axle			
Height adjustment: From wheel contact patch to measuring surface on lateral subframe		173 ± 10 mm*	10 mm
Toe-in, each wheel		+ 10' ± 5'	10'
Camber		- 40' ± 10'	10'

* Height adjustment settings apply to new cars. After cars have been driven for a period the height may be max. 10 mm less, in other words the downward tolerance can vary by 10 mm more. However, this must then apply to both axles.

** The caster angle value of 4° + 1° can be adopted retrospectively on cars back to the 1986 model year inclusive (from introduction of vertical ball joint at front axle subframe pivot / refer to Page 40 - 19). The caster tolerance range on the measuring chart should be modified if necessary. The printed measuring chart will not be amended until a new issue is printed.

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Specimen measuring chart*



* The caster adjustment setting has been changed **for 1991 models** on to 4° + 1° (previously 3° 30' + 30'). This changed caster value can be adoopted retrospectively on cars back to 1986 models inclusive (from introduction of vertical ball joint at front axle subframe pivot / refer to Page 44 - 19).

Wheel alignment measuring data

The following values apply at empty weight in accordance with German DIN 70020 standard (car with full fuel tank, spare wheel and tools).

FOR GENERAL INFO ONLY

OLD

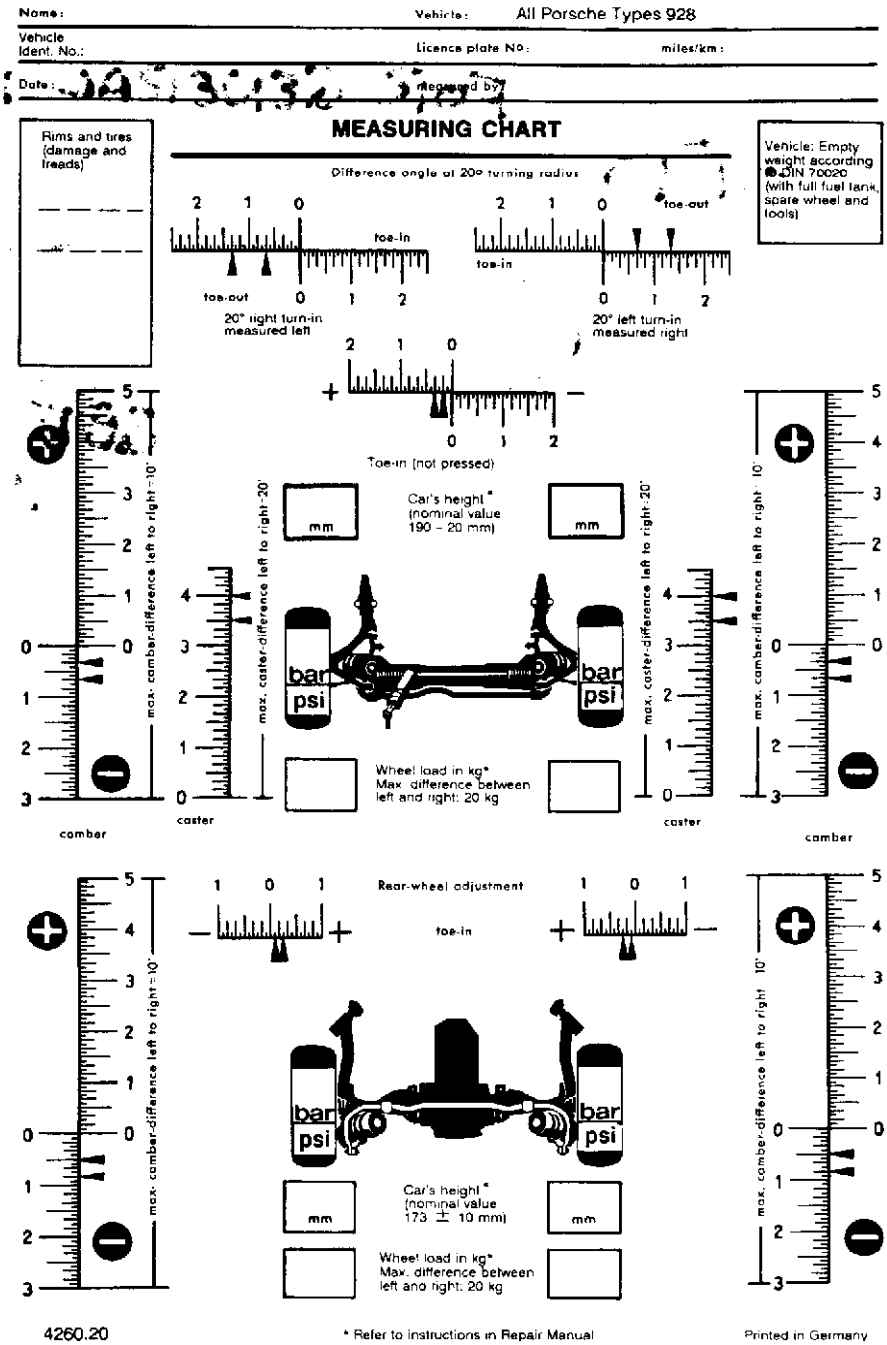
		Adjustment values and tolerance	Max. difference between left/right
Front axle			
Height adjustment: From wheel contact patch to Measuring surface on rear control arm pivot		190 -20 mm*	10 mm
Toe-in, no pressure applied		+ 15' ± 5'	SEE NEW SHEET
Toe-out on turns at 20° steering lock		- 1° ± 20'	Can only be varied by renewing steering arms
Camber		- 30' ± 10'	10'
Caster	1990 models inclusive	3° 30' + 30'**	20'
	From 1991 models on	4° + 1°**	20'
Rear axle			
Height adjustment: From wheel contact patch to measuring surface on lateral subframe		173 ± 10 mm*	10 mm
Toe-in, each wheel		+ 10' ± 5'	10'
Camber		- 40' ± 10'	10'

* Height adjustment settings apply to new cars. After cars have been driven for a period the height may be max. 10 mm less, in other words the downward tolerance can vary by 10 mm more. However, this must then apply to both axles.

** The caster angle value of 4° + 1° can be adopted retrospectively on cars back to the 1986 model year inclusive (from introduction of vertical ball joint at front axle subframe pivot / refer to Page 40 - 19).
The caster tolerance range on the measuring chart should be modified if necessary. The printed measuring chart will not be amended until a new issue is printed.

Printed in Germany – XXIX, 1992

Specimen measuring chart*



* The caster adjustment setting has been changed for 1991 models on to 4° + 1° (previously 3° 30' + 30'). This changed caster value can be adoopted retrospectively on cars back to 1986 models inclusive (from introduction of vertical ball joint at front axle subframe pivot / refer to Page 44 - 19).
The caster tolerance range on the measuring chart should be modified if necessary. The printed measuring chart will not be amended until a new issue is printed.

Alignment

General

Use an optical or electronic axle measuring device to align the vehicle. Refer to the operating instructions for the axle measuring device for the measuring procedure.
The following preconditions must be fulfilled before starting alignment:

- Vehicle at curb weight as per DIN 70020, i.e. ready for the road with full tank, spare wheel and tools.
- Correct joint and wheel-bearing play
- Prescribed tyre inflation pressure, more or less uniform tyre tread

If vehicle is to be aligned front and rear, first check and/or adjust the wheel values for the rear axle. Center the steering wheel and steering for track adjustment.

Before starting to adjust the wheel values for front or rear axles, it may be advisable or necessary* to check the rear axle height setting at DIN curb weight, as well as the front axle for vehicles with adjustable front spring struts.

If wheel-load scales are available, it is possible to keep the difference between right and left wheel loads as low as possible thanks to the height adjustment facility. The difference in wheel load is adjusted by altering the height of the vehicle within the height tolerance. Priority is given to the least possible difference between right and left wheel load.

* following work which causes an alteration in height or if the height is incorrect.

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Important notes for alignment

The following must be observed during alignment:

1. Actual vehicle height
2. Height setting / alteration in wheel load

To 1: (Actual vehicle height)

Explanation of vehicle heights:

Specified vehicle height

Corresponds to the specified value. The tolerance range may be used to reduce the difference in wheel load.

Actual vehicle height

- Should be within the tolerance range for the specified vehicle height.
- Is lost if the vehicle or front axle have been raised.
- Is recovered after a longer journey or longer operating period. Exact value can be achieved by pulling the front axle downward in a precisely defined way.
- Description in the following text.

Influenced vehicle height

Existing height value after the vehicle or front axle have been raised. Never use this height value as a starting point, to prevent:

a) a result of height measurement that does not correspond to the actual vehicle height, or

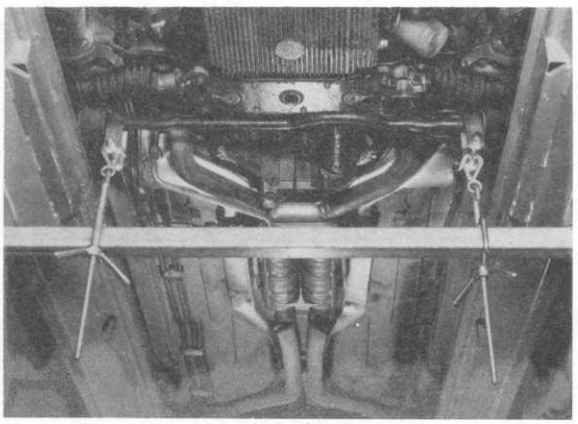
b) a toe-in value, when correcting the wheel position, which, because of the FA kinematics, does not comply with regulations at actual vehicle height.

Obtain actual vehicle height as follows:

- After the vehicle has been raised, starting at the influenced vehicle height, pull the front axle down by 60 - 70 mm and hold for 1 minute. Use special tool 10 - 222 A for this. Keep to the specified time.
- After releasing the vehicle, bounce the front and rear axles – approx. 25 mm – a few times.

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For the pulling down procedure, fasten the engine support (prop device) 10-222 A to the stabilizer. Use suitable hooks or straps. The transport lugs (strap No. 28, Page 40 - 7) may be used if there is enough distance between the rails of the platform. This is possible without removing the sump guard.



89/5

To 2: (Height adjustment/alteration in wheel load)

Changing the height on one side causes an alteration in wheel load. If there is an alteration in wheel load for one wheel, the loads for the other wheels also change.

An increase in spring pretension (raising the vehicle) on one side causes an increase in wheel load.

A reduction in spring pretension (lowering the vehicle) on one side reduces the wheel load.

An alteration in wheel load always acts on the wheel diagonally opposite. In other words, if the wheel load of one wheel is increased or reduced, the diagonally opposite wheel undergoes the same alteration.

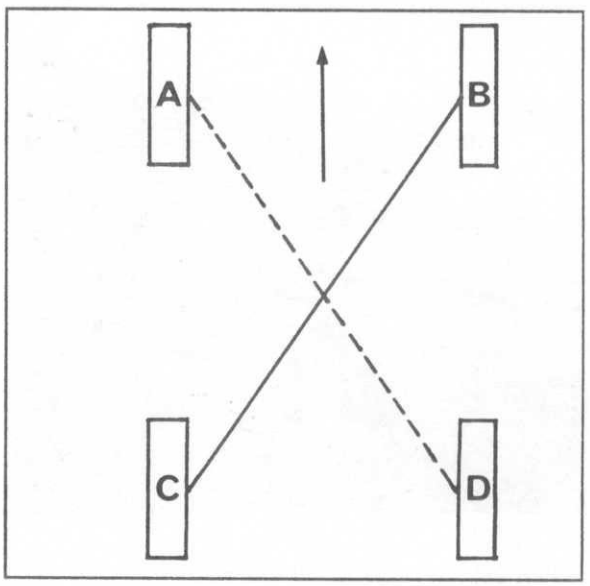
Example

Spring pretension is increased at the rear left C.

This means that the wheel load:

- increases rear left C and front right B

- reduces rear right D and front left A



The difference between left and right wheel load should be kept as low as possible for front and rear axles (less than 20 kg).

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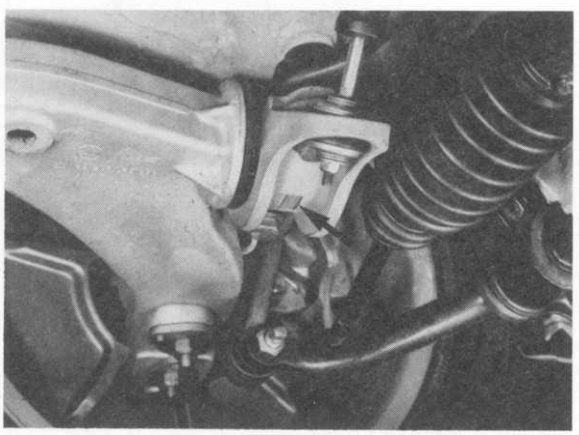
Check/adjust height

Note

The adjustment facility is used to correct differences between left and right wheel loads. If the height is correct, the differences in wheel load are within a permitted tolerance as long as the coil springs on each axle are the same length (spring pretention).
Tolerance ± 1 mm.
It is possible to keep the differences in wheel load as low as possible if wheel-load scales are used. The tolerance between right and left on front and rear axles less than 20 kg.

Front axle

1. At actual vehicle height
(Page 44 - 2 / 44 - 2a), measure the distance between the tire contact surface and the measuring point on the rear link bearing.



Nominal value 180 ± 10 mm
max. difference between left and right 10 mm.

2a) If spring struts are not adjustable
the vehicle height at the front axle is determined by the coil spring and cannot be adjusted. It is only possible to make a correction by replacing the front axle coil springs or fitting spacers under the lower spring seat.

No more than max. 2 spaces may be fitted to each spring strut to ensure that the guide for the lower spring seat is maintained. Bear in mind that a settling allowance must be made for new vehicles and replaced axle components.

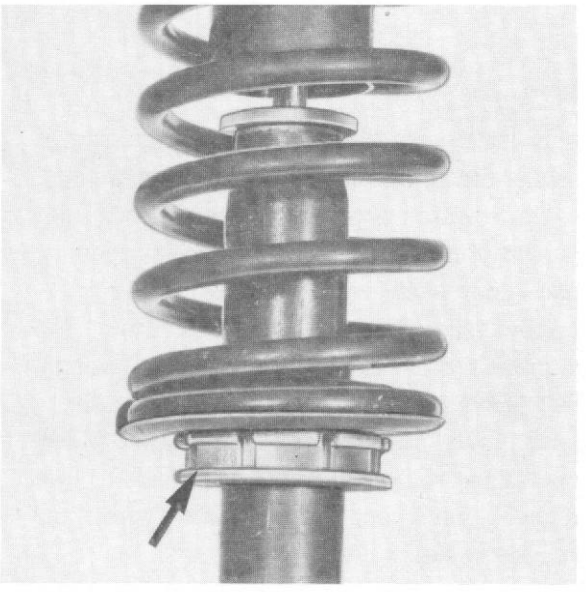
2b) If spring struts are adjustable

the vehicle height is adjusted at the front axle by turning the adjusting nut. Set the wheels to a suitable lock to give access to the adjusting nut (do not raise the vehicle). Should the vehicle be raised, restore to actual vehicle height before checking the height again.

Adjusting nut
- turn to the right = vehicle higher
- turn to the left = vehicle lower

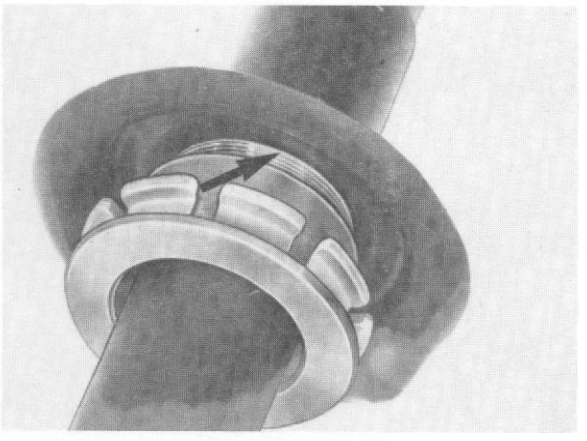
Adjust using the same tools as for the rear axle.

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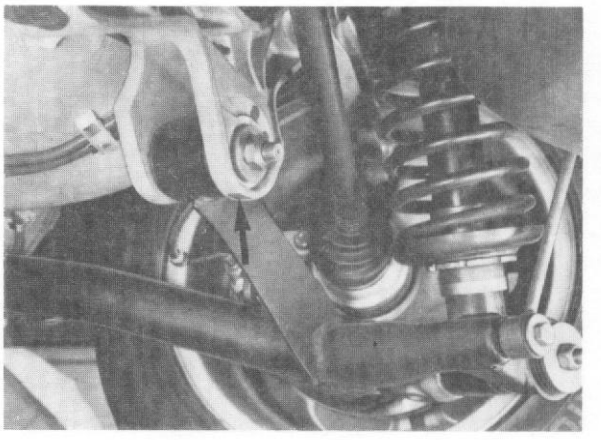
Note

If Bilstein spring struts are installed, the adjusting range for lowering the vehicle is limited by a stop for the adjusting nut. **If Boge spring struts** are installed, the adjusting nut turns too easily at the lowest position. This means that the lower spring seat no longer has contact with the adjusting nut, but with the threaded sleeve. Under normal conditions, this acceptable range is not reached (if height is adjusted according to regulations).



Rear axle

1. At actual vehicle height
   (Page 44 - 2 / 44 - 2a) measure from tire contact surface to measuring point on the cross member.



Specified value 173 ± 10 mm
max. difference between left and right 10 mm

2. The vehicle height is adjusted at the rear axle by turning the adjusting nut. Use an extended hook wrench (with welded-on pipe) or Special Tool
   VW 637/2 (lever) to turn the nut accordingly. Do not raise the vehicle.

Adjusting nut
- turn to the right = vehicle higher
- turn to the left = vehicle lower

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Wheel alignment values

Important notes

Only check and/or adjust wheel alignment values if the specified preconditions have been fulfilled (Page 44 - 1 under general) and at actual vehicle height
(Page 44 - 2/ 44 - 2 a).

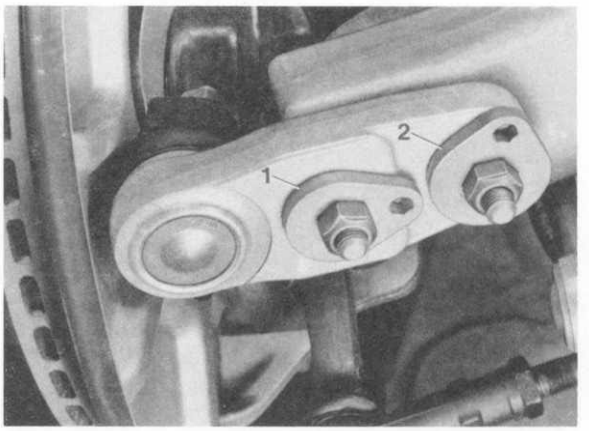
If the vehicle is to be aligned front and rear, first check and/or adjust the rear axle.

Note

If vehicles have **aluminium joint carriers**, always turn the caster eccentric from small values towards large caster values, i.e. if the caster value is too high, first turn the eccentric back completely and then adjust to the correct value. This guarantees that the camber and caster values are always maintained, even under extreme operating conditions. If it is not possible to achieve the prescribed caster value, adjust the other side to the higher value if necessary (up to 4 degrees 30' is acceptable).

Front axle

Prepare the vehicle for checking and/or adjusting the wheel alignment values. Position the front wheels on rotary plates, etc.
If the vehicle is not driven onto rotary plates, but raised, or raised for any other reason, the actual vehicle height must then be restored by pulling down.



Adjust camber and caster

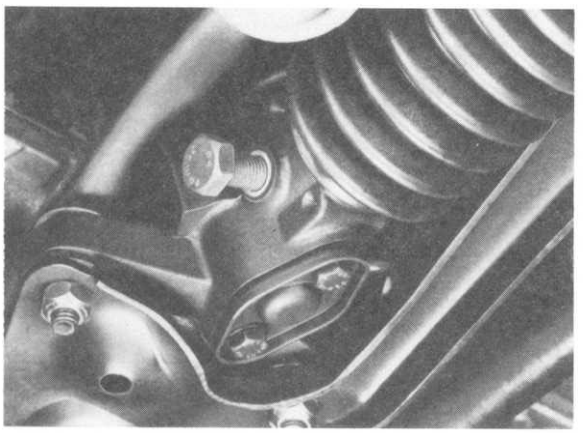
Camber and caster are both adjusted by means of eccentrics on the lower control arm.
Tighten self-locking hexagon nuts with 120 Nm (88.5 ft. lb.)
Seal the slit openings for the adjusting eccentrics (Page 40 - 23).

No.	for aluminium joint carrier	for steel joint carrier
1	Caster eccentric	Camber eccentric
2	Camber eccentric	Caster eccentric

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Adjusting toe

- Preparation: Center steering gear with Special Tool 9116. If the steering wheel is offset, relocate at the best value.
  Then remove Special Tool 9116.



- Clamp the steering wheel in the central position with **steering wheel lock** and adjust the toe with the tie rods.

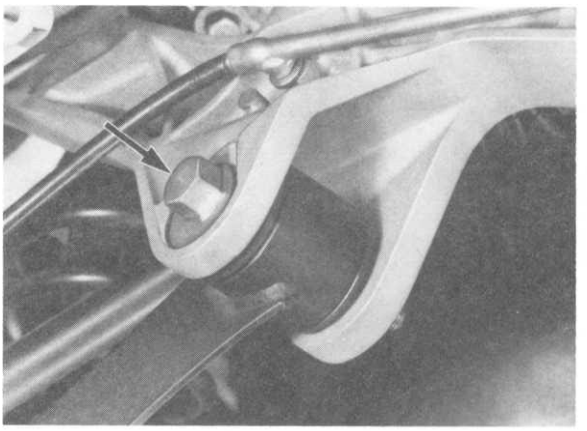
Track difference

It is not possible to adjust the track difference (can only be affected by replacing steering arms).

Rear axle

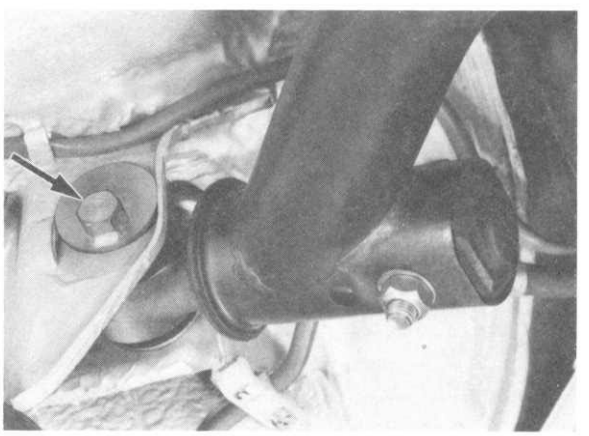
Adjust camber

The camber is adjusted by means of an eccentric screw on the inner link bearing.



Adjust toe

The toe is adjusted by means of an eccentric screw on the front link bearing.



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CHECKING WHEEL RIMS

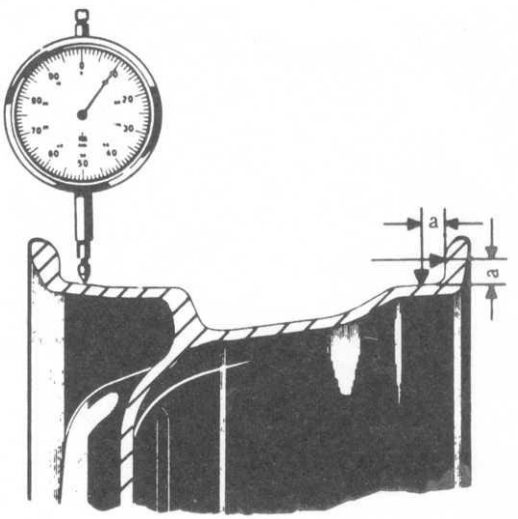
Refer to drawing for lateral and radial runout measuring points on inside of rim.

Max. permissible lateral and radial runout on aluminum rims = 1,0 mm

Max. permissible lateral and radial runout on rim with tire = 1,25 mm
(also refer to page 44 - 8)

Note

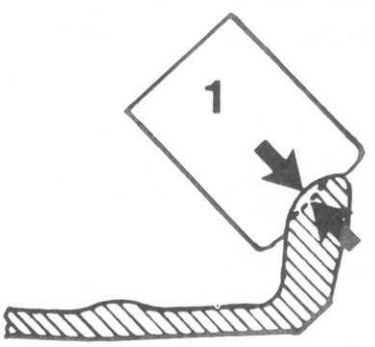
Damaged rims should never be straightened.



Distance "a" = 8 mm

Check flanges of aluminum wheel rims for wear. The inside rim flange is more subject to wear.
Use a standard 8 or 10 mm radius gauge for checking. Remove any sharp edges or burrs before checking.
Wear limit: 1 mm.
Replace wheel rim, if necessary.

Checking Rim Flange Shape



——— New condition
- - - - - - - - Worn
→ ← Max. wear limit: 1 mm
1 Radius gauge

8 mm radius gauge for cast wheel rims

10 mm radius gauge for forged wheel rims

General assembly information, tires

Always use new rubber valves when replacing tires.

Attention: When fitting tires, always comply with any instructions on the side walls with regard to direction of rotation or side-specific assembly (e.g. arrow or "outer/inner")

When fitting tubeless tires, check that the sealing areas of the tire and the disk wheel are clean and look for any damage. With regard to this, always bear in mind that a tubeless tire is sealed by the bead base. If the side wall of the bead were used for sealing, it would be possible for air to escape under extreme driving conditions.

Check the rim flange of light alloy disk wheels for wear (see Page 44 - 6).

When fitting the tire beads into place, use only the tire assembly compounds specified below. **If an unsuitable assembly compound is used, the following may occur:** Tire may rotate on the wheel, bead core may break during fitting and the rim surface may be damaged by aggressive substances.
Caution: Use only TIP TOP Universal, Order No. 593 0601 (3.5 kgs can) or Contifix **as tire assembly compound.**
If Contifix is used, coat beads sparingly (to avoid tire rotation on the wheel rim) and avoid driving the car for 24 hours after tire fitting or matching if possible.

Tell your clients to avoid extreme driving behavior (acceleration, braking) during the first 60 to 120 miles with new or newly fitted tires to prevent the tire twisting on the rim under driving conditions. Mark the tires if necessary.

A maximum of 20 mm twisting of the tire on the rim must be regarded as the ultimate limit value. The best result of the wheel balancing in such cases is usually only moderate. This will have a detrimental affect on an optimally balanced wheel.

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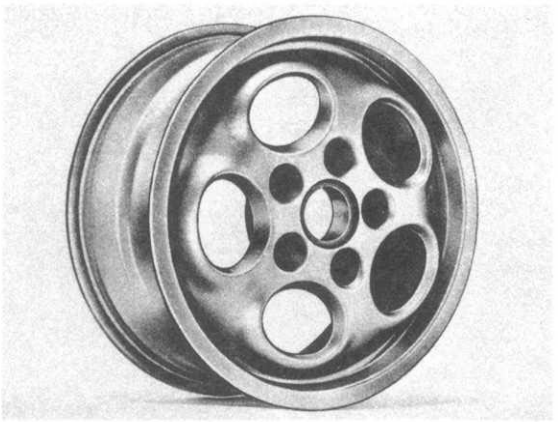
Mount the tire in a beneficial position to the rim (matching) in order to achieve optimum smooth running. The following text describes both uncontrolled matching and controlled matching with identification marking or using a wheel-balancing machine with matching program.

After fitting, inflate tubeless tires to approx. 4 bar (58 psi) without valve inserts, to ensure that they are correctly seated on the rims. At 3.3 bar (4.5 bar for wheels with **asymmetrical hump**)), at the latest, the tire bead must jump from the well base over the hump of the bead seat to avoid breaking the bead core. Screw in the valve insert and inflate to the prescribed tire pressure.

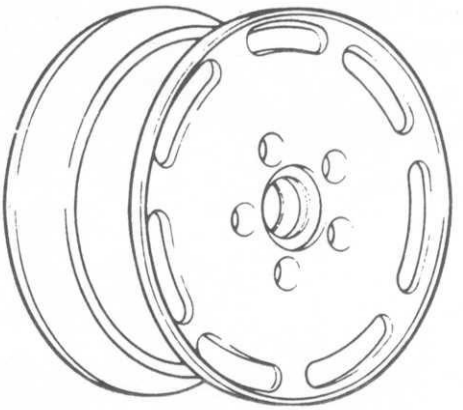
The max. permitted radial and lateral run-out of the wheel (tire + rim) is 1.25 mm. Try to achieve values less than 1.0 mm and greater than 0.5 mm.

If necessary, turn the tire on the rim by 90° or 180° to obtain an acceptable value (uncontrolled matching). Controlled matching: align the highest point of the rim with the green or white dot on the side wall of the tire. The highest point of the rim must be determined before- hand. *In the case of forged disk wheels, however, this is identified by a milled recess in the rim well as well as by a red dot glued to the outer side.*
Bear in mind that it is possible to get even better results from the point of view of smooth running in some cases using a wheel-balancing machine with matching program (true-running, imbalance and weight distribution of the balancing weights) .

Cast light-alloy disk wheel



Forged light-alloy disk wheel



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Cast light-alloy disk wheels must not be fitted to the vehicles with four-piston fixed calipers (as from Model 86).

Club Sport version wheels (larger cutouts) have a different rim offset (see Page 44-01).

New tires should always be fitted to the front axle wherever possible (if the same wheels are fitted to rear and front axles), as

1. the rear axle is more critical with regard to stability, and

2. in wet conditions, the front wheel must first steer a course which the rear wheel can follow to a great extent. When replacing a defective tire, the difference in tread depths on one axle **must not be more than 30 %.**

If a wheel is removed from the vehicle during service operations, the wheel stud next to the valve or, in the case of 17-inch wheels (Cup Design), the wheel stud opposite the valve should first be marked with red paint. (This is to ensure that the wheel is refitted in the same position relative to the wheel hub or brake disc).
In addition, rotate the valve so it is in the upper position or, in the case of 17-inch wheels, in the lower position, before the wheel is tightened on the wheel hub (also refer to page 44 - 13).
This prevents the optimum balancing effect that was obtained by stationary balancing or by additional finish balancing from being lost. The lockable wheel must be fitted to the color-coded stud.

Refer to Technical Information Group 4 for further general information on tires (tire damage, tire wear, storage, *tire age*)

Tire age:
High-speed tires VR/ZR in particular, must not be too old, under no circumstances older than 6 years. The age of a tire can be determined from the manufacturer's code which follows the DOT code on the tire wall. The date of manufacture ist at the end of the code number. The identification is followed by the manufacturing date. **From 1990 to 1999**, the three-digit mark is complemented by a **"triangle suffix"** (differentiation mark).

Example:
DOT DM CP 05 Y 276
27 = Production week 27
6 = Production year 1986

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Wheel balancing

General

If the wheels are too unbalanced, this not only causes vibrations and shaking of the steering wheel but also results in higher wear on various chassis components.

Even if wheels are balanced correctly, uneven running and steering can be caused by excessive geometry faults (radial and lateral run-out) and irregularities in tires, e.g. material accumulating in one place (when rolling under diverse suspension conditions).

Extreme care, compliance with instructions and procedures, as well as the attempt to remedy even the last gram of imbalance is necessary to achieve a good result.

Notes / prerequisites

- Wheel suspension elements must be technically sound.

- Wheels must be cleaned, without any foreign bodies in the tires.

- Check radial and lateral run-out on wheels without flat spots with a radial run-out measurement gauge, e.g. VAG 1435. *Try to achieve values of less than 1 mm and greater than 0.5 mm.*

- Tires must be matched to achieve minimum out-of-true characteristics or to optimize smooth running. Tips and information on this as well as tire mounting paste can be found on Page 44 - 7/8

- If disk wheels (rims) run absolutely true but there is extreme radial and lateral run-out (caused by braking flat-spots, cord breaks, other damage) replace the tire if necessary.

- *Only balance used wheels when warm as flat spots may otherwise simulate an imbalance. Never match in the case of flat spots.*

- The correct tire pressure is a crucial prerequisite

- Use self-adhesive or clamp weights according to the type of disk wheel. Use self-adhesive weights for cast light-alloy disk wheels.
  Coated clamp weight for forged light-alloy disk wheels.
  Notes on fitting the weights, see Page 44-17

Procedure for optimizing the wheels

The complete procedure is subdivided into 4 working steps

1. Fitting the tire to the rim

2. Stationary balancing of the wheel (eliminating static and dynamic imbalance) with optimization of smooth running

3. Fitting the wheel to the vehicle

4. Electronic fine balancing (static balancing) of the wheel on the vehicle *(after stationary balancing if required - not usually necessary)*

Further to 1: (Fitting the tire to the rim)

- Clean the rim; above all, remove residual rubber and dried-on tire paste from the bead seat and the hump.

- Inspect the rim for damage, remove old balance weights.

- *Use specified tire assembly compound (refer to page 44 - 7) to keep the tire from rotating on the wheel during the first drive as this would render all the careful work useless (20 mm tire slip on the wheel may be enough to reduce good balancing results to average results only).*

- Mount the tire on the rim, aligning matching points (if available) of tire and rim. Bear in mind that it is possible to achieve an even better result in some cases from the point of smooth running and imbalance using a wheel-balancing machine with matching program (see Page 44 - 8).

- Inflate tires to approx. 4 bar; the beads should slip over the rim shoulder hump at a pressure of 3.3 bar* at the latest.

- Check that the tire is seated correctly on the rim by means of the bead centering line.

* 4.5 bar max. for wheels with asymmetrical hump (p. 44 - 18a).

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Further to 2: (Stationary balancing with optimization of smooth running)

- Clamp the wheel onto a stationary balancing machine, observing the following under all circumstances:

a) Follow the operating instructions of the respective balancing machine, adjust the machine from time to time if necessary.

b) The contact surface of the wheel at the bead flange (level surface) and the middle centering device must be clean.

c) *Center from the inside outwards using a stepped ring (cylindrical ring - commercially available Porsche version, e.g. from Messrs. Schenck or Messrs. Hofmann).*
Do not center from the outside as well

d) *Clamp the wheel onto the balancing machine as specified* (valve always pointing upwards, the wheel will then drop downwards through the small amount of play necessary when centering, before tightening) *and then fit to the vehicle in the same position* (there may otherwise be a shift of up to 1/2 oz).
In the case of balancing machines with horizontal wheel fixture (wheel lying), position the valve opposite the mechanic, then pull the wheel in this position in the direction of the mechanic and clamp firmly.

- Check the radial and lateral run-out during the first measurement procedure. *Try to achieve values less than 1.0 mm and greater than 0.5 mm.*

- Be critical with regard to the size of the measured balance weights and their distribution on the inner and outer rim flange.

Even distribution with low values (e.g. 3/4 / 7/8 oz) indicates that the tires are correctly fitted and that the quality of tires and rims are in good order.

Do not exceed a value of 1 $^{3/4}$/ 1 $^{3/4}$ oz, a widely deviating distribution, e.g. 1 / 2 $^{1/2}$ oz is very unfavorable, this usually indicates a fitting fault. Problem wheels of this sort often have obvious radial and lateral run-out.

- Remedy by "matching" (use the correct fitting paste sparingly / Page 44 - 7/8)
a) Manual improvements are possible
b) Considerable improvements possible in virtually all cases with smooth- running optimization program.

- When balancing, the tire pressure should not be less than 22 psi.

- Permissible residual imbalance less than / or max. 1/10 oz per side.

Further to 3: (Fitting the wheel to the vehicle)

- Fasten the wheel to the wheel hub as prescribed (also see Page 44 - 9 - General assembly instructions, tires). Always fit the best wheels on the left.

- Valve must point up or, for 17-inch Cup Design wheels, down (same position as on the balancing equipment). Observe instructions on page 44 - 03.

- Bore close to valve is for wheel mounting; fit lockable wheel nut to color-coded wheel stud. On 17-inch wheels, locate the valve opposite the marked stud. Tighten nuts, start tightening equally at the top. Before lowering the vehicle onto its wheels, tighten wheels to 130 Nm (96 ftlb.) to make sure that its predefined position on the wheel hub does not change anymore.

- Tire pressure according to specification

Further to 4: (Electronic fine balancing)

- Use the RAW 04 from Messrs. Schenck ASG or ipk 2 from Messrs. Hofmann for electronic fine balancing of the wheels on the vehicle. Refer to the equipment's operating instructions for procedure.

- If all wheels are to be finely balanced, begin at the front axle.
  4a Fine balancing of the front wheels because of steering-wheel vibrations at approx. 120 km/h
  4b Fine balancing of the rear wheels because of vibrations at 180 km/h and greater 230 km/h

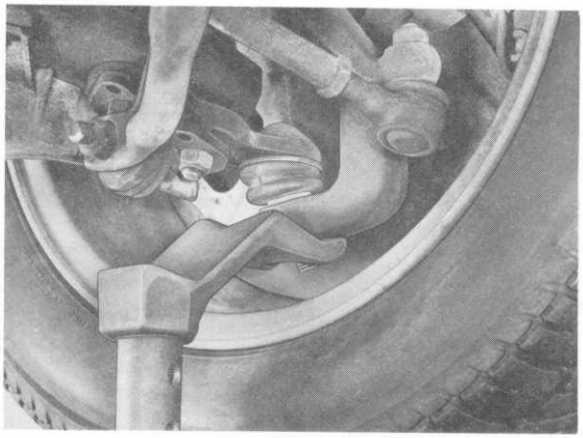
- **The following generally applies for front and rear axles: the measurement jacks must stand on a firm foundation, must only record at the specified points (measurement fixture situated as close to the wheel as possible), doors and hoods must be closed and the vehicle must not be touched during the measurement run. Ensure that the lifting equipment (jack, platform) has no contact with the vehicle.**

- Attach balance weights to the outside (uniform procedure / may also be distributed - or fitted to the inside).
  Under no circumstances remove the weights fitted during stationary balancing.
  Identify balance weights from electrical fine balancing with a center punch.

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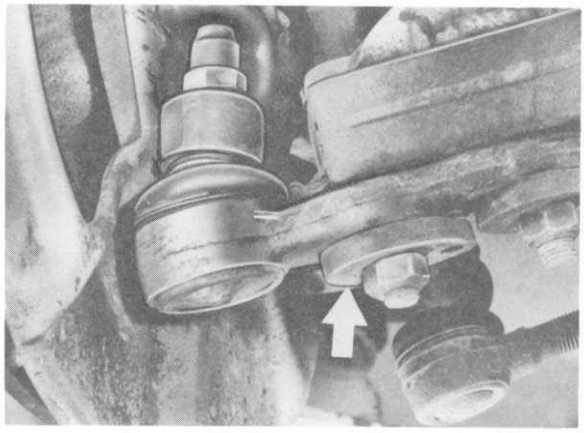
Mounting points for fine balancing
Front axle

As from Mod. 86



88/266

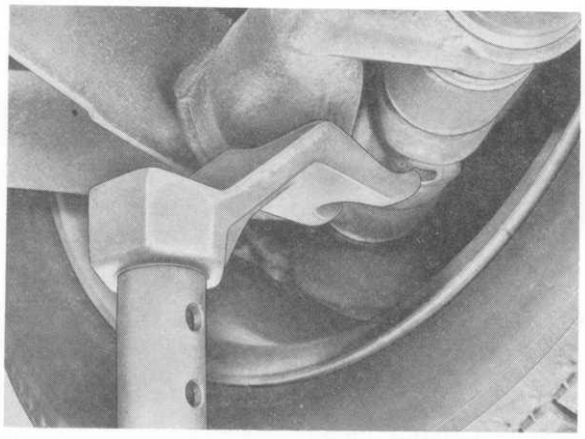
before Mod. 86
at the outer eccenter (arrow)



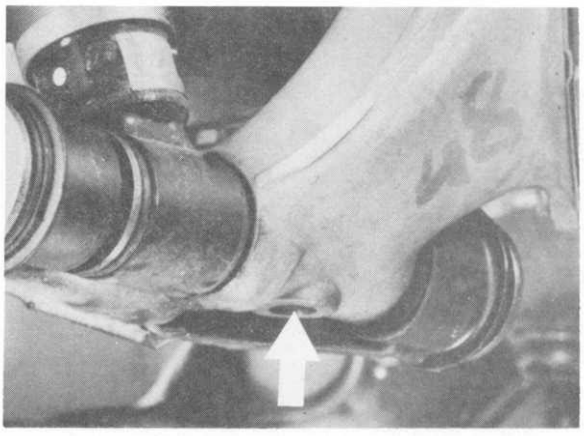
10778 A

Rear axle

When using the Hofmann finish balancer, use the special mounting forks with spigots (Hofmann Part No. 641 4113), which fit into the recess of the wheel mount (arrow).



88/265



4858 A

Notes

Make sure that no parts are damaged by the mounting forks of the measuring jack. *Make sure that the vehicle cannot slide off the measuring jack before making the first measurement run.*

Further to 4 a: (Fine balancing of the front wheels)

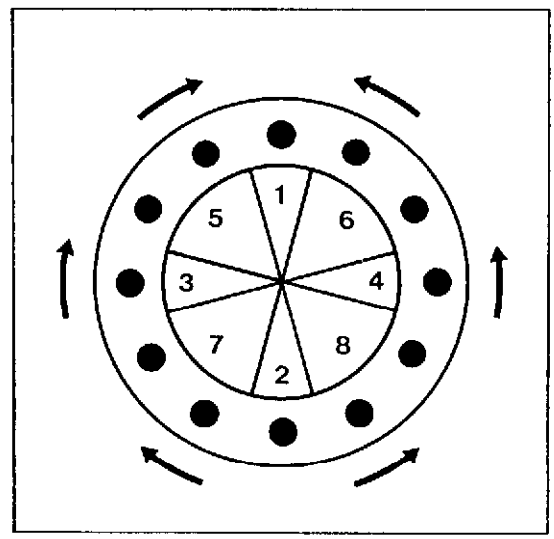
- Position one or both measuring jacks (see mounting points).

- Set the sensitivity controller to position 5.5 for Hofmann, or 5 for Schenck. Make a measurement run.

- Fit balance weights if necessary. Then make a check run. If the result is not acceptable (assuming orderly work), calibrate the finish balancer - adapt the sensitivity controller to the actual conditions.

- If the balancing result is still not completely acceptable (e.g. 5 g) even after calibration, alter the balance weight according to the balance correction table and eliminate the residual imbalance. (Balance correction schematic on the measuring unit in the case of the Schenck RAW 04).

Balance weight in section	Modification of the balance weight
1	enlarge at the same position
2	reduce at the same position
3 or 5	place in arrow direction in case of same size
5 or 6	enlarging and place in arrow direction
7 or 8	reducing and place in arrow direction



Further to 4 b: (Fine balancing of the rear wheels)

- Position measuring jack *right and left* (see mounting points).*The driven axle may only be balanced if both wheels are jacked up simultaneously.*

- Set the sensitivity controller to position 3 for Schenck or 3.5 for Hofmann

- Make a measurement run at a speed of 130 km/h or 1150 - 1200 rpm (wheel rotations) with the Schenck RAW 04, in top gear or in the top driving position.
  Fit appropriate balance weights.

- Make a check run. If the balance result is not acceptable, calibrate the finish balancer - i.e. adapt the sensitivity controller to the actual conditions.

- Subsequently (with a good balance result) slowly increase the speed to 190 km/h and pay particular attention to the areas where there are obvious vibrations in the steering wheel and/or in the seat (predominantly at 175 ± 5 km/h).

  Maintain this speed and rebalance the wheels as for 130 km/h. Do not fit new weights, but make improvements by *altering those already fitted* according to the "balance correction" schematic.

  Note: The imbalance values apparent in this speed range are not "real" values. Their actual values amount to max. 1/4 - 1/3 of those indicated.

  The subjective impression in the vehicle plays an important role. The balancing procedure may only be terminated when the driver can no longer detect vibrations caused by imbalance.

Notes for fitting the self-adhesive weights

- Determine the precise location of the balance weights (possibly by fitting balance weights provisionally with tape until the correct position has been determined).

- Prepare the sticking area on the rim. This area must be absolutely clean and free of grease.

- Pull the protective paper from the adhesive surface of the weight and press on firmly.

Note

Only remove the protective foil immediately before sticking on the weight as the adhesive capacity is reduced when exposed to the air and there is also the risk of contamination.

- The self-adhesive weight must be fitted carefully on the smooth ring surface of the wheel. It must fit evenly over the entire contact area.



- Check that the balance weight is fitted securely. The new fitted weight must not come away from the rim when subjected to transversal shearing stress to its longitudinal extension.

Notes for fitting the clamp weights

- When fitting clamp weights, unseat the tire with a tire caliper after letting out the air.

- Use a tire unseating caliper for this, e.g. from Messrs. Hofmann 6409 757

- Insert the spring clamp

Note

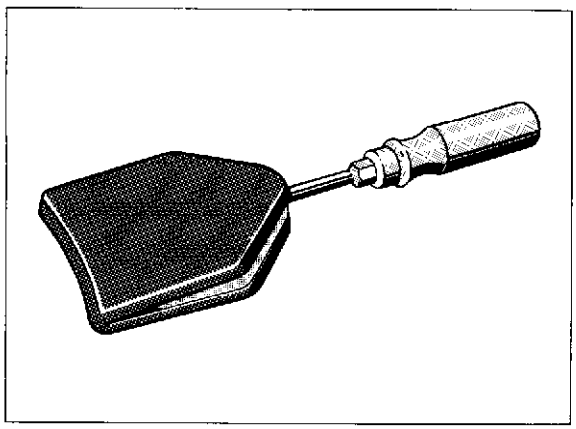
Do not knock in the spring clamps or apply fitting paste to them as this will have a detrimental effect on the correct seating of the spring clamps.

Tire fitting

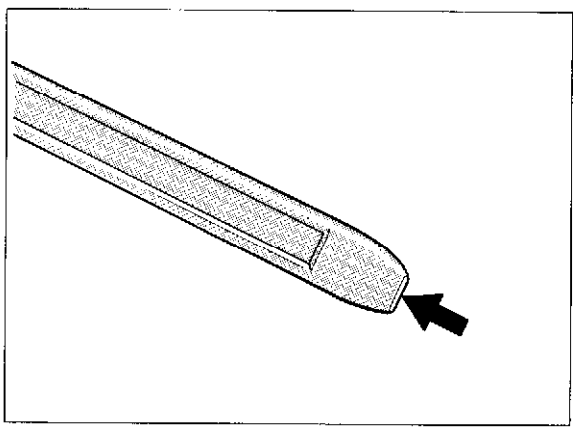
The following assembly and dismantling procedures refer to the 17-inch Cup Design wheels with asymmetric hump.

Notes / tools

- Avoid damaging the wheel paintwork.
- To remove / fit a tire, a tie-down tool – Special Tool 9539 – is required. In addition, the tire lever should be flattened along its front face and should then be rounded (arrow).



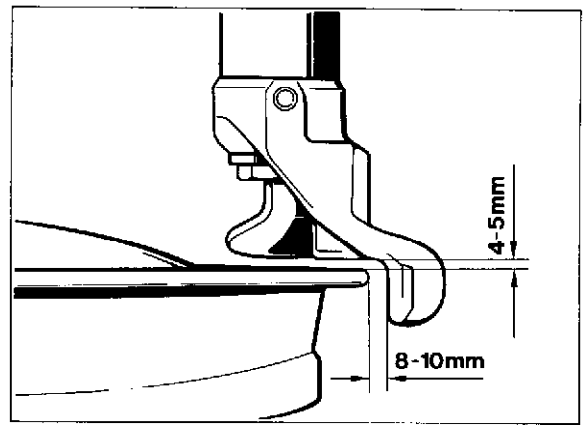
1012 - 44



1013 - 44

Tire assembly

- Fit wheel to assembly stand and coat inside of wheel and both tire beads with tire assembly compound.
  Replace the valve whenever a tire is fitted or refitted.
- Set assembly tool to correct clearance.



1014 - 44

- Fit first tire bead in the usual manner.

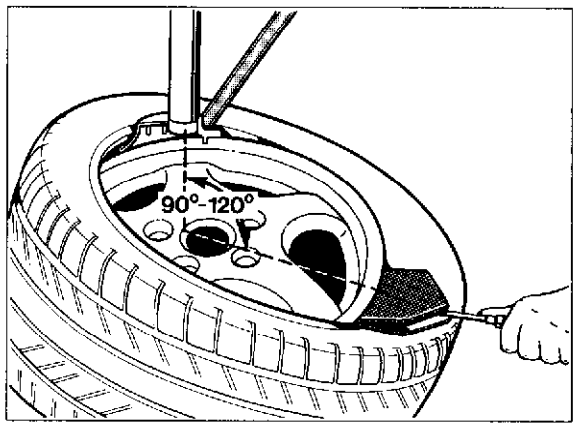
Note

The asymmetric hump changes its cross-section across the circumference.
The following points must therefore be observed when fitting or removing a tire.

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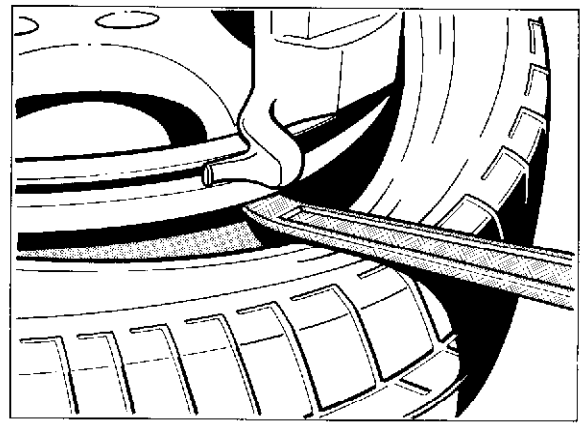
– When starting to fit the **second bead,** the assembly arm should be located **opposite the valve.** Then place the second bead as flat as possible onto the wheel, guide it across the assembly head and tie it down with Special Tool 9539, keeping it offset by approx. 90 to 120 deg.

  While performing the turning motion and fitting the **second bead,** use a second tire lever and Special Tool 9539 to locate the tire bead in the drop center.



1015 - 44

– To facilitate assembly, position the additional tire lever below the hump.



1016 - 44

– **When inflating the tire, the beads must jump over the hump at a positive pressure of 4.5 bar at the latest.**
  The bead still located in the drop center must therefore be positioned **opposite the valve (flatter hump section)** when the tire is pumped up. If required, rotate the tire accordingly and coat with assembly compound again.

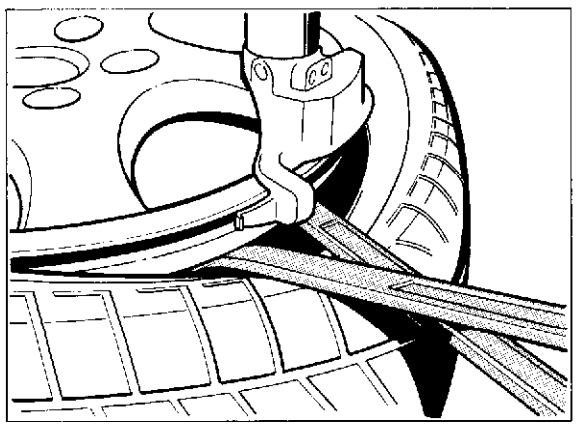
Removing the tire

– Adjust assembly head as for tire fitting (Fig. 1014 - 44).

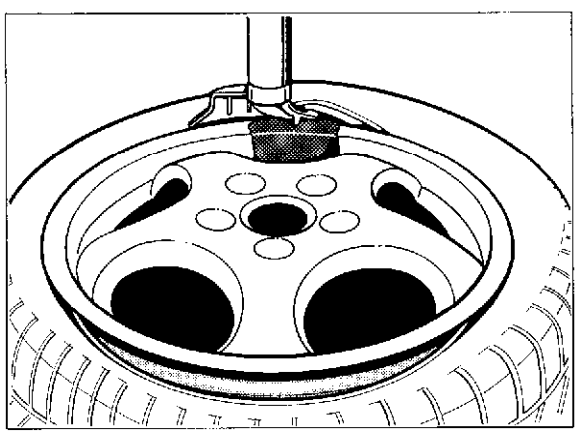
– **When pressing off the tire, start at the valve since the levering force required in this area is somewhat lower.**
  Then press off the tire on both sides, coating the rim flange with assembly compound.

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– **Lift the first side of the tire** over the assembly head (Fig. 1017 - 44). Place a rag or a leather cloth between the wheel and the tire lever.
In addition, make sure the tire remains in the drop center opposite the disassembly head (Fig. 1018 - 44). Use Special Tool 9539 to facilitate this.



1017-44



1018-44

– **Remove the second side of the tire** in the usual manner.

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INSTALLING AND REMOVING WHEELS ON CAR

General Information:

Aluminum wheel nuts may only be loosened and tightened with Special Tool P 300.

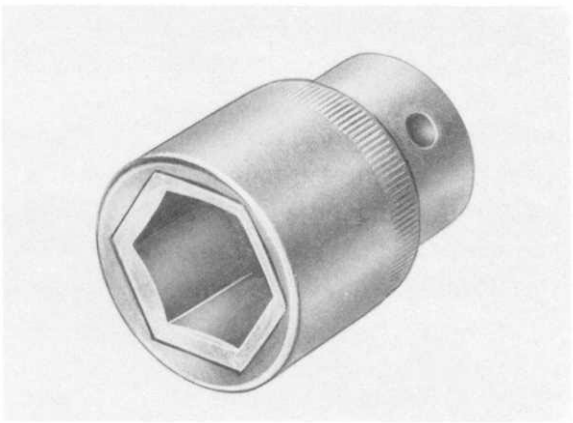
Aluminum wheel nuts could shear through:

- use of unsuitable tools (wheel nuts held by only about 2/3rds of total depth),
- excessive tightening torque,
- erratic loosening (impact tool) and
- missing or unsuitable lubricant.

In this case the calotte would shear off of the wheel nut's hexagon exactly at the point of transition and impair removal of rim.

Installing and Removing

1. Always use a perfect-condition Special Tool P 300. Other socket wrenches, wrench sockets or wheel bolt wrenches may not be used. Impact tools must never be used regardless of circumstances.

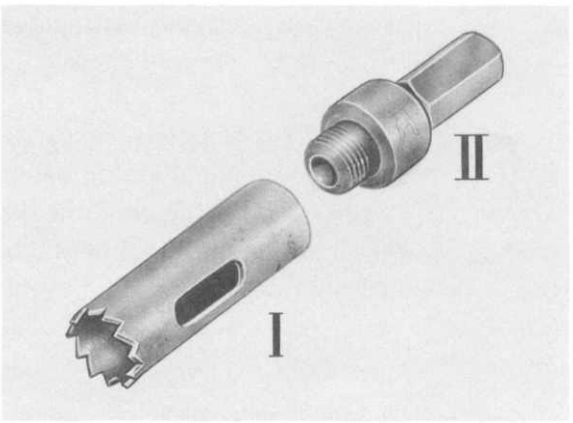


2. Lubricate threads and calotte with Optimoly TA.

3. Always tighten nuts to specified torque of 130 Nm.

Removal with Sheared Off Nut(s)

The rim can be taken off of the wheel hub without damage with the tools listed below. However, damaging the wheel bolt(s) cannot be avoided.



I. Compass saw, 17.5 mm diameter. This tool can be used after grinding off and smoothing inside diameter (welding seam must be eliminated).

II. Shaft for mounting compass saw.

III. Standard portable drill.

Delivery and Supply Sources

Sauer-Werkzeug GmbH & Co. KG
Humboldstr. 53
2000 Hamburg 76
Tel.: 040/223322
2296666
Telex: 214120

Order Numbers:
303 017 – Compass saw 17.5
303 161 – Adapter, size 1

or on commercial market

Manufacturer: The Cooper Group
Deutschland GmbH
7122 Besigheim

Order Numbers:
261 110 00 – Compass saw 17.5 – H 111
264 020 00 – Adapter M 402 H

1. Grind off calotte with the mentioned tools. Work with a speed of approx. 450 rpm to guarantee good chip removal. Also bleed tool.
   The calotte will jump off of the wheel bolt after complete removal of threads from the sheared off wheel nut.

Note:

The wheel rim might be ground slightly during this step, but this is not important.

2. Replace pertinent wheel bolt(s) on removed wheel hub.
   Use a proper size drift for removal and installation.
   Front wheel hub must be heated to 120 – 150 °C for this step.

Tire pressure warning system - General

General

A tire pressure warning system is fitted to 928 S 4 vehicles as standard, from Mod. 1989 onwards, initially excluding USA and Canada, however. The tire pressure warning system is another development which constitutes a significant contribution towards road safety. The tire inflation pressure is monitored by the control system, which

- monitors the correct inflation pressure with a greater degree of accuracy and reliability than any pressure tester in the on-board tool set, at the garage or in the workshop

- automatically allows for temperature's influence on the air pressure (temperature-compensated threshold value system)

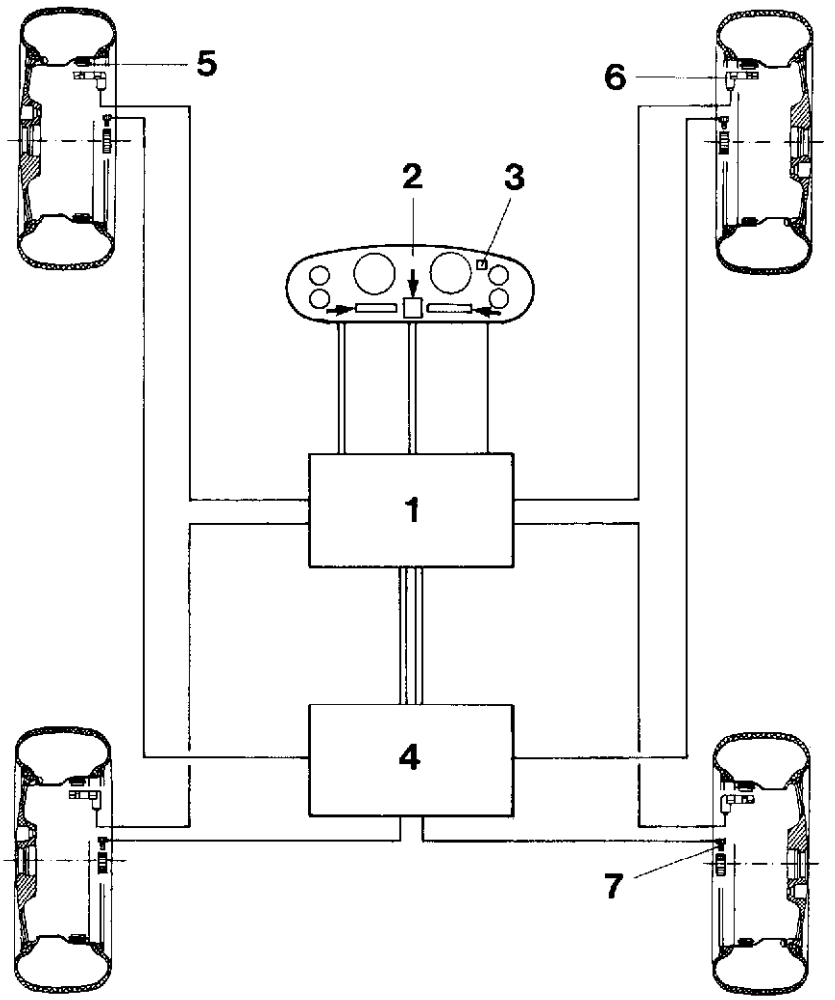
- Ensures perfect driving behavior and low fuel consumption as a result of correct inflation pressure

- Helps to prevent initial tire damage and increased tread wear as a result of inadequate inflation pressure.

The tire pressure warning system detects inadequate inflation pressure in one or several wheels, and displays this on the instrument cluster after at least 20 m distance at a speed of more than 5 km/h.

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Tire pressure warning system - diagramatic view



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1- Control unit

2 - Instrument cluster
Arrow = Display boxes for the information system (fault display - tire pressure warning system)

3 - Warning lamps

4 - ABS control unit

5 - 2 pressure-operated switches per wheel (offset by 180°)

6 - 1 HF sensor per wheel (high frequency sensor)

7 - ABS speed sensor

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Tire pressure warning system

Description

Two pressure-sensitive switches are allocated to each wheel, fitted to the rim well, 180° apart. The pressure-sensitive switches are subjected to the tire inflation pressure and act as switches for a resonant electric circuit, integrated into the pressure- sensitive switch. The resonant circuit remains closed as long as the tire inflation pressure remains *above* a specific setpoint value for the switch. If the inflation pressure drops below the setpoint value, the pressure-operated switch opens the resonant circuit.

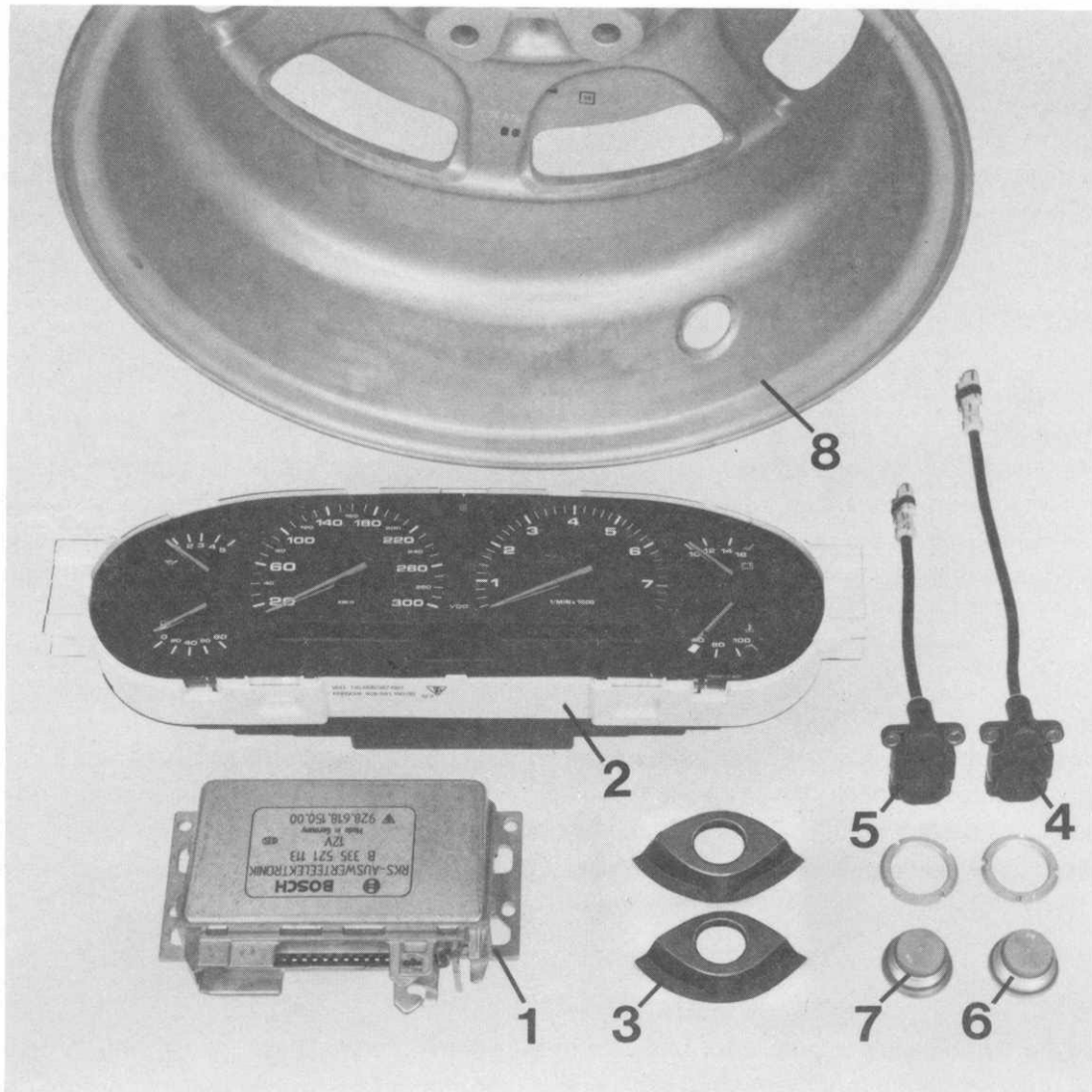
A high-frequency sensor (HF sensor) is fitted to the wheel mount or steering knuckle of each wheel. The HF sensors are connected to the control unit of the tire pressure warning system. Each HF sensor generates an electomagnetic field on the sensor side which is directed towards the diaphragm-type pressure-operated switches. If the wheel turns, the pressure-operated switches are led past the HF sensor. At the same time, the resonant circuit of the pressure-operated switch enters the effective range of the HF sensor's electromagnetic field. An inductive coupling is produced between HF sensor and pressure- operated switch.

If the inflation pressure is correct (resonant circuit closed) current flows in the resonant circuit of the pressure-operated switch, as the resonant circuit acts like a consumer, thanks to the circuit design. This additional current requirement is detected by the tire pressure warning system control unit and processed into voltage pulses. These voltage pulses are compared with the wheel speed pulses from the ABS control unit.

If there are two HF sensor pulses for one turn of the wheel, the tire pressure warning system control unit detects adequate inflation pressure. If there are less than two pulses per turn, the control unit detects a fault which is indicated by a corresponding warning on the instrument cluster.

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Tire pressure warning system components



88/153

1 - Control unit (Position see page 44 - 33)

2 - Instrument cluster

3 - Deflector for pressure-operated switch

4 - High-frequency sensor - front

5 - High-frequency sensor - rear

6 - Pressure-operated switch 2.5 bar, front

7 - Pressure-operated switch 3.0 bar, rear

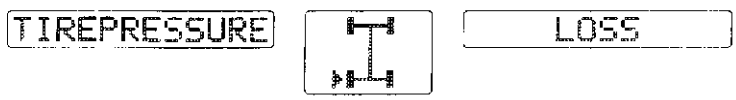
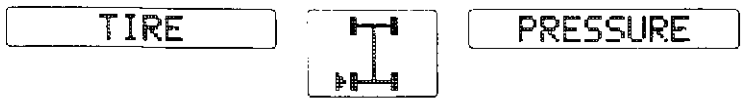
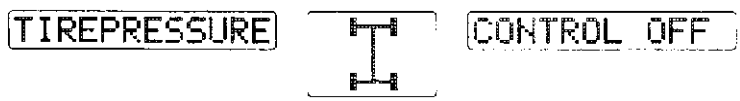
8 - Wheel

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RDK - possible fault displays and their causes

Possible RDK fault displays

Tire pressure at each wheel is monitored by two pressure sensing switches installed in the wheel. If the tire pressure drops below the nominal value to which the pressure sensing switch is set, or if a system fault develops, a warning appears on the instrument panel: the warning light at the top right comes on and the corresponding fault display is shown in the display panels.

	Possible fault display	color
A		red
B		orange
C		red

When the ignition is turned on, the warning light comes on as a bulb test. It goes out when the engine is started. Tire pressure monitoring starts after the car has been driven for approx. 20 m and when a minimum speed of 5 kph has been reached.

Display A: Arrow indicates wheel with low tire pressure (cause in wheel area).
Display B: Appears for approx. 2 minutes after switching off the ignition as a reminder.
Display C: RDK system fault has occurred. Tire pressures are no longer being monitored (cause in system).

If a system fault has occurred, the cause is stored in the fault memory of the RDK control unit and can be called up by means of the diagnostic facility (from Page 44 - 301).

The fault display (RDK system fault and pressure warning) can be acknowledged with the in-car computer control lever, after which the text display will disappear. However, displays re-appear periodically until the fault is eliminated.

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RDK - Possible causes if a fault is indicated

Fault display A = TIREPRESSURE LOSS **= Cause in wheel area**

Natural pressure loss	Tire/wheel damage	As soon as car starts to move	Only at fairly high speed
approx. 0.2 bar/month	Display reappears at frequent intervals	Although tire pressure is correct	Caused by centrifugal force
Stop car, switch off ignition Increase tire pressure at indicated wheel by 0.3 bar. Increase pressure at wheel on opposite side of same axle to the same pressure. Or: Adjust tire pressures exactly with 9288 System-Tester (to 0.3 bar above the pressure-sensing switch trigger value).	Leaking wheel rim or tire valve; slow puncture in tire, damaged sealing ring at pressure-sensing valve. Fit the temporary spare wheel. Take car to Porsche dealer tire repair as soon as possible. Perform brief RDK test.	Pressure sensing switch (DS) and HF sensor are misaligned, or gap between them is too great. DS is damaged or wheel not fitted with DS. Have the car put right by a Porsche dealer Perform brief RDK test.	Stop the car and switch off the ignition Raise tire pressure at indicated wheel by 0.3 bar. Raise pressure at wheel on opposite side of same axle to the same value. Or: Adust tire pressures accurately with the 9288 System Tester (to 0.3 bar above the pressure-sensing switch trigger value).

Fault display C = TIREPRESSURE CONTROL OFF **= Cause in RDK system**

Fault in system
Tire pressures no longer monitored
Take car to a Porsche dealer; have falut localized with System Tester and put right.
Perform brief RDK test each time a wheel or tire is fitted (Page 44 - 28)

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Tire pressures on cars with RDK

Important notes

The tire pressure control system takes the effect of tire temperature on tire pressure into account. Despite this, it is possible for the tire not to reach the nominal pressure only in a particular vehicle operating situation.

In other words, a pressure loss display may not necessarily appear immediately the car is driven away. It may also fail to appear after switching the ignition off and on and driving the car away a second time. This merely indicates that the same vehicle operating conditions do not apply on this occasion. Nevertheless, the driver should be aware that tire pressure remains too low for a certain combination of temperature and road speed, in other words for a given driving situation.

When low pressure has been indicated even once, it should be corrected as soon as possible in the interests of safety.

If tire pressures are too low, the car's road behavior is adversely affected. In addition, wheels and tires may suffer damage.

If the information system indicates a loss of pressure several times in rapid succession, or if the pressure is indicated as well below the nominal value, this suggests that tire damage has occurred or that the tire valve or the wheel rim are damaged (see Page 44 - 26).

Very slight tire pressure loss occurs all the time, since a small amount of air escapes through the tire rubber (this process is known as diffusion).

To avoid damaging the pressure sensing switches, never inflate tires to a pressure of more than 6 bar when fitting them.

Checking and correcting tire pressures

When tire pressures are corrected, a distinction has to be made between the conventional method (method A) and the more accurate method in conjunction with the 9288 system tester (method B).

Do not check tire pressure by the conventional method (method A) unless pressure loss has been indicated on the instrument panel.
By using the 9288 system tester, however, tire pressure can be checked and accurately adjusted at any time (method B). This is practicable during wheel and tire fitting work or when the car is brought into the workshop for any other reason.

Tire pressure should be checked and corrected if necessary when the "Pressure Loss" fault display appears.

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A: Conventional adjustment of tire pressure

If the "Pressure Loss" fault display appears, tire pressure at the affected wheel must be increased by 0.3 bar or at least to the specified pressure at that wheel. Since diffusion losses are approximately the same at the two wheels on any one axle, the tire pressure at the other wheel should therefore be increased by the same amouint. But do not reduce the tire pressure if too high a value is measured.

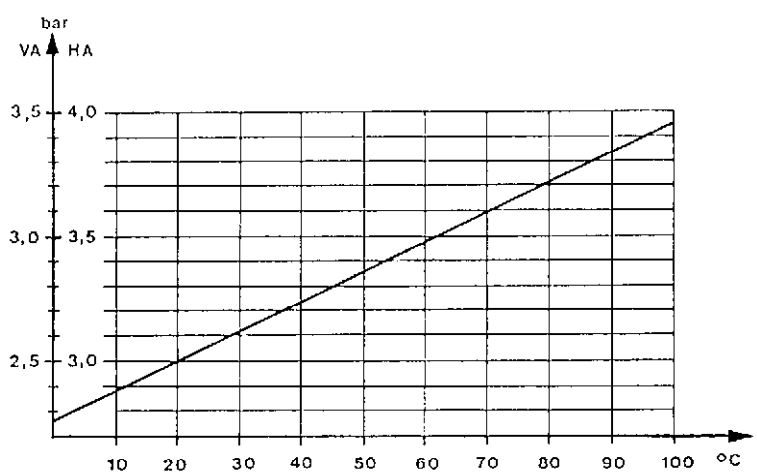
The specified tire pressures at 20°C are: front 2.5 bar, rear 3.0 bar (2.5 bar for 17" summer tires)

Note also in this connection that a small amount of air escapes when the pressure gauge is removed from the tire valve. Since the RDK system responds to even slight losses of pressure, this should be taken carefully into account.

Stop the engine while correcting tire pressures, so that the control system can register the new pressure settings.
After the car has been driven for a short distance (at least 20 meters) and has reached a speed above 5 kph, the RDK system will have registered the new tire pressures. If the low pressure warning persists, increase tire pressure further at the affected axle.
Repeat this procedure until no further warning is displayed.

However, do not exceed maximum tire pressures of 3.5 bar at the front wheels and 4.0 bar at the rear wheels (3.5 bar for 17" summer tires), since these pressures correspond to tire temperatures which will never be reached in normal driving conditions. Normal conditions basically assume that tire pressures are correct. **If a loss of pressure is still shown when 3.5 or 4.0 bar respectively have been reached, the pressure sensing switch must be faulty, a wheel without a pressure sensing switch has been fitted to the car or the pressure sensing switch has become displaced to one side of the HF sensor (see also Page 44 - 26).**

To measure and adjust the tire pressure to precisely the correct value (see chart), tire temperature must therefore be known or else the tire pressure must be adjusted accurately with the 9288 system tester. For each 10°C increase in the temperature of the air in the tire, its pressure rises by approx. 0.1 bar. In other words, the correct pressure at any given moment is always higher than the nominal tire pressure once the tire has become hot, and for this reason should never be reduced.



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B: Accurate adjustment of tire pressures with the 9288 system tester

In view of tire pressure gauges' display tolerances and the difficulty of measuring the temperature of the air in the tire accurately, cars with what appear to be correctly adjusted tire pressures are very often only just above the switching threshold of the diaphragm-pattern pressure sensing switches. When a slight centrifugal force acts on the diaphragm at high speed, an entirely **justifiable tire pressure warning is displayed.**

To avoid this problem, tire pressures in the workshop should always be adjusted as follows with the Porsche 9288 system tester, and not with a conventional tire pressure gauge:

1. Connect the Porsche 9288 system tester and select the RDK control unit.

2. Call up the "Switch Inputs" menu with the "Pressure Switch" display.

Pressure Switch
FL: closed FR: open
RL: open RR: closed
Coniune: N

3. By pushing the car or, if it is on a hoist, by turning one wheel (for instance a rear wheel), position one of the pressure sensing switches precisely opposite its high-frequency transmitter. This adjustment can be carried out with the aid of the tester: at the correct wheel position the display for the RL or RR pressure sensing switch changes from **"Open"** nach **"Closed"** (assuming that the tire pressure is correct; in case of doubt, slightly increase the tire pressure temporarily).

Next, reduce the tire pressure until the display changes from **"Closed"** to **"Open"** (switching point of pressure-sensing switch).

Now increase tire pressure again slowly until the switching point is just reached (display changes from **"Open"** to **"Closed"**). Take an accurate reading of the pressure then shown on the gauge, and add 0.3 bar to it. Adjust the tire pressure at the other wheel on the same axle to the same value.

If the wheels register different temperatures, for example because of exposure to the sun on one side of the car only, the switching point must be determined for all wheels and the tire pressure adjusted as already described.

4. Adjust front wheel tire pressures in the same manner as described in Item 3.

This method of adjustment ensures that tire pressures are 0.3 bar higher than the switching point of the pressure sensing switches, regardless of tire temperature and measuring equipment tolerances. Unless there are air leaks at the tire or the wheel rim, it also ensures that no tire pressure warnings will occur for a lengthy period.

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Quick test of RDK

Whenever a wheel or tire is changed, it is essential to perform a quick test of the tire pressure control system.

If only one wheel was removed, the quick RDK test need only be performed at this wheel.

A short test drive for a distance of at least 20 meters, at a road speed of between 5 and 40 kph and at the following tire pressures is sufficient:

1. Tire pressure 0.5 bar below nominal value:* front 2.0 bar
rear 2.5 bar (2.0 bar for 17" summer tires)

The relevant arrow(s) must flash on the instrument cluster display panel.

If an arrow is continuously illuminated instead of flashing, one pressure sensing switch for the wheel converned is faulty and must be replaced. (Check pressure sensing switch by using the 9288 system tester, see Page 44 - 311).

Do not drive the car at more than 50 kph. Above this speed, the display always begins to flash.

2. Tire pressure 0.5 bar above nominal value:* front: 3.0 bar
rear: 3.5 bar (3.0 bar for 17" summer tires)

No fault display should occur. If it does, this indicates a system fault or a faulty pressure sensing switch (diagnosis from Page 44 - 301 on).

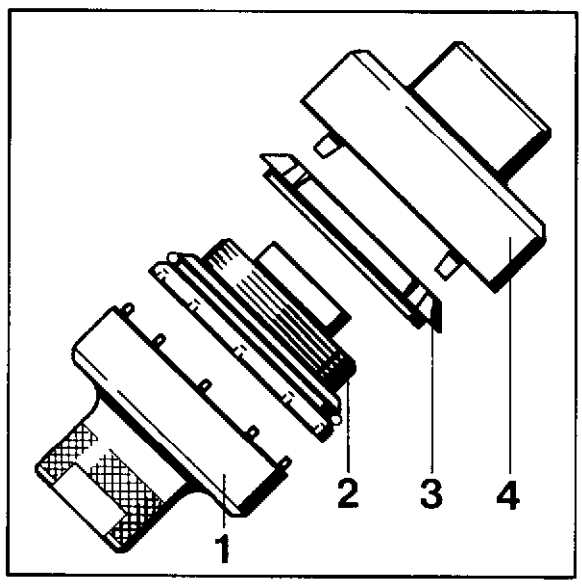
3. After the quick test, restore tire pressures to the nominal value*, or preferably 0.3 bar above the pressure sensing switches' switching points (Page 44-27).

* Nominal tire pressures: front 2.5 bar / rear 3.0 bar (17" summer tires = 2.5 bar) at 20° C tire air temperature

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Removing and installing pressure-operated switches (tire pressure warning system)

Special tools



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No.	Designation	Special tool	Order number	Remarks
1	Pin socket wrench	9273	000 721 927 30	
4	Mounting wrench	9274	000 721 927 40	

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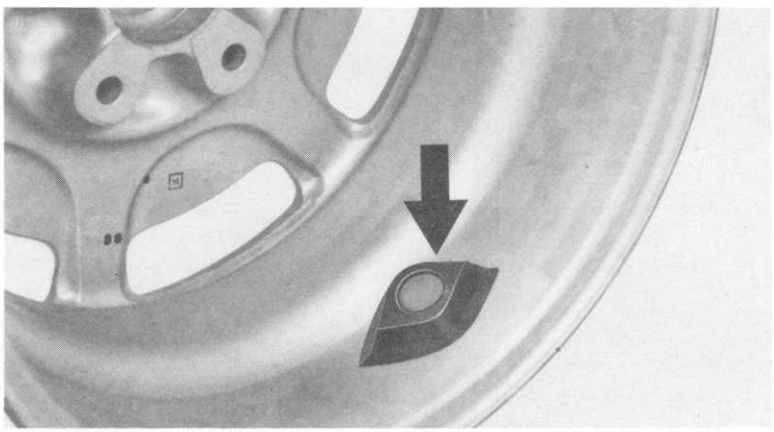
Removing and installing pressure-operated switch (tire pressure warning system)

Important note/preparation

The tire must be removed from the rim before removing or installing a pressure-operated switch. The following points must be observed under all circumstances when dismounting or mounting the tire:

- Clean dirty wheels before removing the tire. Mark the position of the tire on the rim for reassembly.

- *Apply the forcing blade of the tire mounting unit at the central point between both pressure-operated switches. The deflector (arrow) must remain fitted while removing and fitting the tire to protect the pressure-operated switch.*



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- The diaphragm of the pressure-operated switch must not come into contact with grease, tire assembly paste or similar under any circumstances.

- Always replace the fastening nuts and torroidal sealing rings for the pressure-operated switches.

- **The tire inflation pressure must not exceed 6 bar in order to present damage to the pressure-operated switch.**

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Removing and installing pressure-operated switches

tire pressure warning system)

1. Turn the rim and clamp onto mounting unit. Remove the deflector from the pressure-operated switch.

2. Remove pressure-operated switch with Special Tool 9274/9273. Hold the pressure-operated switch with Special Tool 9273 while undoing fastening nut.

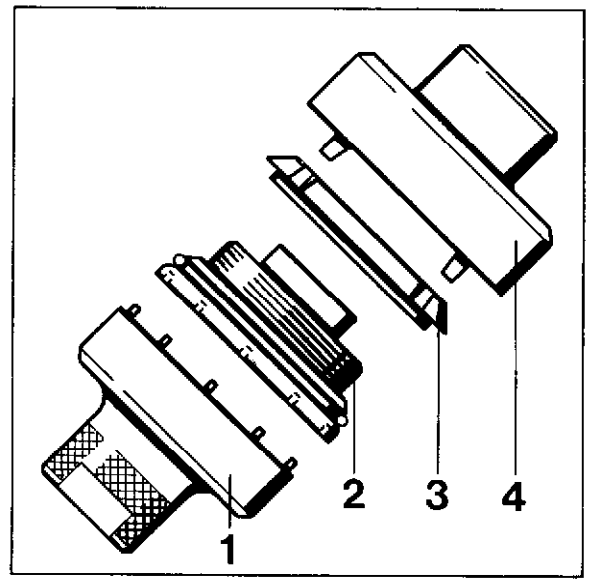
3. Fit the correct pressure-operated switch (marked with specified pressure (2.5 - or 3.0 bar) as follows:

   Apply pressure-operated switch with new seal. Apply a film of Vaseline to the seal before fitting. Center pressure-operated switch and tighten new fasten nut by hand.

   Call on the services of a second mechanic to counter the pressure-operated switch while you tighten the fastening nut. Tightening torque for the fastening nut 20 Nm (15 ftlb.)

Note

The pressure-operated switch must not turn while tightening the fastening nut. (Damage to the seal/leak).



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1 Tool to counter (9273)
2 Pressure-operated switch with seal. Specified pressure
front 2.5 bar / rear 3.0 bar or 2.5 bar
(P. 44 - 01)
3 Fastening nut
4 Tool to tighten (9274)

4. Remove protective foil from the diaphragm side if necessary. Press deflector onto the fastening nut and adjust. Check for secure fitting.

5. Mount tire (max. 6 bar tire pressure) and balance wheel.

6. Mount wheel onto hub and carry out short test for tire pressure warning system (page 44 - 28)

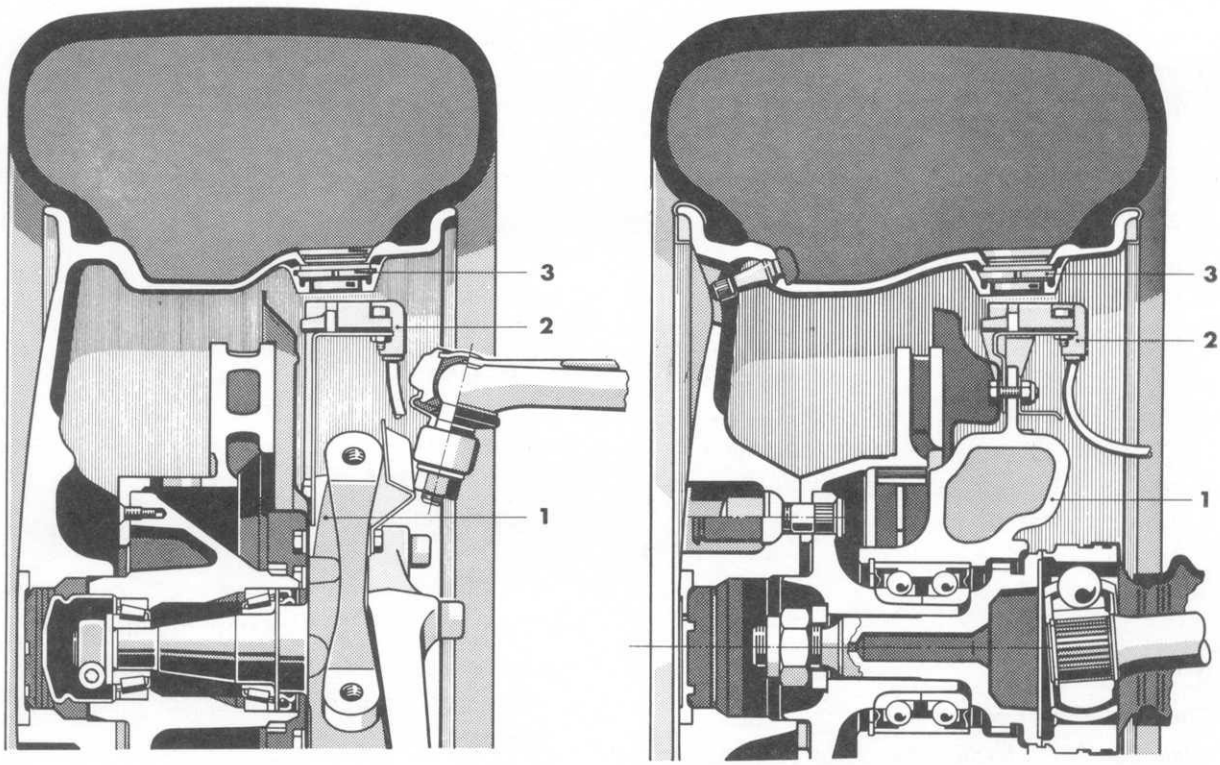
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Removing and installing high-frequency sensor (tire pressure warning system)

Notes

The front and rear high-frequency sensors (HF sensors) (2) have different cable lengths. The rear sensors have shorter cables.

The distance between HF sensor (2) and the pressure-operated switch (3) is approx. 6 ± 2 mm. This distance is maintained as long as the HF sensor holder is not out of shape.



1. Remove the HF sensor fastening screws from the holder.
2. Slide the HF sensor (2) out of the holder.
3. Undo and separate the HF sensor connectors at steering knuckle or wheel mount (1).
4. Carry out HF sensor test after installation (tire pressure warning system diagnosis, menu 2, refer to Page 44-310)

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Removing and installing RDK control unit

Notes

The RDK control unit is in the footwell on the driver's side, above the base of the storage compartment. On right-hand drive cars, the RDK control unit is attached to the right side panel in the driver's footwell.

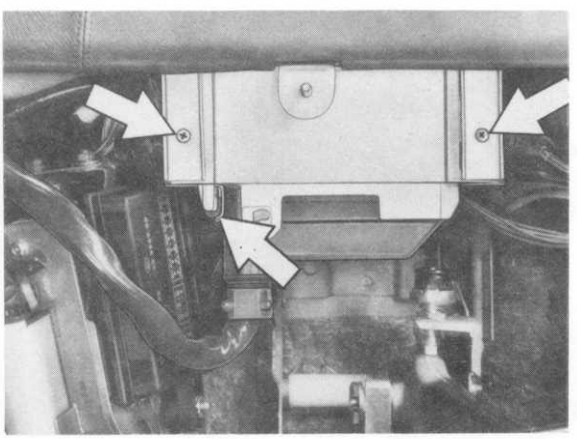
When the RDK control unit is removed or installed, the ignition must be switched off.

Remove the storage compartment (4 retaining nuts).

From software status R 02 on, the RDK control unit has an event memory for tire pressure losses. This was introduced during the 1991 model year / amended part number index for control unit. Any tire pressure losses on the last 8 occasions that the car was driven can be read out with the 9288 system tester (Page 44 - 302).

Removing

Unscrew and remove the screws holding the RDK control unit. Remove control unit with plug from holder, release the plug by applying pressure to the retaining clip and pull it off the control unit.



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Installing

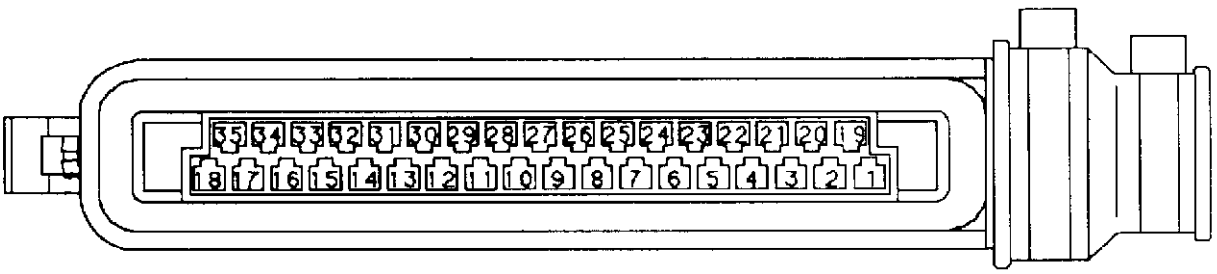
Proceed in the opposite order of work.
Make sure that the plug locates correctly in the control unit. After installing, perform the quick RDK test (page 44 - 28).
After this, read out the fault memory with the 9228 system tester (menu 1). Erase any faults stored in the memory.

Note

When attaching the control unit, first push it into the clips at the rear. Make sure that no wiring is trapped between the control unit and the holder.

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Connections at RDK control unit plug



1 Data line to instrument cluster Plug 2 PIN 10

2 Data line to instrument cluster Plug 2 PIN 11

3 RDK warning light

4 not in use

5 not in use

6 not in use

7 not in use

8 Speed sensor HR

9 not in use

10 not in use

11 not in use

12 not in use

13 Ground

14 not in use

15 not in use

16 not in use

17 HF transmitter, FR

18 HF transmitter, RL

19 Data line to diagnosis (L)

20 Data line to diagnosis (K)

21 not in use

22 to alternator, terminal 61

23 not in use

24 not in use

25 not in use

26 Speed sensor, RL

27 not in use

28 Speed sensor, FR

29 Speed sensor, FL

30 not in use

31 not in use

32 not in use

33 Power supply, terminal 15

34 HF transmitter, FL

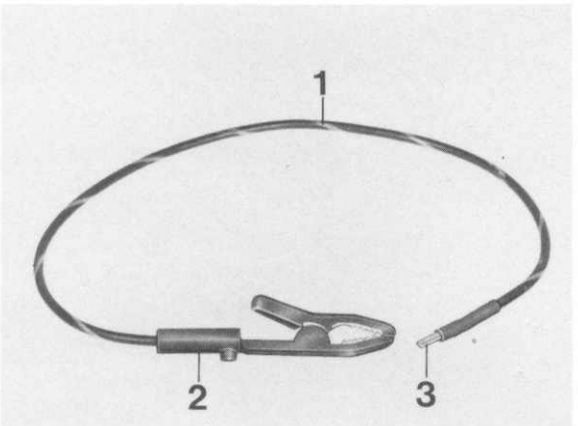
35 HF transmitter, RR

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Notes on trouble-shooting - Tire pressure warning system

Aids

Use 1 or 2 auxiliary cables (own construction) for measurements on the control unit connectors and plug connections with the same contacts (flat contacts). This will prevent the contacts becoming deformed.

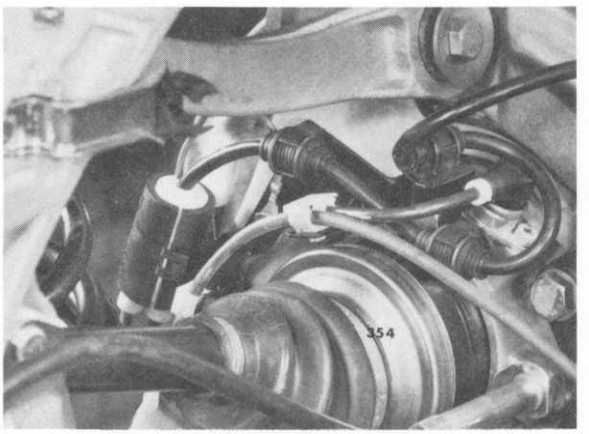


1 - Highly flexible line

2 - Crocodile clips (standard)

3 - Flat connector 2.8 (N 17.457.2)

Combined plug connections - distinguishing line features



There are several combined plug connections of the same type in the lines for brake-pad wear, speed sensors and HF sensors. The lines in this area can be distinguished from one another as follows:

- Sheathed lines for
  HF sensors and speed sensors.
  For brake-pad wear: 2 lines protected by tubing.

- The HF sensor connectors have 1 pin and 1 socket. The connectors for the speed sensors have 2 pins with 2 sockets on the other side.

- There are 2 combined connectors on top of one another in the area of the spare wheel. The lines here are marked with RL - rear left and HR - rear right.

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Important notes when working on vehicles with the tire pressure warning system

- Always carry out a tire pressure warning system short test on the respective wheel every time a wheel or tire is changed.

- After the wheels have been finally balanced or after running on the test bench, erase the fault memory in the tire pressure warning system control unit.

- If Club-sport vehicles are fitted with winter tires, remove the spacer on the rear axle if necessary. This is only necessary if the vehicle is fitted with permitted rims having a different offset. If the spacers are not removed, the pressure-operated switch will be offset in relation to the HF sensor which will activate the pressure loss display on the instrument cluster.

- Rims without pressure-operated switches must not be fitted to vehicles with the tire pressure warning system.

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Tire pressure warning system (RDK) diagnosis

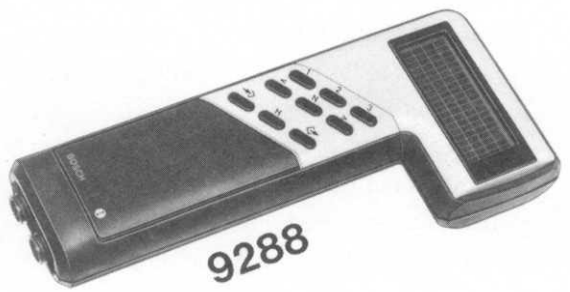
General

- The system tester 9288 will be used for PORSCHE DIAGNOSIS from Mod. 89 onwards.
  PORSCHE DIAGNOSIS can be used for all systems capable of self diagnosis.
  Capable of self diagnosis means: the control unit can detect, store and output system errors.

- Read out tire pressure loss event memory (from control unit version R02 on (introducing during 1991 model year).

- As the number of systems capable of self diagnosis will be increasing in the forseeable future, diagnosis of the relevant system will be filed at the end of the respective repair group as of now. The pages in repair group 03 continue to be applicable. Apart from the diagnosis procedure filed there to date (flashing code diagnosis with tester 9268) this will also contain a description of how to operate system tester 9288 (OFF-board diagnosis with plain text output).

- Tire pressure warning system diagnosis is *not* possible using tester 9268 (flashing code diagnosis).



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Areas of application for the 9288 system tester on the RDK tire pressure control system

- Reading out the fault memory
- Reading out the tire pressure loss event memory, from control unit version R 02 on (introduced during 1991 model year)
- Checking the correct functioning of various components with the tester
- Switch inputs can be checked



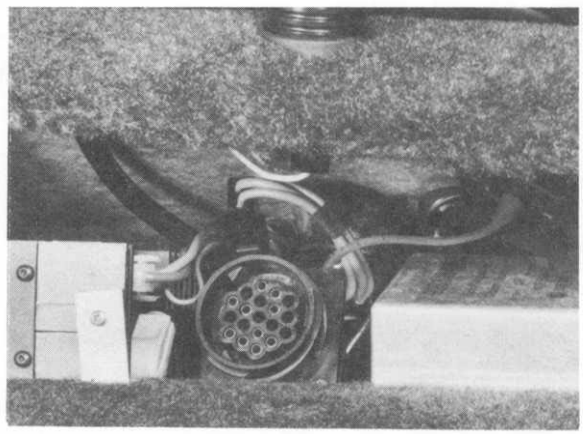
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Connecting the 9288 system tester, testing procedure

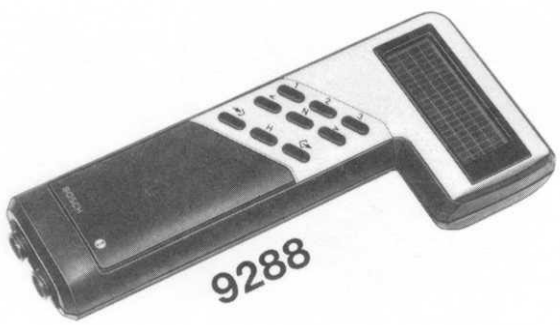
Notes

- RDK diagnosis with the 9288 system tester must be carried out with the ignition switched on and the car standing still.

1. Connect the 9288 tester to the diagnosis socket under the booster cover next to the passenger's seat, using connecting lead 9288/1 (adapter lead).



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2. Switch on the ignition and the tester. The tester can be switched on by pressing any button. For 9288 tester operating instructions, refer to Repair Group 03.
Important: Never select any speed range at the automatic transmission while testing, because engine speed may be raised by the tester when the engine is running.

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3. Select vehicle type and system (RDK).

Note:

If the display shows:

- No Data Exchange Possible
  Restart: >
  Terminate: N

- the > (Restart) button should be pressed.

If the RDK is not mentioned in the "Installed Systems" display, the reason may be one of the following:

- Power supply to control unit interrupted
- No ground connection
- Leads K or L from diagnosis are not intact
- Control unit is faulty

4. Selection from menu

Possible RDK menus / Explanation

1 = Fault memory
Read out fault memory / eliminate fault
Erase fault memory

2 = Sensors
Check HF sensor / speed sensor

3 = Switch inputs
Pressure sensing switch test

1* = Events
Read out tire pressure loss event memory

5. Notes on desired menu
Menu 1 = **Fault memory**:
From Page 44 - 305 on
Menu 2 = **Sensors**
Checking HF sensor and speed sensor:
Page 44 - 310
Menu 3 = **Switch inputs:**
Pressure switch test Page 44 - 311
Menu 1* = **Events**
Read out event memory for any tire pressure losses during the past 8 journeys from Page 44 - 312 on.

* Additional RDK menu from control unit version R 02 on (introduced during 1991 model year). This menu should normally have the serial number 4. However, since the tester only has selection buttons marked 1, 2 and 3, the menu at the top of the display,in this case the Events menu, starts again with the number 1.
To change from the one to the other Menu 1 display (either Events or Fault Memory), use the > or < keys (page forward, page backward).

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Important notes on the diagnosis and assessment of RDK faults

- When the RDK control unit plug is disconnected, the display panel shows "RDK SHUT DOWN" after the engine has been started. This display is supplied from the instrument panel.

- If a wheel without a pressure sensing switch is fitted to the car, "TIRE PRESSURE LOSS" appears on the display panel after a short time, and the affected wheel is indicated by an arrow.

- The system fault display takes precedence over the pressure loss display (in the event of pressure loss and an RDK fault, the RDK system is shut down).

- **If tire pressure loss is indicated continuously,** inspect the tire for external damage or penetration by foreign bodies, and check the wheel for leaks. Perform the quick RDK test (Page 44-28), in order to determine whether a pressure sensing switch is faulty. If necessary, localize the faulty pressure sensing switch (there are 2 pressure sensing switches for each wheel) with the 9288 system tester, menu 3 = Switch Inputs (pressure sensing switch test).
  1991 model cars (with RDK control unit software status from 02 on) have an event memory integrated into the RDK control unit. This enables conclusions to be reached concerning possible leaks at one or more wheels.
  The event memory stores data from the last 8 times the car was driven. The event memory is read out with the 9288 system tester; there is no provision for erasing it (Page 44 - 312).

- Not all system faults are identified by the RDK control unit as faults (in this connection, refer to Page 44 - 305).

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Menu 1 = Fault memory
Reading out fault memory / eliminating faults

Important notes

- Faults which were not present during the last journey and the test conditions applying them cannot be measured (with one exception). The relevant fault path should therefore be inspected visually, **since with this type of fault** the cause is either poor electrical contact, contact resistance or corrosion at the plug connections.
  Exception:
  "HF sensor signal not plausible" (fault code 1-4). This fault is always output by the system tester as "Not Present". However, it is possible that the fault is present and can be measured by way of the sensor test (menu 2).

- A displayed fault, for example "HF sensor ground short", refers not only to the HF sensor but to the complete circuit path as far as the control unit input.

- After eliminating the fault, erase the fault memory. After a short test drive (approx. 500 meters), read out the fault memory again.

- The fault code for the fault output is displayed as additional information if button 1 is pressed. In addition, from control unit software status R 02 on (introduced during 1991 model year), the road speed when the fault first occurred is memorized.

- **If the 9288 system tester is connected, make quite sure that no speed range is selected at the automatic transmission, since when the engine is running the tester could increase its running speed.**

- Not all system faults are identified by the RDK control unit as faults. This applies to the RDK control unit itself. If the fault display "RDK SHUT DOWN" appears and no fault is stored in the control unit, the following points must be checked or confirmed before the RDK control unit is replaced:
  a. Is the control unit plug attached correctly and are the connection contacts between the plug and the control unit in good condition?
  b. When the ignition is switched on, a voltage higher than 9 Volt must be present at PIN 13 (ground) and PIN 33 of the disconnected control unit plug (refer to Page 44 - 34).
  c. There must be no break in the data line from RDK control unit PIN 2 to instrument cluster plug 2, PIN 11.

- The following display may appear as a fault output although no fault is present:
  Data line - interruption - not present (fault code 18).

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(Menu 1 = fault memory)

Fault/Fault code	Possible causes Remedy/Remarks
HF sender rear left Fault code - 1 -	
- **Short to ground**	- may also be checked via menu 2 = sensors. In this case, **HF sensor defective** appears regardless of the wheel position if there is a ground fault. - Disconnect the control unit plug and measure from PIN 18 to ground (≈ 5 kOhm would be displayed if there is no ground fault). Check the entire line path between control unit plug and HF sensor according to the circuit diagram.
- **Open circuit**	- may also be checked via menu 2 = sensors. In this case, **HF sensor defective** appears regardless of wheel position if there is discontinuity. - Open HF sensor connector on the wheel carrier. Check cable path for discontinuity from the socket of the combined connector to PIN 18 of the control unit plug. If it is not possible to determine any discontinuity, check whether ground is present at the pin of the combined connector. If both are OK, replace HF sensor.
- **Signal improbable**	- Continue HF sensor test via menu 2 = sensors. If **HF sender rear left O.K.*** (meaning HF sensor attenuated) appears during this test regardless of the wheel position, replace the HF sensor.

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Fault/Fault code	Possible causes Remedy/Remarks
HF sender **rear right** Fault code - 2 -	- Proceed as for fault code - 1 - for all faults, but use PIN 35 of the control unit plug.
HF sender **front left** Fault code - 3 -	- proceed as for fault code - 1 - for all faults, but use PIN 34 of the control unit plug.
HF sender **front right** Fault code - 4 -	- proceed as for fault code - 1 - for all faults, but use PIN 17 of the control unit plug.
ABS speed sensor **rear left** Fault code - 5 -	
- **Open circuit/** **short to ground**	- Check speed signal via menu 2 = sensors. If no bar diagram appears when the wheel is turned, **but ABS serviceable**, the fault lies in the line path between ABS control unit and tire pressure warning system control unit. Connector assignment: ABS control unit 55-pole PIN 12 ABS control unit 35-pole PIN 30 Tire pressure warning system control unit PIN 26

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Fault/Fault code	Possible causes Remedy/Remarks
	- If the ABS is also deactivated, look for the fault in the area of the speed sensor or in the fault path between ABS control unit and speed sensor. - If no fault found, repeat. If the fault is still apparent, try replacing the ABS control unit.
- **Signal improbable**	- Fault not present: This could have occurred under certain environmental conditions, e.g. driving in the vicinity of powerful transmittors. There is no fault in the vehicle. - Fault present: First try replacing the ABS control unit then the tire pressure warning system control unit.
ABS speed sensor rear right Fault code - 6 -	- proceed as for fault code - 5 - for all faults. Connector assignment: ABS control unit 55-pole PIN 10 ABS control unit 35-pole PIN 31 Tire pressure warning system control unit PIN 8
HF sender front left Fault code - 7 -	- proceed as for fault code - 5 - for all faults. Connector assignment: ABS control unit 55-pole PIN 16 ABS control unit 35- pole PIN 17 Tire pressure warning system control unit PIN 29

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Fault/Fault code	Possible causes Remedy/Remarks
ABS speed sensor front right Fault code - 8 -	- proceed as for fault code - 5 - for all faults. Connector assignment: ABS control unit 55-pole PIN 53 ABS control unit 35- pole PIN 23 Tire pressure warning system control unit PIN 28
RDK control light Combi instrument Fault code - 9 -	
- **Open circuit / Short to ground**	- In the case of discontinuity, ground fault or short circuit, check the line from PIN 3 of the tire pressure warning system control unit connector to PIN 6 of instrument cluster connector 1
- **Short to B+**	
Data lead RDK combi instrument Fault code - 18 -	
- **Open circuit**	- Check the data line from PIN 1 of the tire pressure warning system control unit connector to PIN 10 of instrument cluster connector 2

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Menu 2 = Sensors

Check HF sender and ABS speed sensor

Component to be tested/ Remarks	Preconditions Fault / Remedy
1 = HF sender	
Each test with attenuated and unattenuated HF sensor	- Required display: **OK*** for attenuated HF sensor **OK** for unattenuated HF sensor
Attenuated means: Closed pressure-operated switch (Tire pressure greater than switching pressure) above the HF sensor	- If display shows: **defective**, there is a fault in the HF sensor or in the line to the control unit. Refer to menu 1 (fault memory) to remedy faults for fault code 1 - 4
Unattenuated means: a) Open pressure-operated switch (Tire pressure less than switching pressure) above the HF sensor or b) neither of the pressure-operated switches above the HF sensor	
2 = ABS speed sensor	- When the wheel is turned, a **bar diagram** appears, dependent on speed. If no signal appears, remedy fault according to information from menu 1 (fault memory) fault code 5 - 8.

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Menu 3 = Input signals
Pressure switch

Important notes

- A defective pressure-operated switch adopts a condition which is defined by the HF sensor as being a standard operational condition. Example: If the pressure-operated switch diaphragm is deformed, the switch assumes the closed state, therefore OK state, even if the tire pressure is too low.

- The HF sensor must be tested and OK before the pressure-operated switch can be diagnosed correctly.

Component to be tested/Remarks	Preconditions Fault, Remedies
Pressure switch	
2 pressure-operated switches (offset by 180°) must be checked per wheel	Align pressure-operated switch with HF sensor. Then a) tire pressure* greater than switching pressure Required display: **CLOSED** If the **"OPEN"** display appears, - the distance or offset between switch and HF sensor is too great or - the pressure-operated switch is defective b) Tyre pressure* less than switching pressure Required display: **OPEN** If the "CLOSED" display appears, the pressure-operated switch is defective. * For practical purposes, the test pressures as used in the short test (Page 44-28) are used as tire pressures.

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Menu 1* = Events

Read out the tire pressure loss event memory

Important notes

From control unit version 02 on, the RDK control unit contains an event memory which stores data on any pressure losses at one or more tires during the last 8 journeys made by the vehicle. It also indicates the road speed at which the event occurred, and whether either one or two pressure-sensing switches were open.
This event memory permits conclusions to be reached regarding **unnatural pressure losses** at one or more wheels. Eliminate the cause of any unnatural pressure loss immediately.
Possible causes are stated on Page 44-26.

Of the 8 recorded journeys, journey 8 is the most recent.

When the event memory is read out the most recent journey, that is to say journey 8, is shown on the system tester's display. The event memory cannot be erased.

If the > button is pressed, the next wheel for which a tire pressure loss event was recorded will be displayed, or if no other wheel was affected during this journey, the previous journey appears on the tester's display panel.

Event storage: when a new journey is started (after the ignition has been switched off), journey No. 1 is erased from the event memory and the previous journey Nos. 8 to 2 moved up to become journey Nos. 7 to 1.

* Additional RDK menu from control unit version R 02 on (introduced during the 1991 model year). This would normally have the serial number Menu 4, but since the tester only has selector buttons 1, 2 and 3, the menu at the top of the display, in this case the event menu, starts again at No. 1.
To change from one Menu 1 to the other (Event or Fault memory), page forward or back with the > or < keys.

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Procedure: call up the event menu. Press the > key repeatedly until the event memory is read out in full. The tester indicates this (test end).

Example

Event	Displayed data
Journey - 8 - of 8 (last journey made) Left rear wheel (RL) Pressure loss detected by 2 switches at 270 kph	Drive - 8 - of 8 RL pressure loss 2 switches open v: 270 km/h 168 mph >
Right rear wheel (RR) No pressure loss	< Drive - 8 - of 8 RR no pressure loss >
Left front wheel (FL) Pressure loss detected by 1 switch at 100 kph	< Drive - 8 - of 8 FL pressure loss 1 switch open v: 100 km/h 62 mph >
Right front wheel (FR) Pressure loss detected by 2 switches at 270 kph	< Drive - 8 - of 8 FR pressure loss 2 switches open v: 270 km/h 168 mph
Journey - 7 - of 8 At all wheels No pressure loss	Drive - 7 - of 8 no pressure loss

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Event	Displayed data
Journey - 6 - of 8 At all wheels No pressure loss	Drive - 6 - of 8 no pressure loss
Journey - 5 - to journey - 1 - of 8 No pressure loss at any wheel	as for journeys 7 and 6 No pressure loss but with the appropriate journey number (Journey - 5 - of 8 Journey - 4 - of 8 etc.)
Display after Journey 1:	Results testing completed return N

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General

As of MY '84, the Porsche 928 S is optionally available with anti-lock system (ABS) (option M593). As of model year 1986, the 928 S is fitted with ABS as standard equipment worldwide

The anti-lock braking system represents an important contribution to the enchancement of active safety in the vehicle.

The system prevents the wheels from locking when the brakes are applied, thus assuring full steerability and directional stability. **Furthermore, the braking distance is optimized under all road conditions.**

However, it is still the responsibility of the driver to adapt his driving to road and weather conditions and to the prevailing traffic situation.

The decisive advantage offered by ABS lies in the stability and maneuverability of the vehicle in moments of danger - when the brakes are fully applied, even in a curve.

It is not possible to retrofit ABS in cars built before model year 84, as the body has undergone a number of changes since then.

Modifications, 86 models onward

As of model year 1986, the 928 S is fitted with ABS as standard equipment worldwide. At the same time, the following modifications were incorporated.

Optimization of plug-in connectors of speed sensors to cable. The cable routing has also been modified.

Number of teeth on impulse ring reduced from 90 to 45 (improved signal registration).

ABS control unit changed (adaption to impulse ring with 45 teeth). **When replacing, ensure that the correct control unit is used. The only outward differences of the control units are the Part No. and Bosch part no., respectively. Observe correct usage references acc. to the spare parts catalog.**

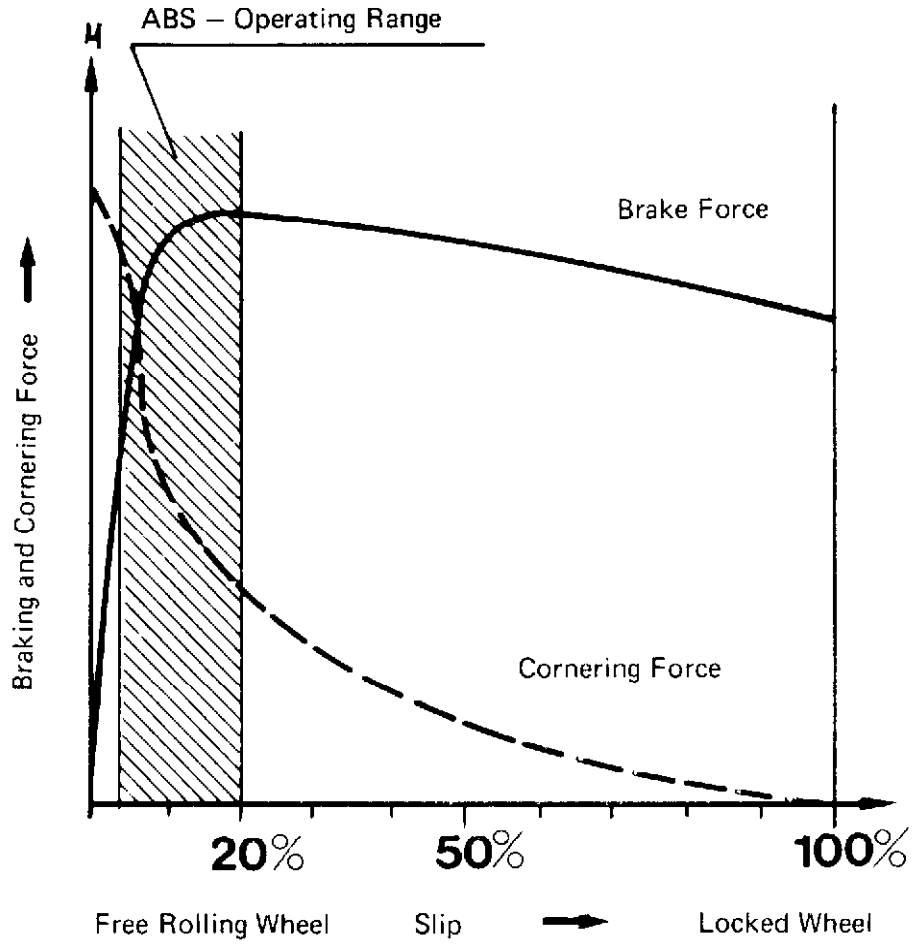
Modifications as of MY '90

Starting with MY '90, the 928 is fitted with a PSD (electronically controlled Porsche limited slip differential). For details, refer to page 45 - 08.

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DIRECTIONAL CONTROL AND STEERABILITY WHILE BRAKING

Acceleration and braking forces have to be transmitted to the road surface by the tires. When a free-rolling wheel is slowed down by applying the brakes, there is slip, i. e. the difference between wheel circumferential speed and vehicle speed. The wheel circumferential speed will be slower than the vehicle speed.



The diagram shows the interrelations of braking force, cornering force and slip. An increase in braking force causes a very fast reduction in cornering force and consequently in directional control and steerability of wheels.

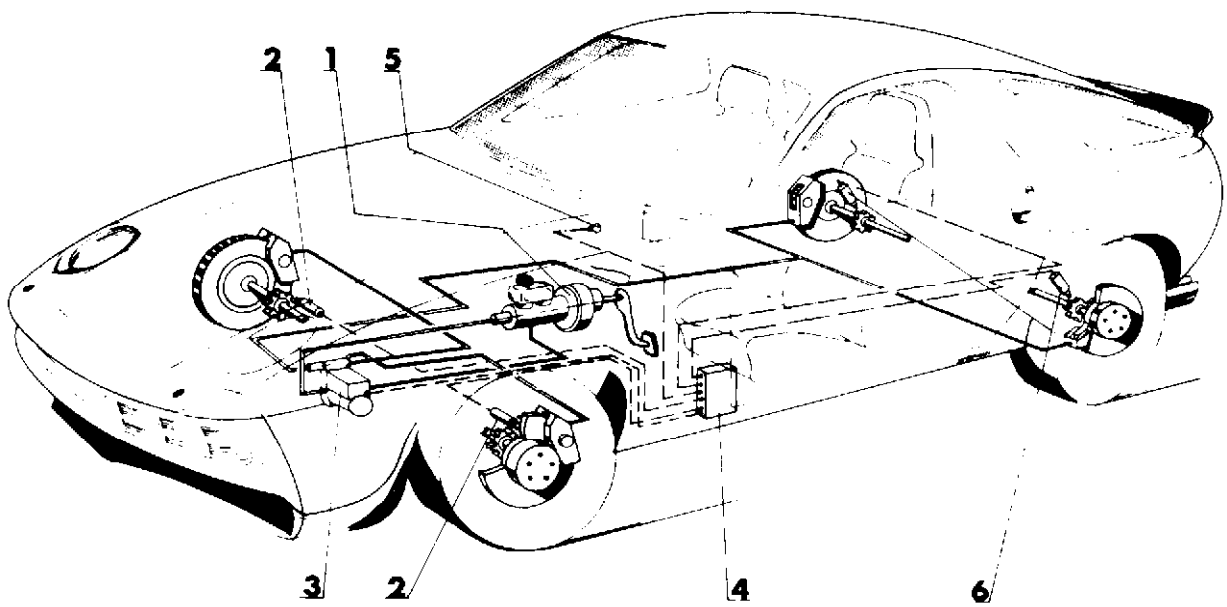
It is well known that absolutely no steering correction is possible when wheels have locked (100 % slip) – the car slides straight ahead in spite of turned front wheels. The operating range of ABS is designed to always provide sufficient cornering force with simultaneous introduction of maximum possible braking force.

ABS regulates the braking pressure in a range of 4 to 20 % slip (car moving straight ahead).

DESIGN

The major components of ABS are: hydraulic unit,
electronic control unit,
four speed sensors * and
wire harness with relays and
overvoltage tripout
(on central electric board).

These components are integrated in the conventional braking system of cars beginning with 1984 models. The conventional braking system of cars beginning with 1984 models has been changed as compared to that of older models in brake circuit division (now by axles), stepped brake master cylinder (piston diameter of both pistons formerly the same) and brake force regulator (see page 47 - 18 a).



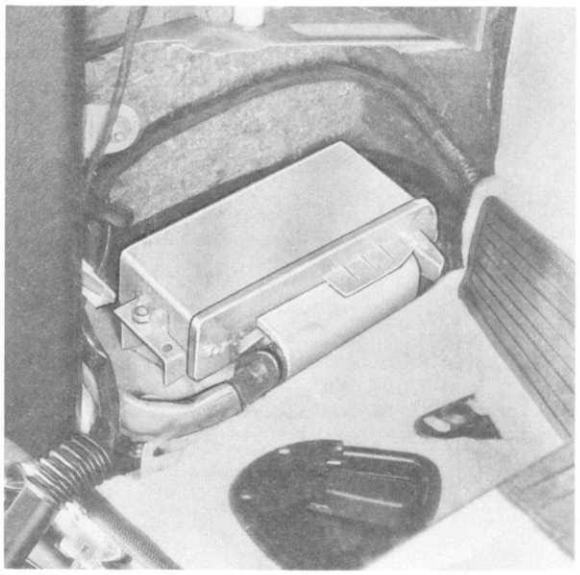
1 – Brake booster with tandem master cylinder
2 – Front speed sensors *
3 – Hydraulic unit (with screwed in brake force regulator, pump motor and valve relay)
4 – Electronic control unit
5 – ABS indicator lamp
6 – Rear speed sensors *

* A pulse gear belongs to each speed sensor. Pulse gears are pressed on front wheel hubs of front axle and machined on axle shafts of rear axle.

A B S COMPONENTS

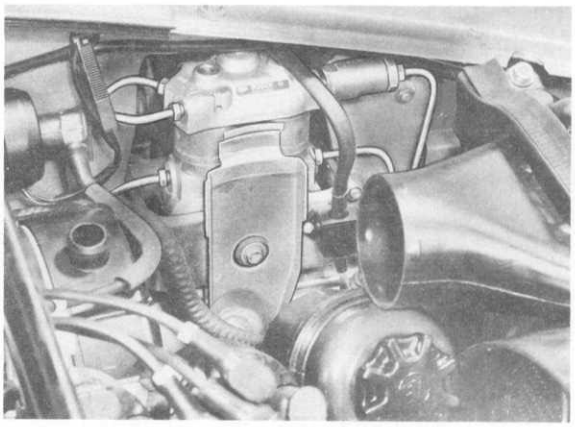
A B S Control Unit

The electronic control unit is located above the hood release handle on driver's side of car (above central electric board in RHD cars).
The control unit uses the speed sensor signals to calculate the necessary control and regulation commands for the hydraulic unit.



Hydraulic Unit

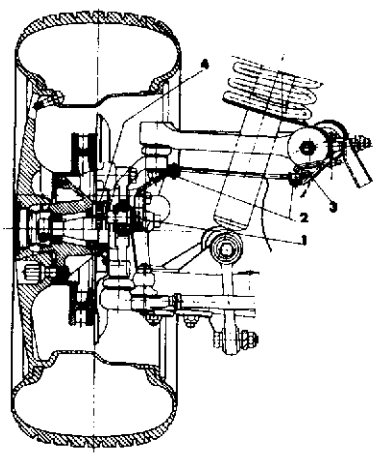
The hydraulic unit is located on the left front wheel house wall. It processes the electric signals coming from the electronic control unit.
The hydraulic unit can change the hydraulic pressure to the wheel brake cylinders independently of pressure in the brake master cylinder. However, a higher pressure than that of the brake master cylinder is not possible.
Depending on the amperage, with which the electric solenoid valves are activated, the hydraulic pressure in wheel brake cylinders can be



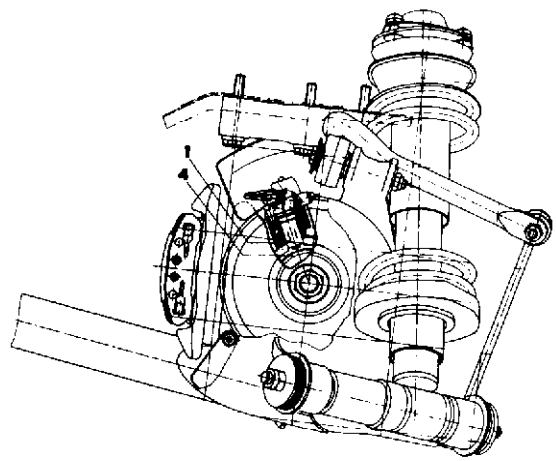
increased	– pressure building-up phase,
maintained	– pressure holding phase, or
reduced	– pressure dropping phase.

Speed Sensors

Speed sensors are arranged on all four wheels. These inductive sensors are held in area of pulse gear rings of front wheel hubs or wheel end shafts on rear axle and produce an alternating voltage for each pulse tooth. This alternating voltage changes its frequency to indicate speed, acceleration and deceleration of wheels, and is processed in the control unit.



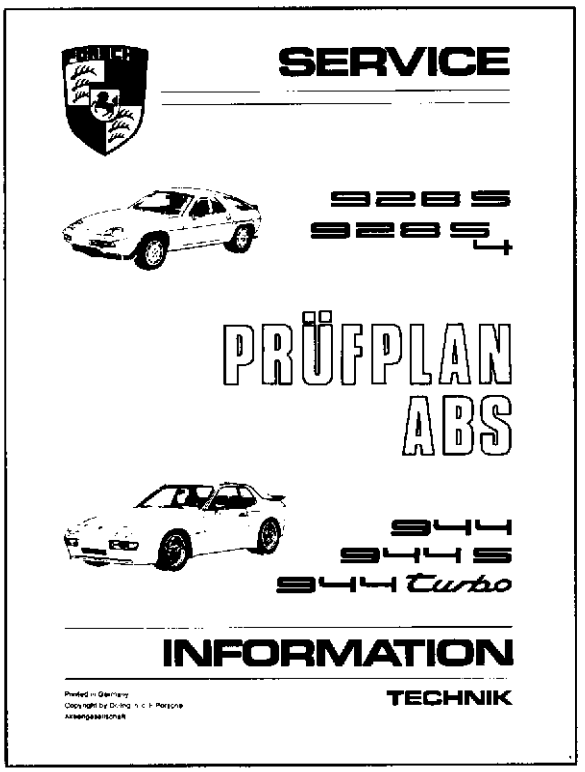
1 – Speed sensor
2 – Wire holder
3 – Speed sensor wire
4 – Pulse gear ring



Important information on troubleshooting and ABS test program

General

- After certain repairs to the ABS system (refer to functional check on page 45 - 07), a test program using an ABS tester must be run. The ABS test plan, Print No. WKD 493 720, is required for this test operation and for troubleshooting.

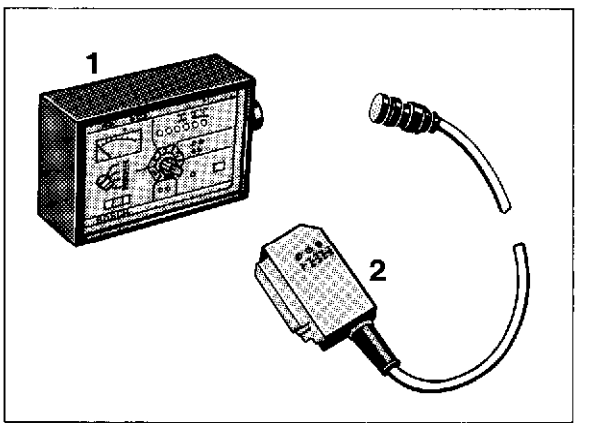


- This ABS test plan describes trouble-shooting and ABS testing, respectively, with both testers, i.e. Bosch K 7 (VAG 1516) and Bosch ABS 2-LED.

- **Vehicles with PSD** may only be tested with the ABS 2-LED tester in conjunction with the 55-pin adapter lead (refer to drawing 499-45).

ABS testing on vehicles with PSD

- Following repairs affecting the ABS system (cf. page 45 - 07), a functional test using the ABS 2-LED tester must be run.



499-45

1 = ABS 2-LED tester

2 = 55-pin ABS 2-LED adapter lead. Same lead as for ABS testing on the 911 Carrera 4. Manufacturer and supplier = Bosch. For address and order no., refer to the Repair Manual 911 Carrera 4, Repair Group 45.

Important information for repairs of vehicles fitted with ABS

When working on vehicles equipped with ABS, observe the following items:

Welding

When welding with arc welding equipment, disconnect the connector of the electronic control unit.

Painting

During paint refinishing, the electronic control unit may be exposed to a temperature of max. 95 deg. C for brief intervals and to max. 85 deg. C for longer periods (max. 2 hours).

Charging the battery

When quick charging the battery, disconnect it from the vehicle wiring.

Jump starting

Do not use a quick charger for starting the engine.

Multiplug for electronic control unit

Never disconnect or reconnect the multiplug to the electronic control unit while the ignition is on.

Checking the ABS operation

If service operations not directly related to parts of the ABS have been carried out on the brake system, a simple functional check is sufficient. I.e. after starting the engine, the warning lamp in the instrument cluster must go off if the ABS system is o.k. Operations of this type include replacement of brake pads, brake hoses, brake discs, brake booster, tandem master cylinder, brake cables and components of the parking brake as well as brake pipes that are not screwed into the hydraulic unit.

When performing service operations on the hydraulic unit*, electronic control unit*, on rpm sensors and/or the wiring harness or when replacing units, e.g. during accident repairs, the operation of the ABS system must be checked with the ABS tester.

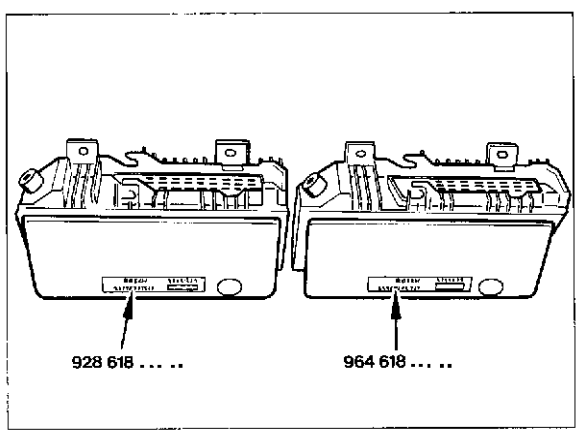
* Hydraulic unit and electronic control unit must neither be repaired nor dismantled.
The electronic control unit checks itself via a self-diagnosis routine. For this reason, checking the control unit is only possible or required, respectively, if an ABS test is performed and only if tester version Bosch K 7 (VAG 1516) is used.

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Vehicles with PSD

The lock control assembly is located on an additional PCB in the ABS control unit. This PSD/ABS control unit has 55 pins. Previous ABS control unit versions had 35 pins. When repairs are required, make sure the PSD/ABS control unit is not confused with the PDAS/ABS control unit fitted to the 911 Carrera 4.
To tell the two versions apart, refer to the Part Nos.

Control unit for 928 with PSD = 928 618... ..
Control unit for 911 Carrera 4 = 964 618... ..



610-D39/45

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Notes on ABS troubleshooting for vehicles with PSD

General

PSD = Electronically controlled Porsche limited-slip differential.

One control unit controls both the PSD and ABS. The PSD is accommodated on an additional printed-circuit board in the ABS control unit.

Not only PSD system faults are stored in the ABS / PSD control unit, but also some ABS system faults.

Fault displays via the instrument cluster

On vehicles with PSD, an ABS fault is indicated not only by the ABS warning lamp, but also by a plain-text display in the instrument cluster (ABS off).

ABS faults automatically lead to deactivation of the PSD.
In this case, the display in the instrument cluster changes between:

ABS off

and

PSD off

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Possible fault displays via system tester 9288

DTCs of the PSD and ABS

DTC	Fault type	System allocation
11	Transverse lock valve	PSD
12	Lateral acceleration sensor - short circuit/discontinuity	PSD
13	Lateral acceleration sensor - signal implausible	PSD
14	Transverse lock - deviation	PSD
15	Control unit - defective	ABS/PSD
21	Wheel speed sensor, front left	ABS/PSD
22	Wheel speed sensor, front right	ABS/PSD
23	Wheel speed sensor, rear right	ABS/PSD
24	Wheel speed sensor, rear left	ABS/PSD
31	ABS valve, front left	ABS
32	ABS valve, front right	ABS
33	ABS valve, rear axle	ABS
34	Valve relay (hydraulic unit)	ABS/PSD
35	Return pump (hydraulic unit)	ABS

Notes on troubleshooting

Troubleshooting / fault description for the above faults are explained under PSD diagnosis/Trouble-shooting in Repair Manual Vol. 3 (Transmission) (Page D39-223).

Faults occurring in the high-pressure hydraulics of the PSD (lock operation) are not stored in the DTC memory of the ABS / PSD control unit. Troubleshooting / fault description is **also** included in Repair Manual Vol. 3 (Page D39-247).

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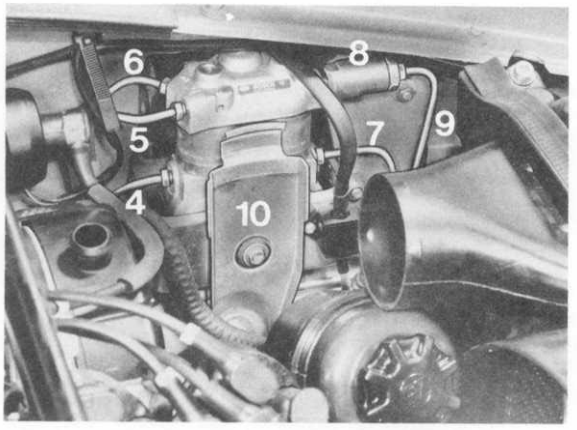
REMOVING AND INSTALLING HYDRAULIC UNIT

Removing

1. Turn off ignition and disconnect battery ground wire on body.

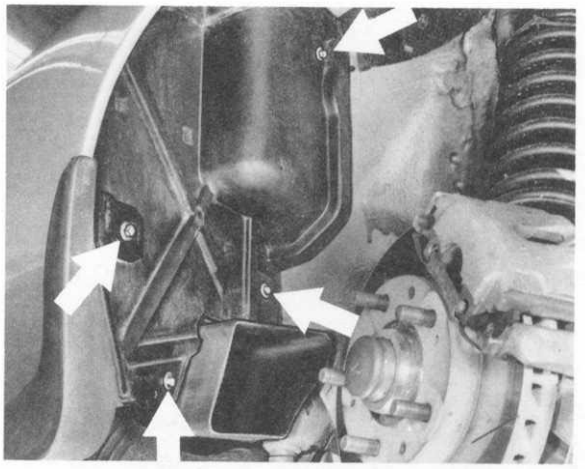
2. Remove left intake hose on air cleaner, loosen power steering supply tank on bracket (hoses remain connected), pull off ignition leads on ignition coil and take off left front wheel.

3. Disconnect brake lines as well as brake pressure regulator (no. 4 – 9) on hydraulic unit.
   This is done by uncliping brake lines in holders on wheel housing (locks are opened from above).
   Insert plugs in open brake lines and connections immediately (danger of dirt entering system).
   If plugs are not available for brake lines, first drain tank and cover lines.

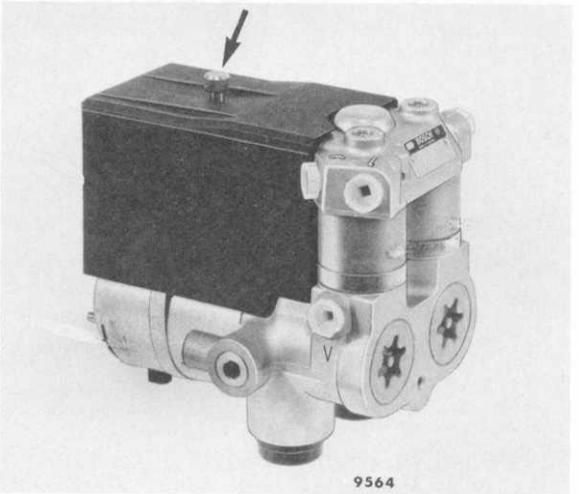


4 – From brake master cylinder, front wheel circuit (code V)
5 – Brake line front left (code l)
6 – Brake line front right (code r)
7 – From brake master cylinder, rear wheel circuit (code H)
8 – Brake pressure regulator
9 – Brake line rear (code h)
10 – Hydraulic unit console with spot-welded bracket for power steering supply tank

4. Remove wheel house cover.



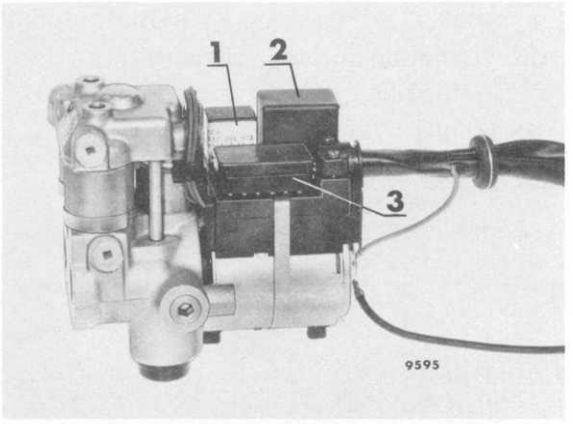
5. Remove cover.

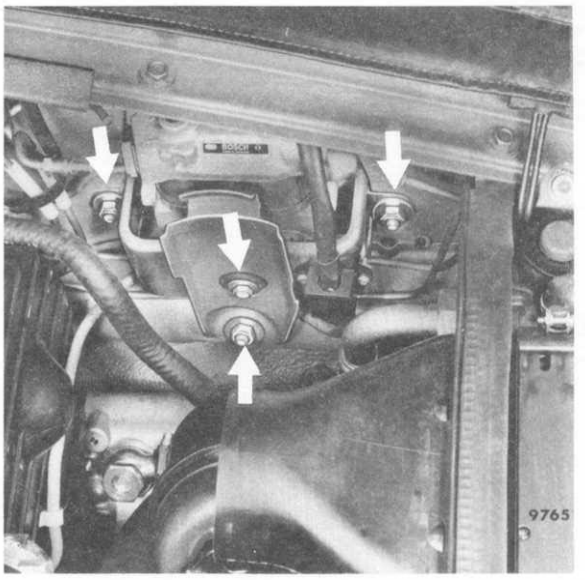


6. Unscrew cable release and take off 12-pin plug (no. 3).

Note:

Both relays for pump motor (2) or solenoid valves (1) can be replaced (see page 45 - 6).

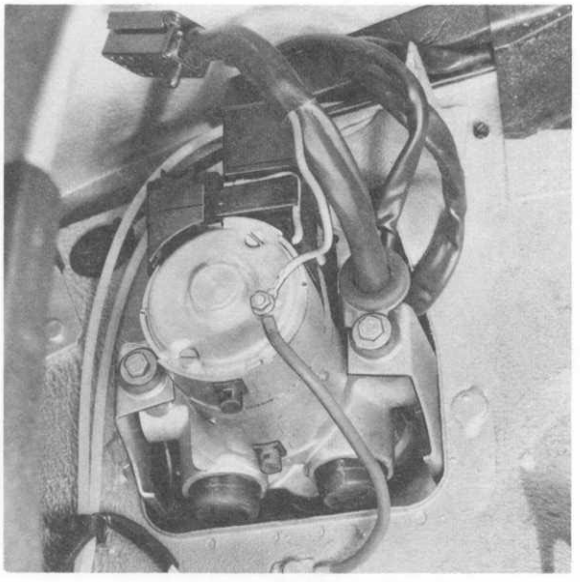


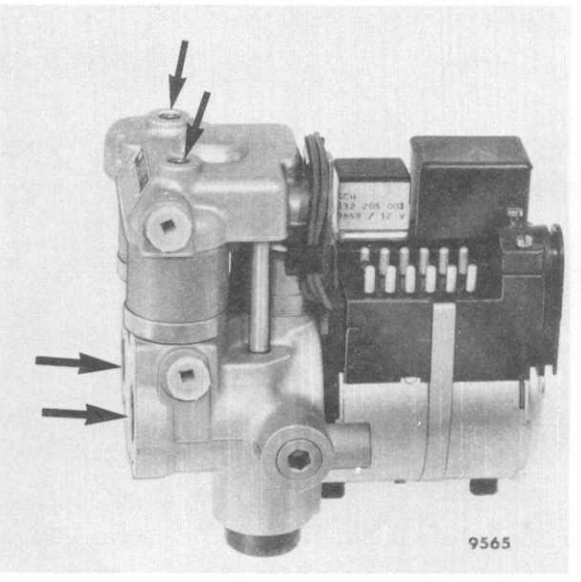


Note:

Never loosen or tighten bolts marked with arrows.

7. Disconnect ground wire on pump motor and loosen two mounting bolts.

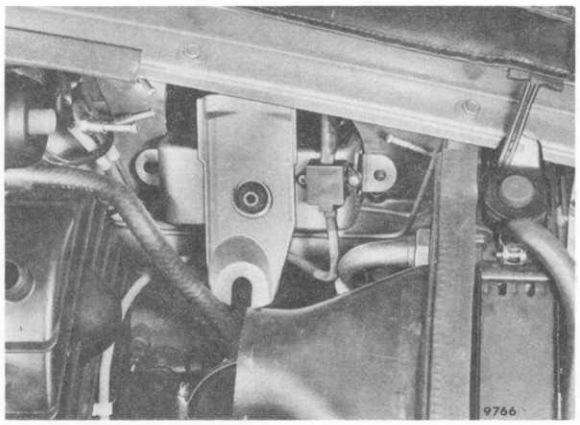




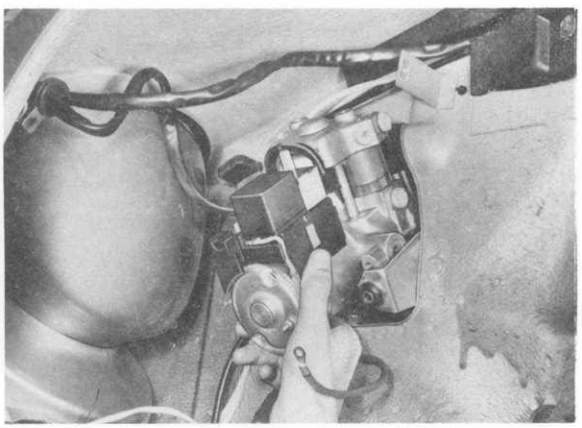
8. Loosen mounting bolt as well as bracket for hydraulic unit.
   Run out hydraulic unit (see installation points 1 + 2).

Installing

1. Tilt down hydraulic unit bracket on wheel side.



2. Move hydraulic unit into bracket from wheel side and install two mounting bolts (position of console as described in point 1).



3. Mount hydraulic unit bracket on wheel housing wall (three self-locking nuts).

4. Finish installation of hydraulic unit on bracket. Tighten three mounting bolts.

5. Mount brake pressure regulator and brake lines on hydraulic unit in correct position. If applicable, hold brake lines in brackets on wheel housing wall with clips and engage locks.

Note:

Make sure brake lines are routed correctly.

6. Connect 12-pin plug and secure cable release.
   Mount cover on hydraulic unit.

7. Mount wire harness on hydraulic unit bracket (loosen right bolt again).
   Connect ground wire on pump motor.

8. Bleed brakes in order of stepped brake master cylinder, push rod brake circuit (front wheels) and intermediate piston circuit (rear wheels) and check for leaks. Bleeding procedures are same as for cars without ABS.

9. Mount wheel house cover, front wheel, power steering supply tank, ignition leads on ignition coil and intake hose.
   Connect battery ground wire.

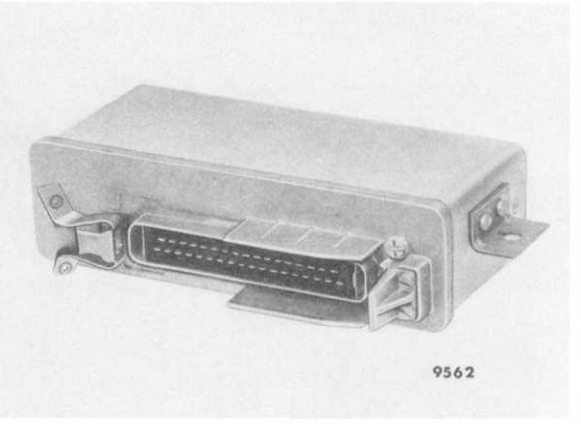
10. Check operation with an ABS tester.

REMOVING AND INSTALLING ELECTRONIC CONTROL UNIT

R e m o v i n g

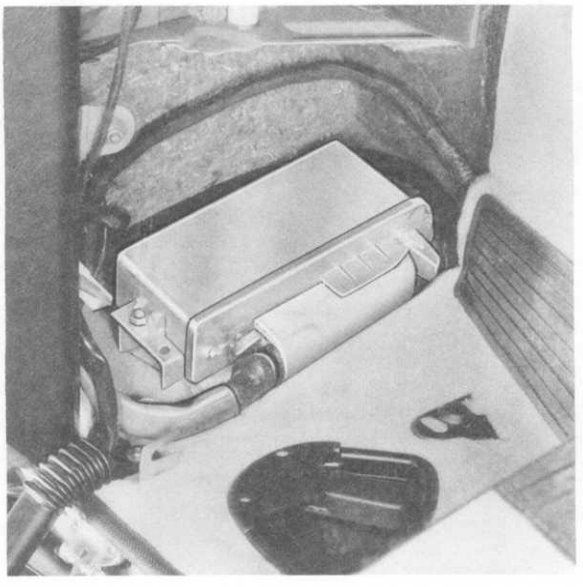
N o t e :

In left-hand drive cars, the electronic control unit is mounted on the driver's side above the hood-release handle on the side panel. In right-hand drive cars, the control unit is located above the central electrics unit.
Always switch the ignition off before disconnecting the multi-pin plug from the control unit or removing the control unit.



1. Move seat to rearmost position and raise steering wheel (to facilitate work).

2. Open retaining spring (clamp) and disconnect plug from electronic control unit.

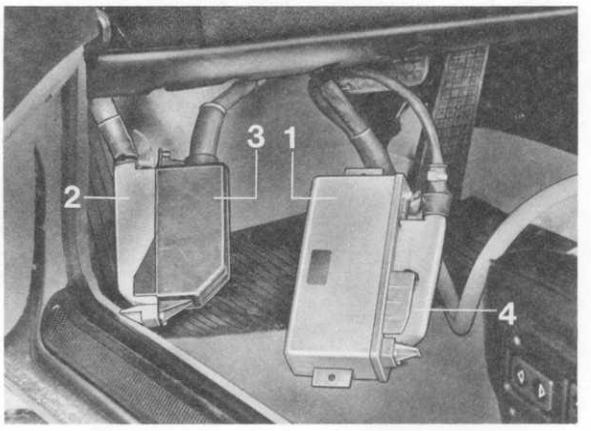


3. Unscrew mounting nuts and remove electronic control unit from holder.

I n s t a l l i n g*

1. Mount electronic control unit on holder.

2. Connect ABS tester with plug of electronic control unit connected to plug of tester. Push plug of tester onto electronic control unit, the retaining spring must engage with an audible click.



* Control unit modified as of model year 86. Ensure correct unit is installed when replacing (see page 54 - 01).

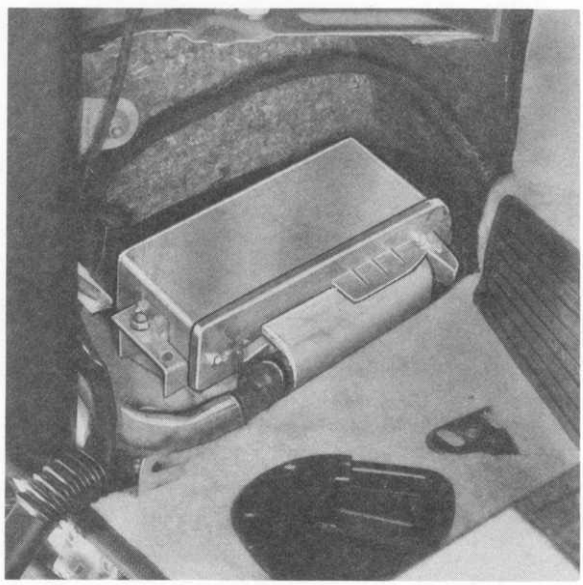
Removing and installing electronic control unit

Removal

Note

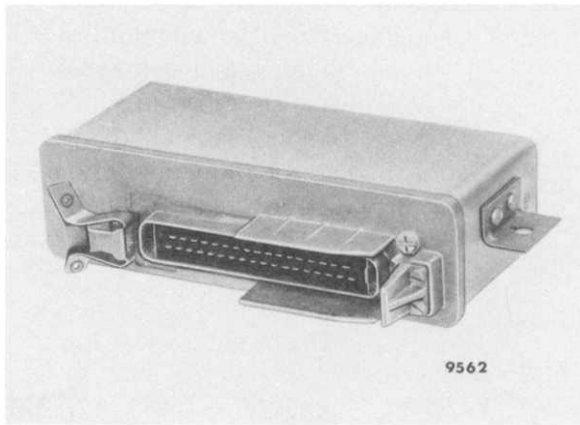
When disconnecting the multiplug from the control unit or when removing the control unit, the ignition must be switched off.

1. Actuate retainer spring (clamp) and pull connector off the electronic control unit.



9537

2. Take electronic control unit off the bracket after having undone the fastening nuts.



9562

Installation

Note

Be sure to use correct control unit when replacing the units as it may be confused with other ABS control units.
The only outward differences of the control units are the Bosch and Porsche part nos., respectively.

1. Fit electronic control unit bracket.

2. Attach multiplug safely to electronic control unit.
   The retainer spring must engage into the plug with an audible click.

Printed in Germany – XXIX, 1992

Removing and installing relay

General

The anti-lock system is fitted with three relays.

The ABS relay (power supply for electronic control unit and scavenge pump motor relay) is located on the Central Electrical System.

The relay for the solenoids and the relay for the pump motor are located below the cover of the hydraulic unit.

ABS relay

Removing and installing

1. Flip up cover of Central Electrical System in the passenger's footwell.

2. With the ignition off, pull out and insert ABS relay, respectively (electronic relay with overvoltage protection).

Note

The relay is located in the lower row of the Central Electrical System.

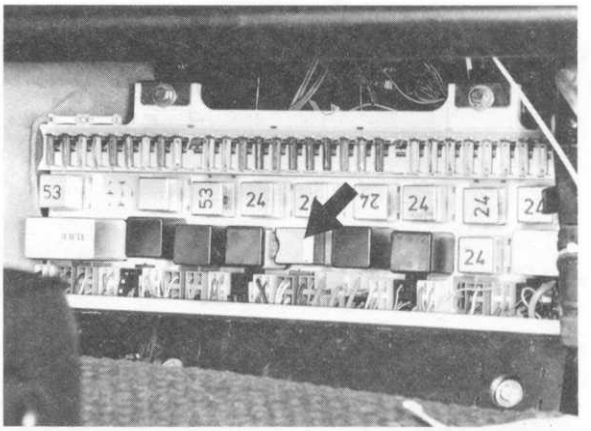
Initial version (up to end of MY '84)
Relay No. XI (arrow).

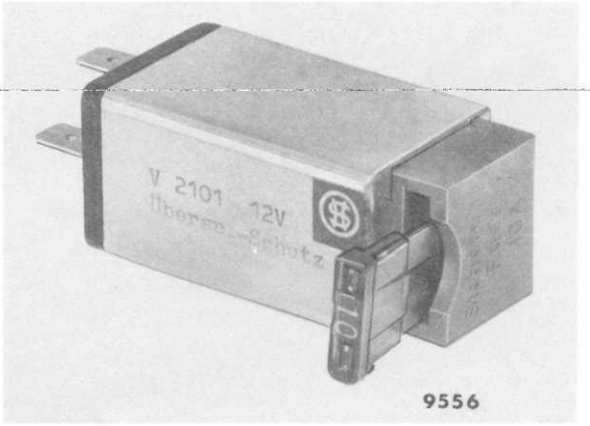
The top of the relay is fitted with a 10 amps fuse insert (little fuse) that protects the ABS circuit.

Modified version
(MY '85 to MY '89) Relay No. XVII

Starting with MY '85, the fuse is no longer located inside the relay but rather in the Central Electrical System. This fuse carries the reference no. 16. It also is a 10 A fuse insert (little fuse).

Current version as of MY '90
Relay No. XV
This fuse carries the reference no. 28





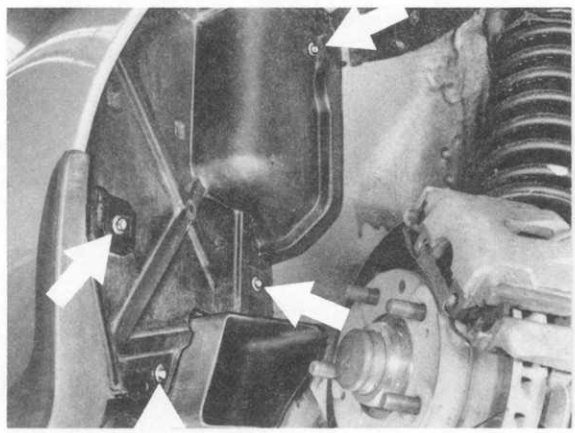
9556

Printed in Germany – XXIX, 1992

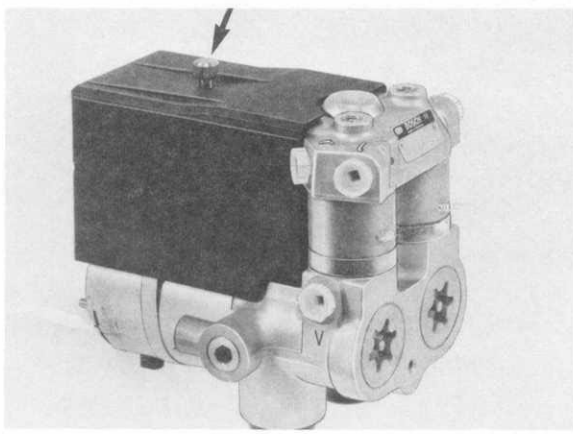
Pump motor relay / valve relay

Removal

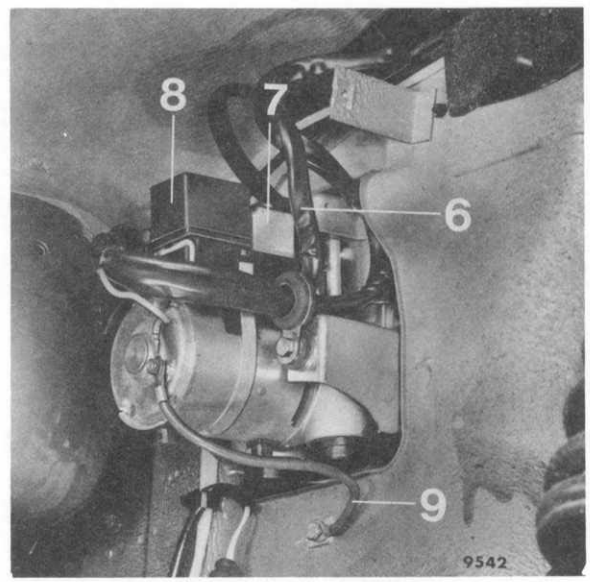
1. Remove the wheel housing cover.



2. Remove the cover hood.



3. Pull out fuse for solenoid valves No. 7 or for the pump motor No. 8 with the ignition switched off.



Installation

Proceed in reverse order.

Printed in Germany XXXV, 1995

REMOVING AND INSTALLING SPEED SENSORS ON FRONT AND REAR AXLES

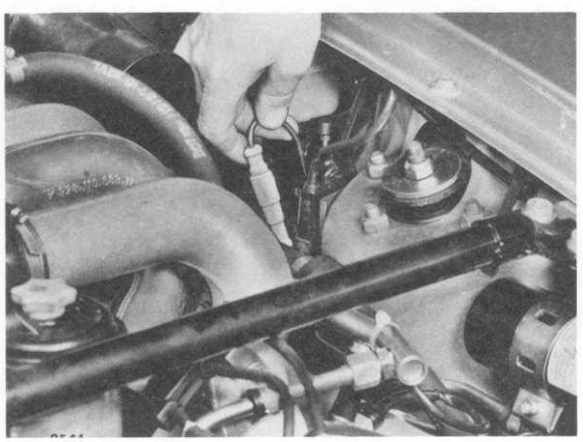
Removing and Installing

Front Axle

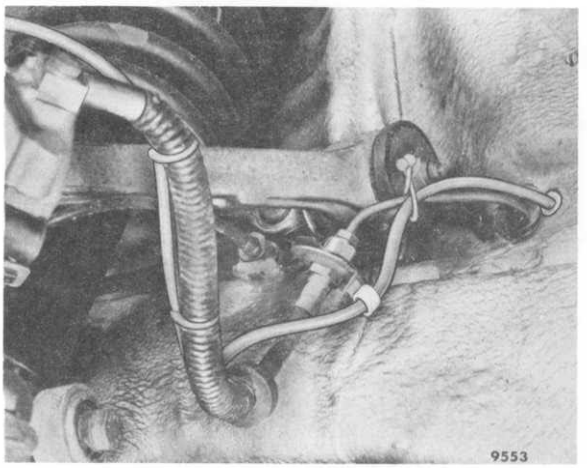
Removing

1. Take off front wheel. Remove intake hose on air cleaner.

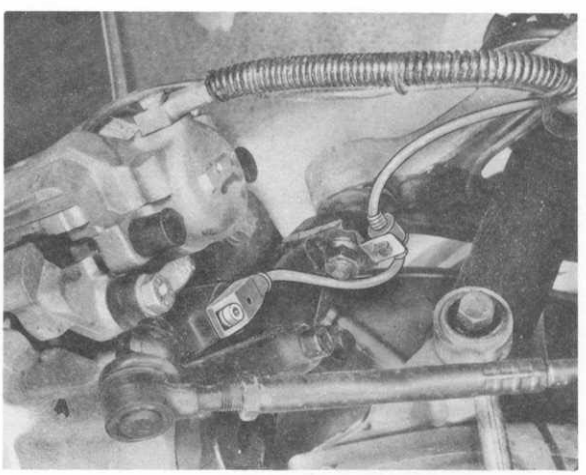
2. Turn off ignition, take wire plug out of holder in engine compartment and disconnect.



3. Remove front exhaust shield (to make procedures easier).
   Unclip wires on wheel housings and pull out with rubber grommet in direction of wheel.
   Also pull out rubber grommet for brake line.

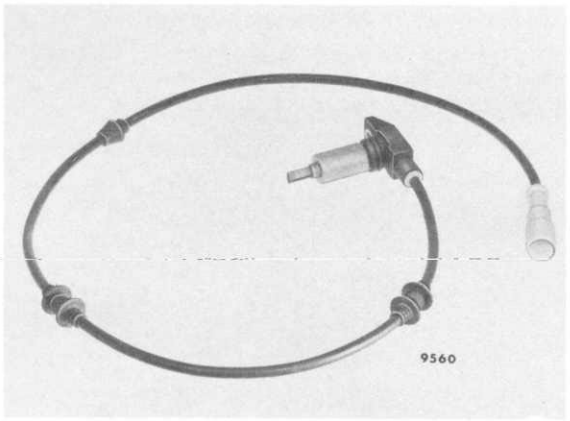


4. Unclip wire on side member and in holders on steering knuckle.
   Loosen socket head screw and pull speed sensor out of steering knuckle.

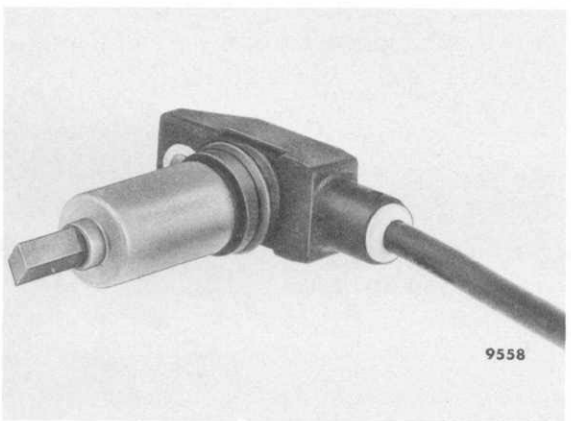


Installing

Note:
- Rubber mounts and grommets on speed sensors are connected with wire covers in precise position.
- Take speed sensors out of protective packaging only briefly before installation (loss of permanent magnetism).
- Make sure that there are no foreign metal particles (burrs) on magnetic edge of speed sensor before installing.



1. Coat speed sensor and bore in steering knuckle with Molykote Longterm 2. Replace O-ring of speed sensor.



2. Insert speed sensor in steering knuckle without application of force and tighten socket head screw to 10 Nm/7 ftlb.

Note:

The distance between speed sensor and pulse gear is given by design and cannot be adjusted.

3. Route wires correctly (insert rubber grommets and clip rubber mount in holder).
Install exhaust shield.
Connect wire plug and press into holder.
Install front wheel and intake hose.

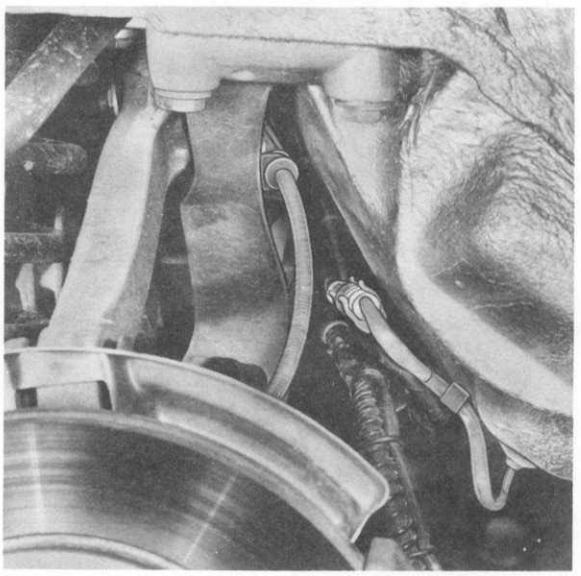
4. Check operation with ABS tester.

Rear Axle

Removing

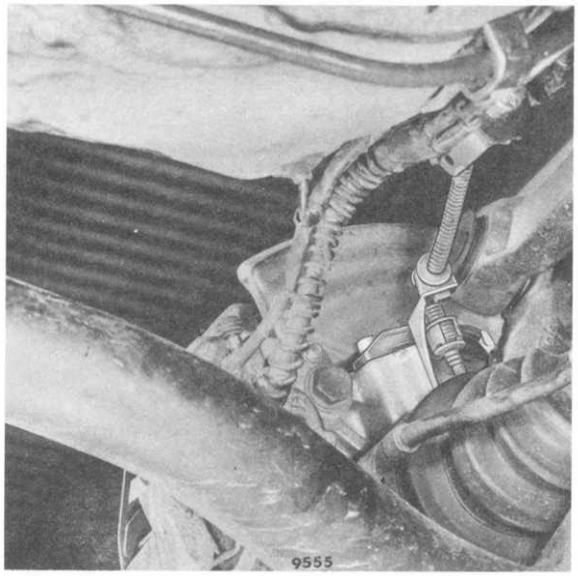
1. Take off wheel.

2. Turn off ignition, take wire plug out of holder and unclip wire on rear axle carrier.



3. Disconnect wire plug.

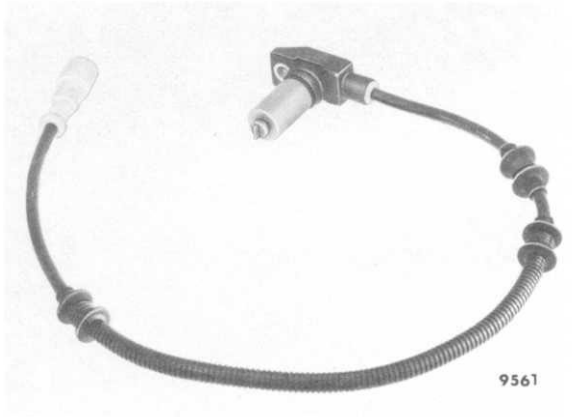
4. Unclip wire in holders on wheel carrier. Loosen socket head screw and pull speed sensor out of wheel carrier.



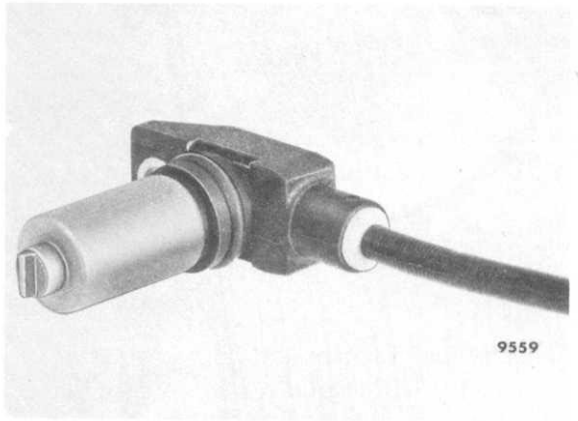
Installing

Note:

- Rubber mounts on speed sensors are connected with wire covers in precise position.
- Take speed sensors out of protective packaging only briefly before installation (loss of permanent magnetism).
- Make sure that there are no foreign metal particles (burrs) on magnetic edge of speed sensor before installing.



1. Coat speed sensor and bore in wheel carrier with Molykote Longterm 2. Replace O-ring of speed sensor.



2. Insert speed sensor in wheel carrier without application of force and tighten socket head screw to 10 Nm/7 ftlb.

Note:

The distance between speed sensor and pulse gear is given by design and cannot be adjusted.

3. Clip wire in holders on wheel carrier and rear axle cross member.

4. Connect wire plug and insert in nolder. Install wheel.

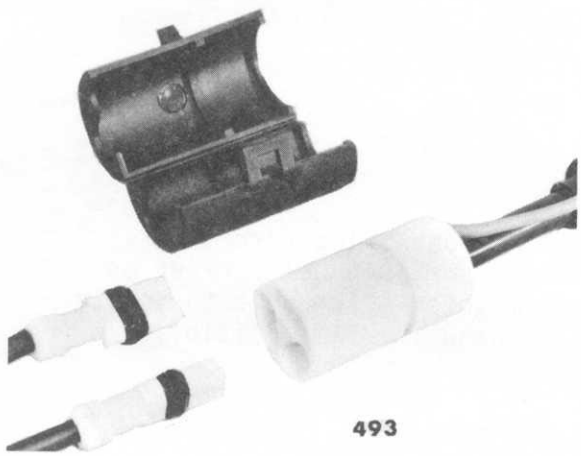
5. Check operation with ABS tester.

REMOVING AND INSTALLING SPEED SENSORS ON FRONT AND REAR AXLES, 86 MODELS ONWARD

Front Axle

Removing

1. With ignition switched off, open ABS cable plug-in connector on the steering knuckle and disconnect.



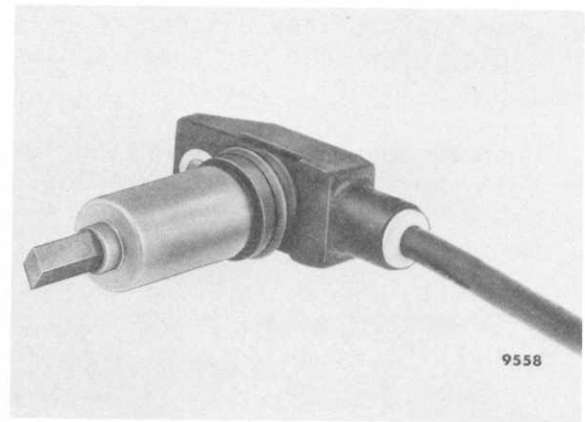
2. Unscrew mounting bolt (Allen bolt) of speed sensor and withdraw sensor from steering knuckle.

Installing

Note:

- Do not remove speed sensor from its protective package until shortly before installation (loss of permanent magnetism)
- Before installation, check that no foreign bodies (metal shavings) have been caught on the magnetic edge of the speed sensor.

1. Coat speed sensor and hole in steering knuckle with Molykote Longterm 2. Renew speed sensor O-ring.



2. Without using force, insert sensor in steering knuckle and tighten Allen bolt to secure. (Torque 10 Nm (7ftlb)).

Note:

The distance between speed sensor and impulse ring is a design feature and cannot be adjusted.

3. Reconnect cable and place in holder on steering knuckle.

4. Check operation with ABS tester.

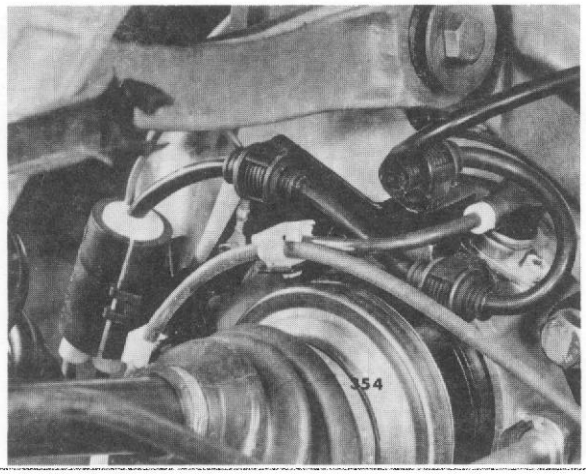
Rear Axle

Removing

1.Remove wheel.

2.With ignition switched off, open ABS cable plug-in connector on wheel carrier and disconnect cable. Open clip for speed sensor cable.

Unscrew speed sensor mounting bolt. Make space by withdrawing cable from holder above the mounting bolt.



3.Withdraw speed sensor from wheel carrier.

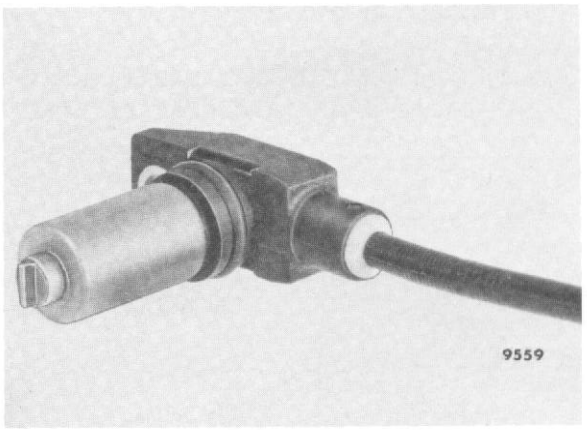
Installing

Note:

- Do not remove speed sensor from protective packing until shortly before installation (loss of permanent magnetism).

- Before installing, check that the magnetic edge of the speed sensor is free of foreign particles (metallic shavings).

1.Coat speed sensor and hole in wheel carrier with Molykote Long-term 2. Renew speed sensor O-ring.



2.Without using force, insert speed sensor in wheel carrier and tighten Allen bolt to secure. Torque: 10 Nm (7 ftlb).

Note:

The distance between speed sensor and impulse ring is a design feature and cannot be adjusted.

3.Place cable in clip on wheel carrier. Close clip. Insert cable in holder above sensor mounting bolt.

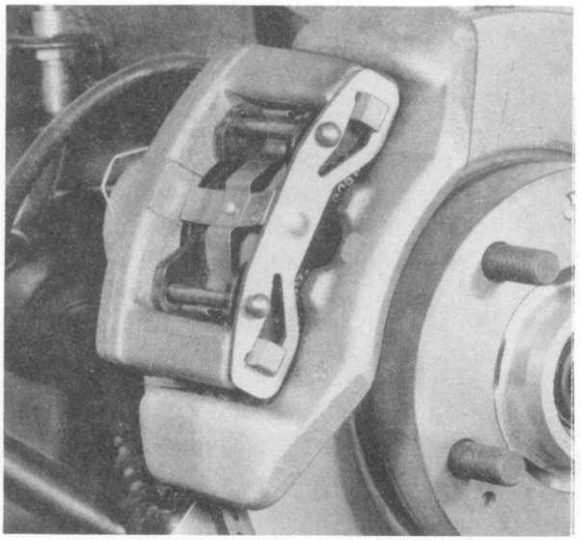
4.Insert plug-in connector and place in holder. Mount wheel.

5.Check operation with ABS tester.

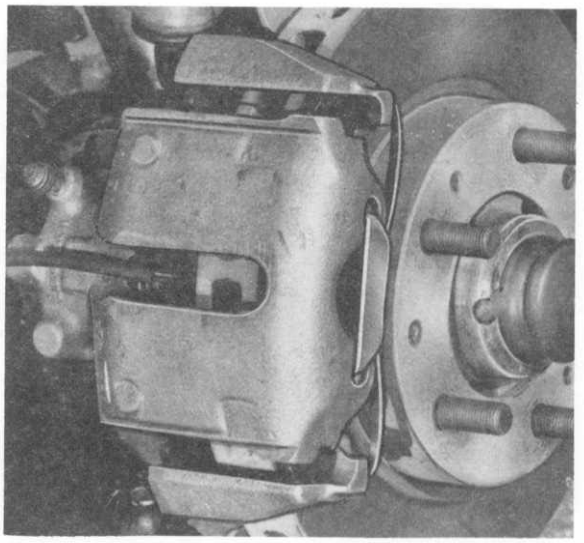
GENERAL

Braking System Until End of Model Year 1985

Until end of model year 1985 and depending on type and model year, the front-axle disk brakes use either sliding or floating calipers. All brake disks are ventilated. The brakes of the 928 S (with floating calipers) have auxiliary ventilation via air guide ducts. In all cars, sliding brake calipers are mounted on the rear axle. Brake pads with differing friction values are used. It is essential to ensure that the appropriate parts are installed (page 46 - 3).



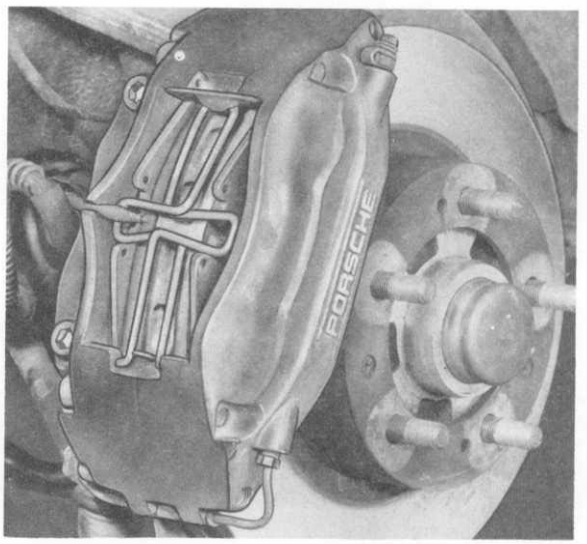
Sliding brake caliper



Floating caliper

Braking System, 86 Models Onward

Four-piston fixed-caliper brakes are fitted on front and rear axles instead of the sliding-caliper (floating or sliding caliper) systems installed in earlier models.



Four-piston fixed caliper

TECHNICAL DATA

Description	Remarks Specifications	Wear Limit
Foot brakes	Hydraulic, dual circuit braking system with disc brakes and diagonal division up to end of 1983 models; axle circuit division since 1984 models, brake booster, floating frame caliper disc brakes on front axle and floating frame or fist caliper disc brakes on front axle. Since 07.12.1977 to end of 1983 models (diagonal division) one brake pressure regulator for each rear axle circuit. Since 1984 models one screw-in brake pressure regulator on brake master cylinder or on hydraulic unit (cars with ABS) for rear axle brake circuit. Since 1984 models optionally extra with ABS, which is integrated in the conventional brake system.	
Brake booster dia. Up to 08.01.1979 Since 09.01.1979	 9 inches 10 inches, internal ratio 3.0 for floating frame caliper disc brakes 10 inches, internal ratio 3.8 for fist caliper disc brakes	
Brake master cyl. dia. Up to 1983 models Since 1984 models	 23.81 mm 23.81/19.05 mm	
Brake pressure regulator	3 versions	
Switching pressure for brake pressure regulator Version I (9" brake booster) Version II (10" brake booster) Version III (10" brake booster and screw-in regulator)	 55 bar 33 bar 33 bar	
Caliper piston dia. Front Rear	 54 mm 36 mm	
Brake disc dia. Front Rear	 282 mm 289 mm	
Eff. brake disc dia. Front – floating frame caliper fist caliper Rear	 220 mm 228 mm 235 mm	

Description	Remarks Specification	Wear Limit
Pad thickness		
Front, floating frame	13 mm	2 mm
floating caliper	13 mm	2 mm
Rear	13 mm	2 mm
New brake disc thickness		
Front, floating frame	20 mm	
grooved disc	20.5 mm	
floating caliper	32 mm	
Rear	20 mm	
Min. thickness after machining *		
Front, floating frame	19.2 mm	18.6 mm
floating caliper	31.2 mm	30.6 mm
Rear	19.2 mm	18.6 mm
Thickness tolerance for brake discs	max. 0.02 mm	
Lateral runout for brake discs	max. 0.05 mm	
Lateral runout for wheel hubs	max. 0.05 mm	
Lateral runout for installed brake discs	max. 0.1 mm **	
Max. surface finish of brake discs after machining	max. 0.006 mm	
Play on brake pedal with brakes bled and engine stopped	10 mm	
Hand brakes (parking)	Mechanical action on both rear wheels (drum brakes)	
Brake drum dia.	180 mm	181 mm
Brake shoe width	25 mm	
Brake surface per wheel	85 cm^2	
Brake liner thickness	4.5 mm	2 mm

*Brake discs must be machined symmetrically, i. e. evenly on both sides.

** See page 46 - 16.

TECHNICAL DATA 86 MODELS ONWARD

Description	Remarks Specifications	Wear Limits
Foot brake	Hydraulic, dual-circuit braking system with separate front/rear axle braking circuits (black/white), brake booster, ventilated brake disks with four-piston fixed calipers front and rear. Push-rod braking circuit for front wheels. A braking-force regulator is bolted on the main brake cylinder or on the hydraulic unit (with ABS system) for the rear-axle braking circuit. Anti-lock braking system (ABS), optional on 86 models, standard on 87 models onward. The ABS is integrated in the standard footbrake.	
Brake booster i_v	10" dia. 4.5 (internal boost ratio) 87 models onward, pedal free travel is shorter	
Brake master cylinder	Tandem cylinder with 2 central valves 23.81/20.64 mm dia.	
Braking force regulator (screw-in regulator) Switchover pressure Reduction factor	 18 bar 0.46	

Description	Remarks Specifications	Wear Limits
Brake disk dia. front	304 mm	
rear	299 mm	
Effective brake disk dia. front	250.8 mm	
rear	246 mm	
Piston dia. in caliper	86 models, each fixed caliper	
front	2 x 42 + 2 x 36 mm	
front	87* models onward each fixed caliper 2 x 44 + 2 x 36 mm	
rear	each fixed caliper 2 x 30 + 2 x 28 mm	
Pad surface per front wheel	126 cm^2	
Pad surface per rear wheel	86 cm^2	
Total pad surface	424 cm^2	
Pad thickness front	13 mm	2 mm
rear	13 mm	2 mm
Brake disk thickness new		
front	32 mm	
rear	24 mm	

* Fixed calipers with pistons of dia. 42/36 mm were installed in some cars (USA, Canada, Australia and Arabian countries) in the 1987 model year.

The front-axle brake calipers with 44/36 mm dia. pistons can be retrofitted in 86 models only in pairs.

Description	Remarks Specifications	Wear Limits
Min. brake disk thickness* after machining front rear	30.6 mm 22.6 mm	30 mm 22 mm
Max. brake disk thickness tolerance	0.02 mm	
Max. brake disk lateral runout	0.05 mm	
Max. lateral runout of installed brake disk	0.1 mm**	
Max. surface roughness after machining	0.006 mm	
Play at brake pedal, brakes bled and engine stopped (footbrake arm without stop)	approx. 10 mm usually (i.e. without any means of support for footbrake arm), determined by permanently set clearance at points inside braking unit	
P a r k i n g b r a k e*** (handbrake)	Drum brakes applied mechanically on both rear wheels	
Parking brake drum dia.	180 mm	181 mm
Brake shoe width	25 mm	
Brake liner surface area per wheel	85 cm^2	
Brake liner thickness	4.5 mm	2 mm

* Brake disks may only be machined symmetrically, i.e. evenly on both sides.

** See page 46 - 16

*** 87 models onward, parking brake liners made of asbestos-free material (Energit 559). The liners can be retrofitted to vehicles earlier than model year 87 (right-hand and left-hand sides).

TORQUE SPECIFICATIONS FOR MECHANICAL PARTS OF BRAKING SYSTEM

Location	Description	Thread	Material	Torque Nm (ftlb)
Panhead screw of clamping nut	Allen-head screw	M 7	10.9	15 (11)
Brake caliper to steering knuckle	Hex screw/cap screw	M 12x1.5	8.8	85 (62)
Brake caliper to wheel carrier	Hex screw/cap screw	M 12x1.5	8.8	85 (62)
Floating caliper to bracket	Guide pin	M 9		15 - 20 (11 - 15)
Brake disk to wheel hub	Hex screw	M 6	8.8	10 (7)
Guard to steering knuckle	Hex screw	M 7	8.8	15 (11)
Locking pawl for handbrake to bearing bracket	Hex screw	M 8	8.8	25 (18)
Propshaft or rear axle to wheel hub	Locknut	VHM 22x1.5	8	460 (336)
Wheel to wheel hub	Wheel nut	M 14x1.5	A1	130 (95)

Location	Description	Thread	Material	Torque Nm (ftlb)
Locking pawl to handbrake lever	Locknut	M 8	8	23 (17)
Guard to wheel carrier	Locknut, Hex bolt	VFM 8 M 6	8 8.8	23 (17) 10 (7)
Speed sensor to wheel carrier and steering knuckle	Socket-head screw	M 6	8.8	10 (7)

Technical data as of MY '92

Designation		Remarks, dimension 928 GTS	Wear limit 928 GTS
Operating brake (foot brake)		Hydraulic twin-circuit brake system with front axle/ rear axle circuit division. Vacuum booster, internally vented brake discs with four-piston fixed caliper on front and rear axles. The pushrod circuit is assigned to the front wheels. ABS standard.	
Brake booster	Ø inch	10	
Boost ratio		4.5	
Brake master cylinder	Ø front	23.81 mm	
	Ø rear	20.64 mm	
Brake booster Vacuum reduction factor		18 bar - 0.46	
Brake disc Ø	front	322 mm	
	rear	299 mm	
Effective brake disc Ø	front	259.6 mm	
	rear	246 mm	
Piston Ø in fixed caliper			
	front	2 x 44 + 2 x 36 mm	
	rear	2 x 30 + 2 x 28 mm	
Brake pad area			
	front	302 cm^2	
	rear	172 cm^2	
Total brake pad area		474 cm^2	
Pad thickness	front	approx. 12 mm	2 mm
	rear	approx. 12 mm	2 mm

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Designation		Remarks, dimensions 928 GTS	Wear limit 928 GTS
Brake disc thickness new	front	32 mm	
	rear	24 mm	
Min. brake disc thickness * after machining			
	front	30.6 mm	30.0 mm
	rear	22.6 mm	22.0 mm
Thickness tolerance of brake disc max.		0.02 mm	
Runout of brake disc max.		0.05 mm	
Runout of wheel hub max.		0.05 mm	
Runout of brake disc when fitted max.		0.1 mm	
Surface roughness of brake disc after machining max.		0.006 mm	
Pushrod clearance (measured at brake pedal plate)		approx. 10 mm**	
Parking brake (handbrake)		Drum brake, acting mechanically on both rear wheels	
Parking brake drum Ø		180 mm	181 mm
Brake shoe width		25 mm	
Brake lining thickness		4.5 mm	2 mm

* The brake disc must only be machined symmetrically, i.e. by a uniform amount on both sides.

** provided normally by preset air gap in brake booster if no support is provided for operating brake lever.

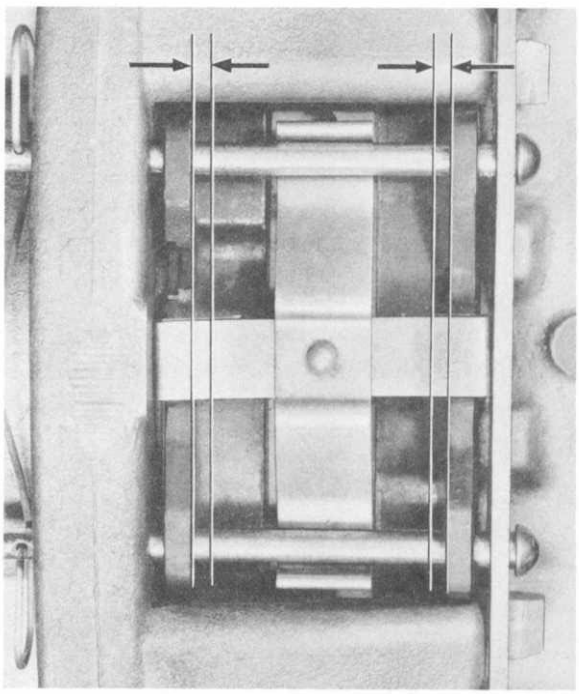
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CHECKING THICKNESS OF BRAKE PADS

All brake pads on one axle must be replaced when "brake pad" indicator comes on, however at latest when pad thickness is worn to 2 mm.

If the indicator lamp reports the brake pad wear, the warning contact (sensor plus wire and plug) must also be replaced.

The complicated and expensive replacement of the warning contact can be avoided by replacing the brake pads at the latest when thickness is 4 mm (or 2.5 mm for version described below).
This will depend on the location of the warning contact in the brake pad. The pad end take-up bore has been moved 1.5 mm in direction of the pad back-plate as from April of 1982. Tolerances on the warning contact have also been limited. The warning contacts must be replaced when the core of the wire has been ground. Replacement is not necessary when only the plastic part of the warning contact has been ground.



Floating Frame Caliper Disc Brake

1. Remove wheels to check the brake pads.

2. Visually inspect brake pads for wear.

3. Visually inspect pads of floating frame disc brakes through opening of housing (frame).

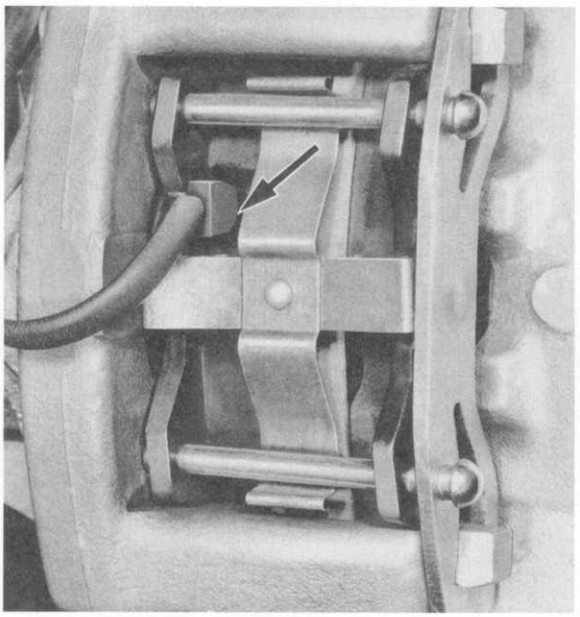
REMOVING AND INSTALLING BRAKE PADS (Floating Frame Caliper Disc Brakes)

Removing

Note

If brake pads can be re-used, mark them for reassembly when removing. Pads must not be moved from outside to inside and vice versa or from right to left wheels. This would cause uneven braking effect.

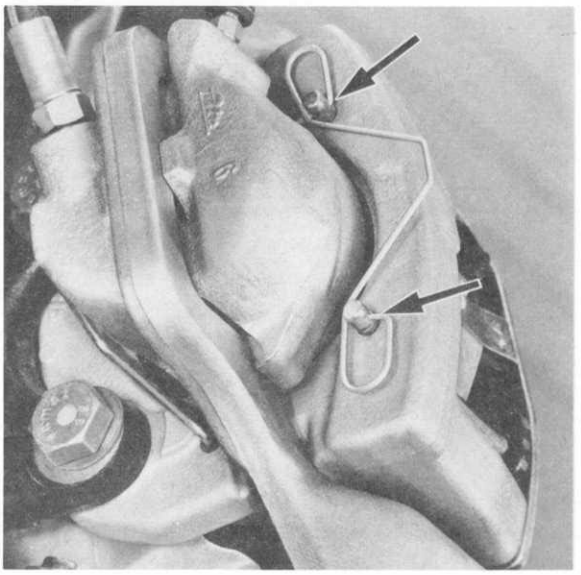
1. Pull warning contact out of pad plate.



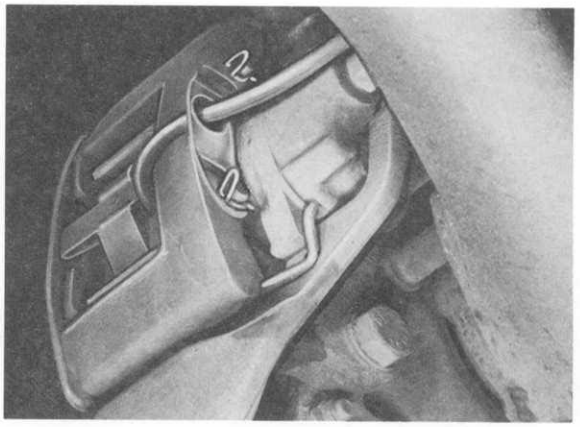
Note

Replace warning contacts when core of wire has been ground through or down. The warning contact can still be used when plastic part of warning contact has traces of wear.

2. Remove spring lock or lock wire with wire guide plate from retaining pins.

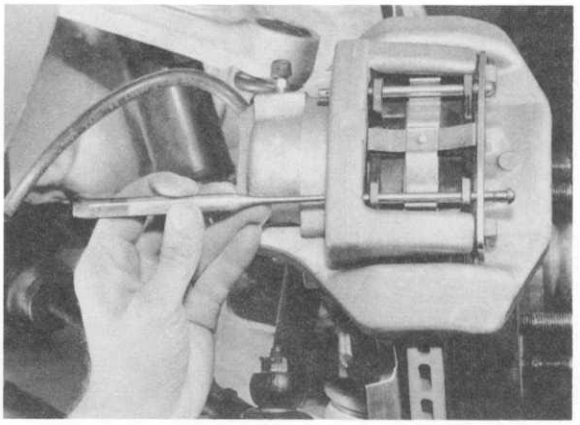


Spring Lock

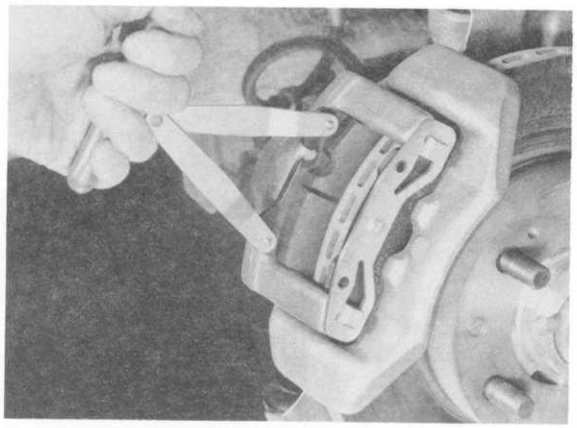


Lock Wire with Wire Guide Plate

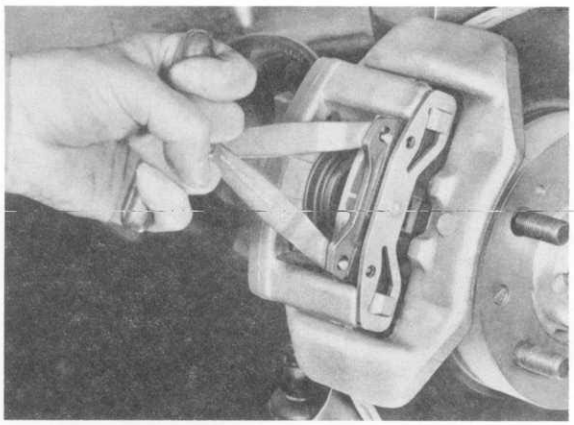
3. Remove retaining pins.



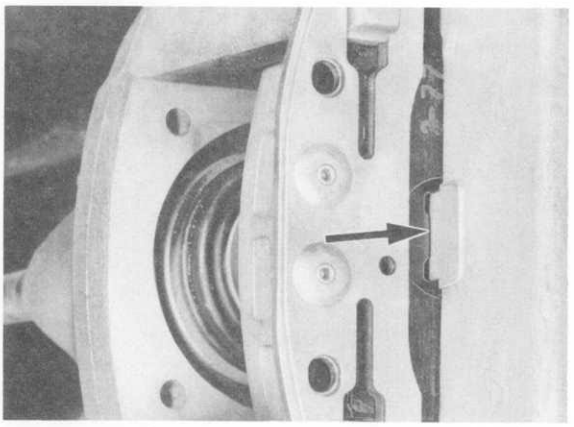
4. Remove inner brake pad with a pulling hook or impact puller.



5. Pull out outer brake pad. This requires pressing out floating caliper frame until brake pad protrudes out of pin on floating caliper frame.



Front Brake Caliper



Rear Brake Caliper

Installing

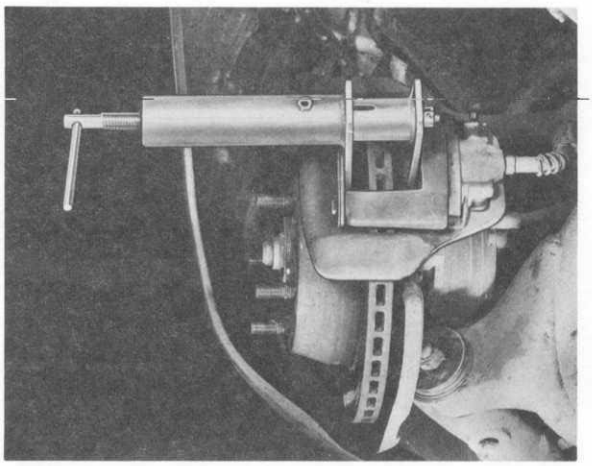
1. Replace brake pads, which show deep cracks, have become loose from backplate or are covered with oil. Also in this case replace all four pads of one axle.

   Brake pads with different friction values are installed depending on version. Make sure that all four wheels have brake pads of same type to correspond with brake caliper combination.

   Floating frame caliper, front axle
   Floating frame caliper, rear axle
   Energit 394 GG/380

   Floating caliper, front axle
   Floating frame caliper, rear axle
   Jurid 226 FF/238

2. Press back piston to initial position with a special tool.



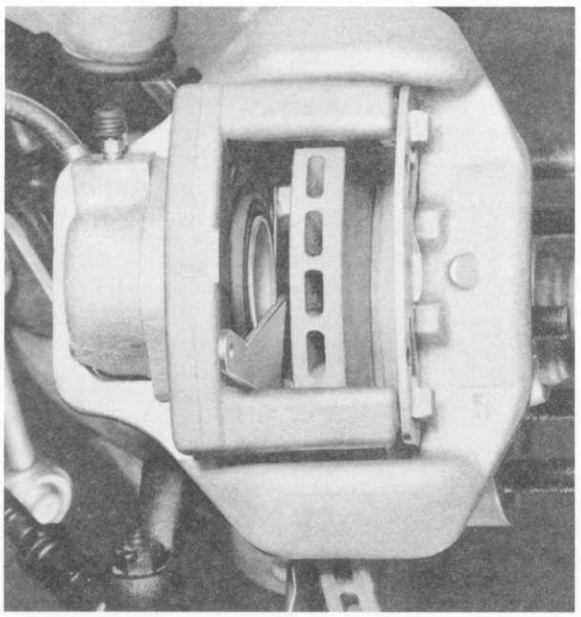
Note

To prevent brake fluid tank from overflowing, draw off small amount of brake fluid before pressing back piston. Use syringe reserved exclusively for brake fluids. Brake fluids are poisonous and must not be syphoned off through a hose.

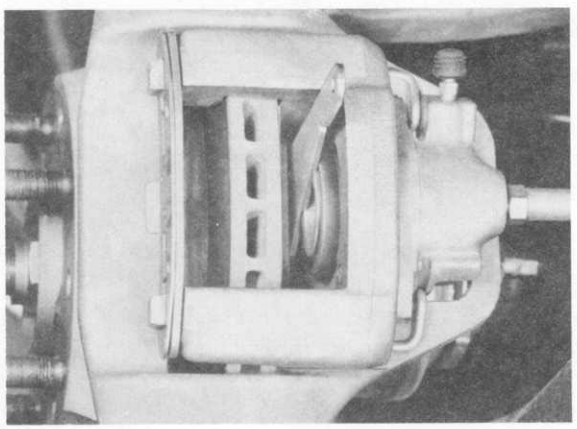
3. Clean bearing and guiding surfaces of brake pads in brake calipers with gasoline or a cylindrical brush. Never use solutions containing mineral oil or sharp edged metal tools.

4. Check 20° piston position and if necessary adjust with piston turning pliers.

   Hold piston gauge at bottom guide surface on front brake caliper.



   Hold piston gauge at top guide surface on rear brake caliper.



5. Insert outer brake pad and press floating caliper frame in direction of brake disc so far, that pin engages in groove of pad backplate.

Note

To prevent seizure of brake pads in brake calipers due to corrosion, apply a thin coat of grease on bearing and guiding surfaces.
Use Optimoly HT (copper paste) or Plastilube.

6. Insert inner brake pad.

7. Install cross spring, retaining pins and spring lock or lock wire with wire guide plate.

8. Press warning contact into pad in correct position.

9. Depress brake pedal of stationary car hard several times to move brake pads to their normal operating position. Now check level of brake fluid in tank, adding more if necessary.

Bedding-In Brake Pads

Brand-new brake pads have a once only loss of braking effect (thermal fading), which disappears after a breaking-in time of about 200 km (125 mi.). During this period full stops from top speeds should be limited to emergency situations. New pads must be bedded in by applying medium forces to brake pedal and at larger intervals. Brake pads will first provide maximum braking effect after being bedded in.

REMOVING AND INSTALLING BRAKE PADS (Floating Caliper Disc Brakes)

Removing

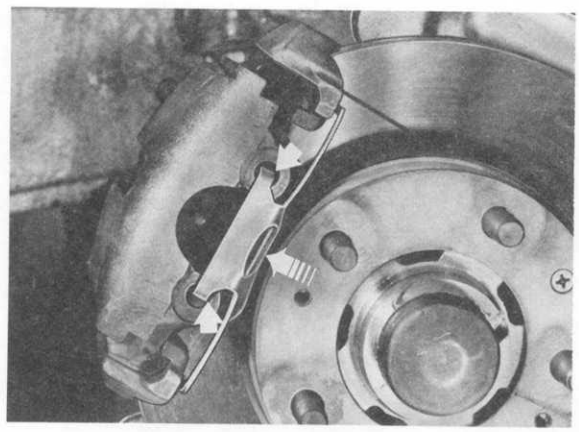
When brake pads can be used again, they must be installed on same wheel (otherwise non-uniform braking effect).

1. Pull warning contact (wear sensor) out of inner pad plate.

Note

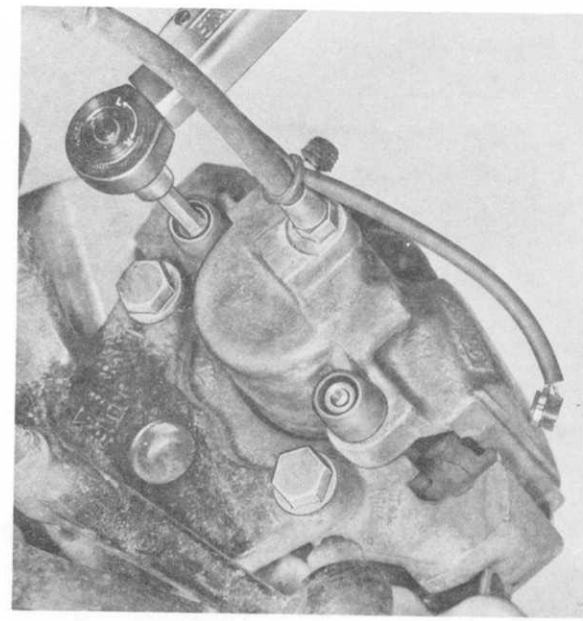
Replace warning contacts with ground through or down wire cores. Warning contacts can still be used when only plastic parts of warning contact have traces of wear.

2. Remove housing retaining spring. This requires applying pressure in center (large arrow) of spring until it disengages in the housing bores. Then remove spring toward outside at same time without applying force.
   Never bend spring by applying force.



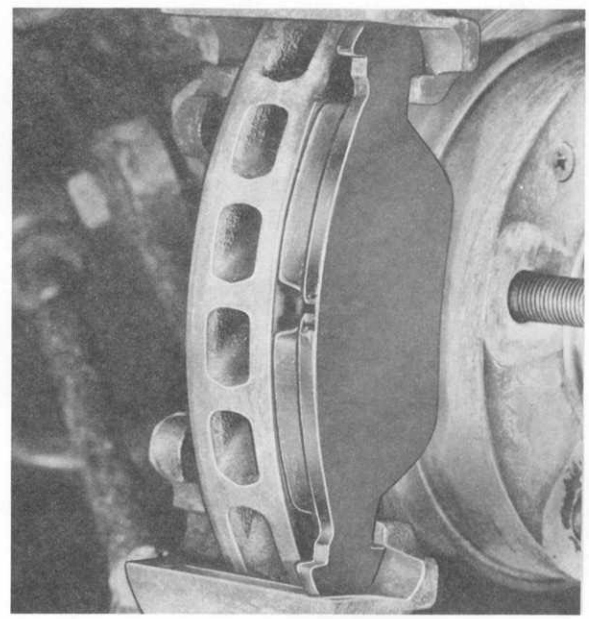
3. Remove any dirt on guide pins between holder and housing.

4. Pull plugs out of guide sleeves. Unscrew guide pins with a 7 mm socket wrench and pull out of guide sleeves.



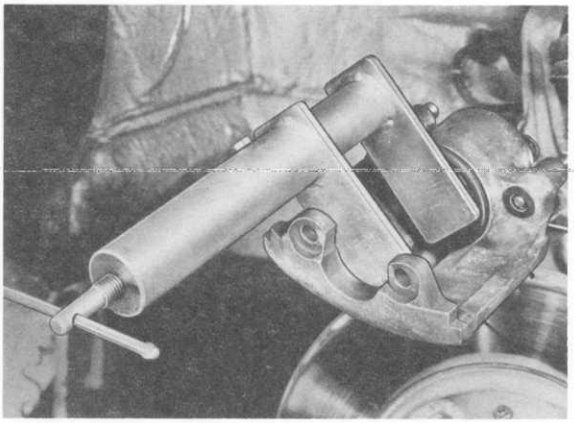
5. Pull housing toward outside of car by hand to push back the piston slightly. Then remove the housing. Pull piston end brake pad out of piston.

6. Lay housing (fist) aside and suspend from suitable point on car with a piece of wire. Remove outer brake pad from holder.



Installing

1. Push back piston completely with special tool.



Note

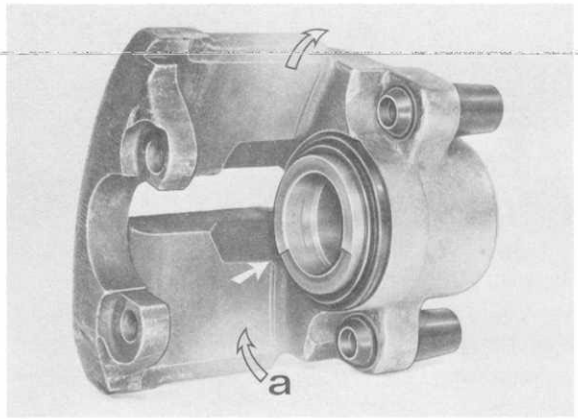
To prevent brake fluid from being forced out of tank, it might be necessary to drain some of the brake fluid prior to pushing back the piston. Use a syringe for this work, which is reserved exclusively for brake fluid. Brake fluid is poisonous and must never be sucked out through a hose.

2. Clean pad guiding surfaces in housing and holder. Never use sharp-edged tools or cleaning solutions with mineral oil content. Check seals, caps, guide pins, guide sleeves as well as housing retaining springs and brake pads for damage, replacing if necessary.
   Watch pairing of brake pads for front/rear axles.

   Two types of brake pads are used on the rear axle.

   Rear axle pads for pairing
   floating frame caliper disc brakes on all wheels.
   Rear axle pads for pairing
   floating caliper disc brakes on front axle and
   floating frame caliper disc brakes on rear axle
   (see page 46 - 3).

3. Check 20° piston position and adjust with special piston pliers, if necessary. Stepped surface of piston faces down toward brake disc inlet side. Edge on bottom of housing (see arrow) can be used as a reference point.



Arrow a = brake disc inlet side

4. Push brake pad with riveted retaining clip into piston and place second pad on outside of holder's guiding surface on brake disc.

   Place housing over brake disc and brake pad, screw in guide pins with a 7 mm socket wrench and tighten to specified torque.

Note

To prevent seizure of brake pads in brake calipers due to corrosion, apply a thin coat of grease on pad guiding surfaces.
Use Optimoly HT (copper paste) or Plastilube.

5. Insert plugs in guide sleeves.

6. Engage housing retaining spring. Check that spring locates properly in hole. Do not use force to bend spring.

7. Insert warning contact: renew if necessary.

8. Press brake pedal several times so that piston and housing align brake pads with brake disk, or until clearance adjusts itself correctly.

9. Check level of brake fluid in reservoir, top up to MAX mark with fresh brake fluid if necessary.

10. Check operation and efficiency of brakes, check system for leaks.

Running in the Brake Pads

New brake pads must be run in over the first 200 km. Only then are the friction and wear characteristics optimized. During the running-in period, severe braking from high speeds should be limited to emergency situations.

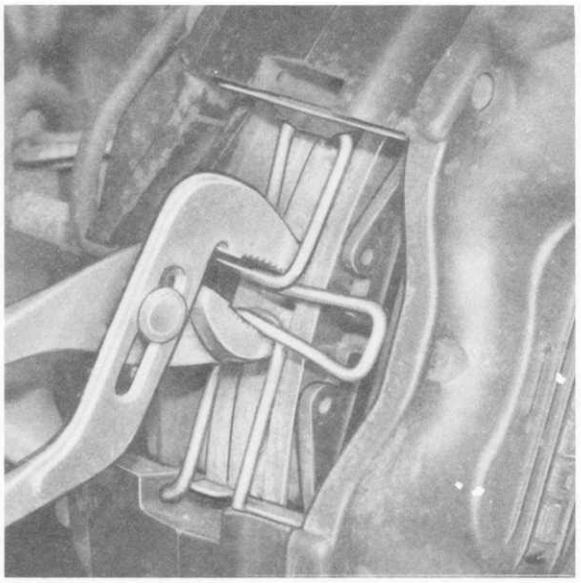
Removing and installing brake pads (four-piston fixed caliper disk brakes)

Removing

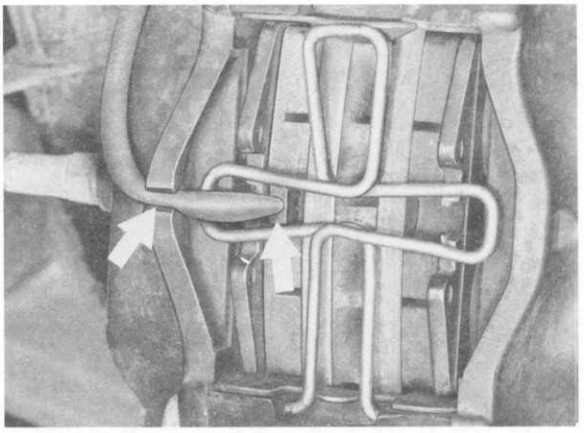
Note

If the brake pads are to be installed again, they must be marked with their positions when removed. It is forbidden to interchange the inside and outside brake pads or those from the left and right wheels, and this can result in uneven braking.

1. Press the spreader spring together in the center and disengage it from its holder. **At the same time, or before pressing the spreader spring together, press it towards the brake disk in the retaining plate area, to relieve the load. This will avoid damage to the retaining plate.**



2. Run the warning contact lead out at the brake caliper and pull the warning contact out of the brake pad plate.



Note

Renew warning contacts if the core wire has been abraded away or ground through. If there are rubbing marks on the plastic part of the warning contact, it can be re-used.

3. Pull the brake pads out with the brake pad extractor tool. On brake calipers with damper plates, always note the following:

Run the brake pads out together with the damper plates. If this is not possible (it depends on the degree of brake pad wear), separate the damper plates from the brake backplate with a suitable spatula before removing the pads. In either case, first move the brake pads back as far as possible with the piston resetting tool. If necessary, draw off a small amount of brake fluid from the reservoir first. Important: the spatula must be inserted accurately between the brake pad and the damper plate, in order to avoid damaging the brake piston seals.

Printed in Germany – XXV, 1990

Installing

Notes

- On four-piston fixed caliper brakes, damper plates must be installed when asbestos-free brake pads are used. For details of the correct damper plates for the various brake calipers, refer to Group 4 Technical Information.
- Renew the damper plates each time the brake pads are renewed.
- It is forbidden to mix asbestos-free brake pads and brake pads containing asbestos on the same car.
- Asbestos-free brake pads are also available for cars with fist-type and floating caliper disk brakes.

1. If necessary, move the pistons back to their initial positions with the resetting tool.
2. Clean the seat and guide faces for the brake pads in the brake caliper with spirit and a special cylinder brush or similar, to ensure that the pads move freely in their bores. Make quite sure that the brake piston seals are not damaged.
3. Check that the brake calipers are installed in the correct positions. The small pistons must be at the side where the brake disk enters. This can also be checked at the arrow above the PORSCHE logo; this arrow shows the direction of brake disk rotation.

Note

From 1987 models on*, the **front** brake caliper piston diameters were changed to 44/36 mm (previously 42/36 mm).
During the 1989 model year, a further modification was introduced. The piston seal was changed from the scraper ring type to the protective cap type. (Technical Information Gr. 4 No. 1/89) Notes on replacement: refer to Pages 47-04 / 47-05.

* On some cars (those for the USA, Canada, Australia and Arab countries), fixed calipers with piston diameters of 42/36 mm were still used in the 1987 model year. For notes on replacement, refer to Page 47-04.

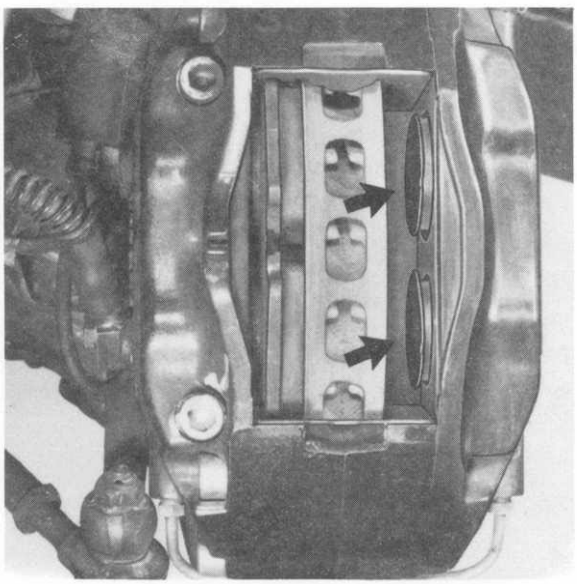
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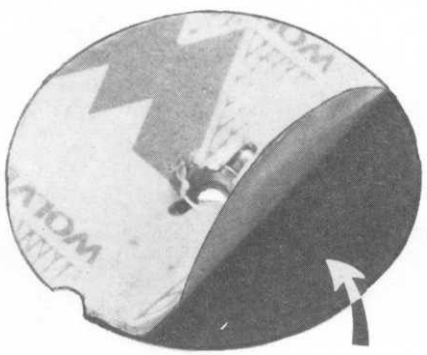
4. Installing new damper plates in the pistons.

When installing, make sure that the internal diameters of the spring and piston are correctly matched together (Technical Information Gr. 4 and Part List).

The damper plates should engage in the pistons when light pressure is applied, but must not be too loose (no radial play is permissible).

The damper plates are provided with an adhesive and protective foil.
The protective foil must be pulled off before installation.

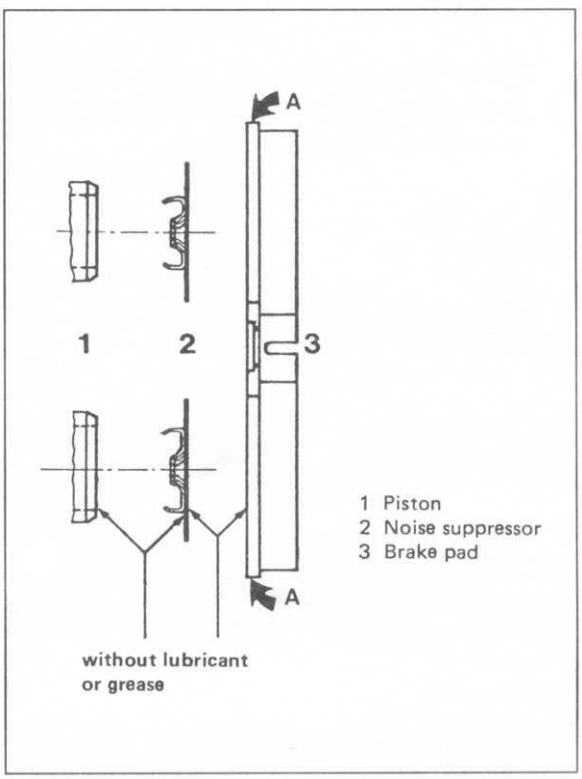




5. Insert the brake pads. **Make sure that the correct grade of brake pad is used.**

Note

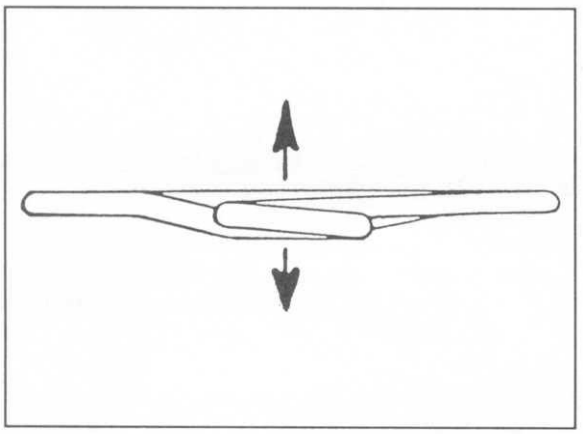
When damper plates are installed, the brake carrier plates (back of brake pads) must not be greased.
However, to prevent the brake pads from corroding and seizing in the brake caliper, the seat and guide faces (arrows A) are given a thin film of grease.
Use Optimoly HT (Cu paste) or Plastilube (Schillings Co., P.O. Box 1703, 7080 Aalen, Federal Republic of Germany) for this purpose.



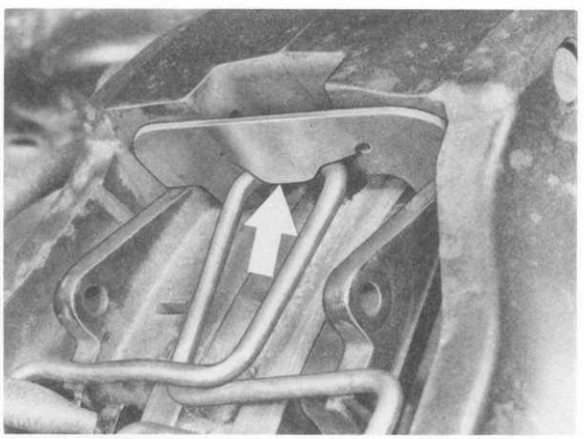
Printed in Germany – XXV, 1990

6. Grease the spreader spring retaining lugs with Optimoly TA or Plastilube. If new spreader springs are installed, the flat side should face the brake disk. If wrongly installed, correct brake pad seating cannot be guaranteed and the raised section in the center of the cross will rub against the brake disk.
   Press the spreader spring together in the center and insert it. Make sure that spreader springs engage correctly (arrow). Do not force the spreader spring into position or the retaining plate may be damaged.

Brake disk



Outboard face



7. Press the warning contact(s) into the pad plate in the correct positions. Secure the warning contact lead to the brake caliper and, if two warning contact leads are present (from 1989 models on), to the cross spring as well.

Note

If tolerances are unfavorable, the spreader spring may have to be disengaged again to do this.

8. With the car standing still, depress the brake pedal firmly several times, so that the brake pads adopt a position ready for later operation. After this, check brake fluid level in the reservoir and add more fluid if necessary.

Running in the brake pads

New brake pads need to be used for about 200 kilometers before they develop their optimum friction and wear characteristics. During this time, avoid full brake applications from high speeds unless an emergency arises.

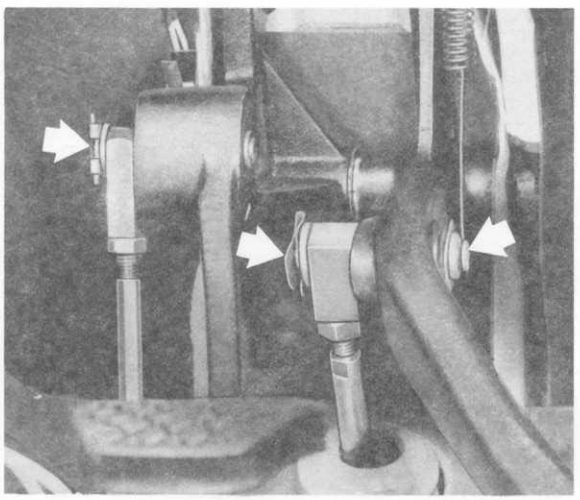
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REMOVING AND INSTALLING BRAKE PEDAL

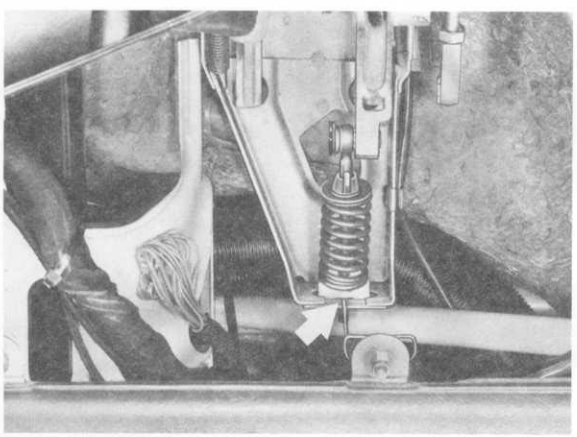
Removing

1. Move back seat and steering wheel up to make job easier.
   If applicable, remove shelf.

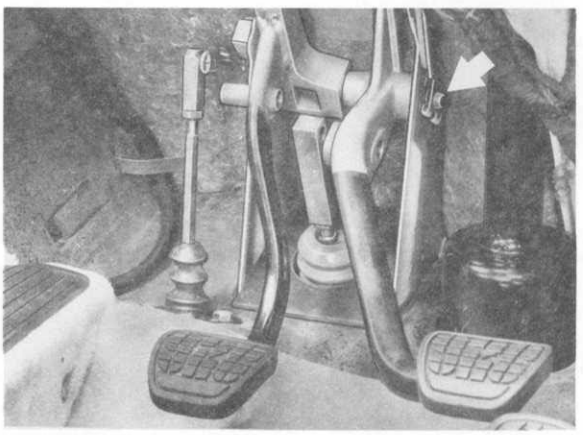
2. Disconnect return spring on brake pedal. Remove shaft for brake and clutch push rod.



3. The guide rod for clutch power spring has an assembly bore. Press down on clutch pedal until bore has cleared the bearing. Insert a piece of 3 mm dia. wire into bore in this position to remove force on pedal.



4. Remove circlip and move bearing shaft toward outside until brake pedal has been run out.



Installing

1. Check all bushings and stops for clutch and brake pedals, replace if necessary. Lubricate all bearing and sliding surfaces with a multi-purpose grease.

2. Install brake pedal with bushings. Slide in bearing shaft and install circlip.

Note:
Bearing shaft can only be pushed in fully, if bearing shaft and console surfaces are aligned.

3. Remove wire in guide rod for clutch power spring.

4. Install clutch and brake push rod.
   Attach return spring. Check push rod play, correcting if necessary.
   Clutch play, see page 30 - 1 (approx. 3 mm on pedal equals approx. 0.5 mm between push rod and master cylinder piston).
   If there is a mechanical stop light switch, check the adjustment.

ADJUSTING BRAKE PRESSURE ROD

Until End of Model Year 85
(Stop on brake-pedal arm)

Note:

With the pedal released, the pressure rod must exert no pressure on the brake unit.

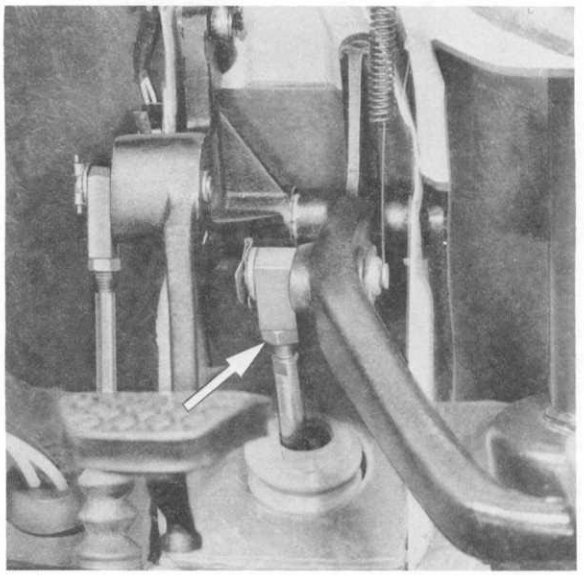
With brakes bled and engine switched off, move pressure rod at brake pedal by hand to check play and assure adequate clearance at the brake unit.

The minimum play is 10 mm.

Adjusting

1. Pull brake-pedal arm back to stop.

2. Slacken pressure rod locknut and adjust pressure rod until pivot pin of adapter at brake-pedal arm is slack, or until the specified play is attained (at least 10 mm at the pedal).



3. Tighten pressure rod locknut. If a mechanical stoplamp switch is fitted, check switch setting (page 46 - 10a).

ADJUSTING BRAKE PRESSURE ROD

86 Models Onward
(without stop on brake-pedal arm)

Note:

It is only necessary to adjust the brake pressure rod if:

- the brake booster is replaced
- brake pressure rod adapter has been removed.
- the pressure rod or the adapter has been turned away from its original position.

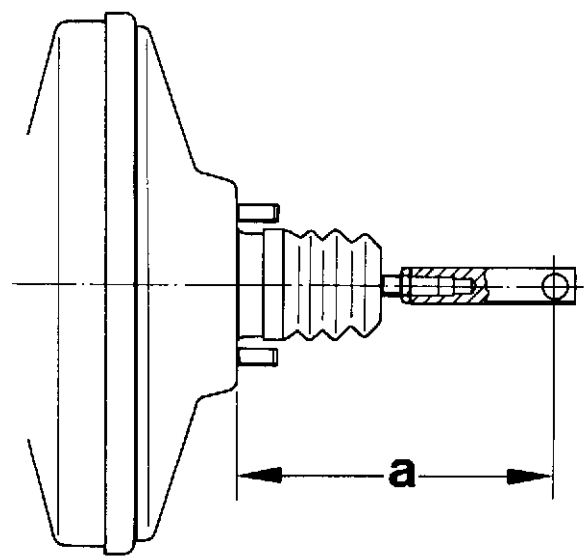
The brake-pedal arm does not have a stop. The arm is in its initial position when brake unit (brake booster + brake master cylinder) is in its released position. Since the brake pedal is unsupported in its initial position when the brake pressure rod is correctly adjusted, the permanently set clearances in the brake booster are assured. When the brakes have been bled and with the engine switched off, a pressure-rod play of approx. 10 mm can be felt at the brake-pedal plate when the pedal is depressed by hand.

Adjusting

1. Adjust length of brake pressure rod by turning adapter or pressure rod. Length a must be 158 ± 2 mm measured from the bearing face of the brake booster on the body to the center of the adapter pivot pin.

Note:

If the car has manual transmission and the brake pedal is more than 8 mm lower than the clutch pedal, correct position of brake pedal by turning pressure rod.

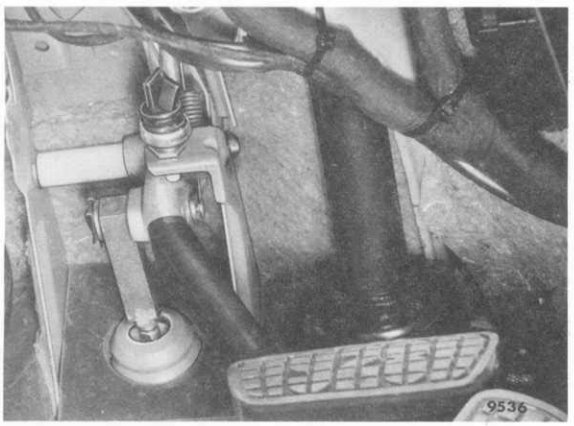


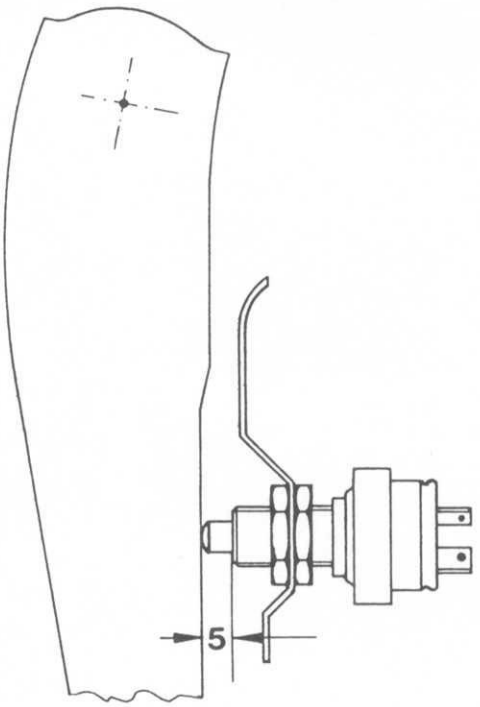
2. Tighten locknut.

3. Check setting of stoplamp switch (page 46 - 10a).

CHECKING SETTING OF STOPLAMP SWITCH

In 1984 models onward, a mechanically operated switch mounted on a bracket above the brake-pedal arm is installed as stoplamp switch.





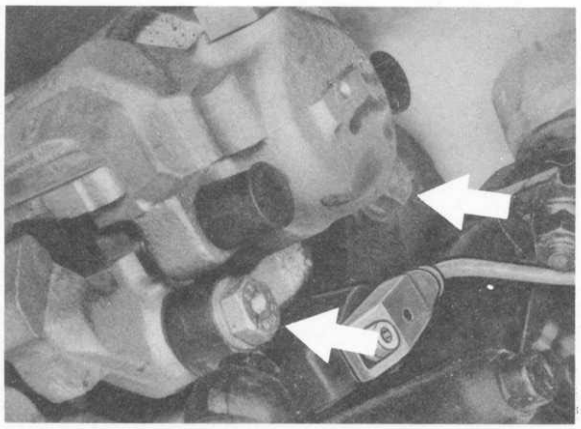
With the pedal arm against its stop (initial position), there must be a 5 mm gap between stoplamp switch and brake-pedal arm. If necessary, adjust position of stoplamp switch by turning mounting nut until the gap is as specified. Turn nuts in opposite directions (counter).

DISASSEMBLING AND ASSEMBLING FRONT WHEEL BRAKE

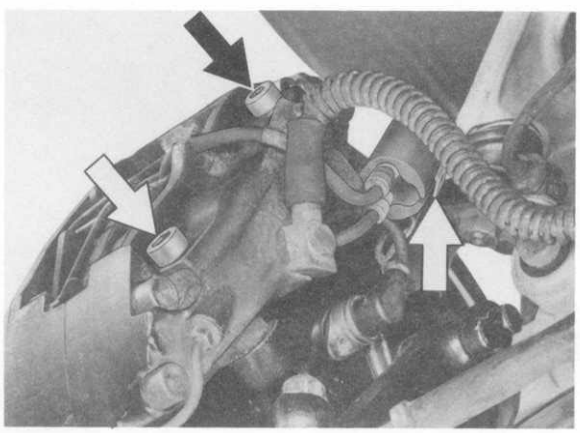
D i s a s s e m b l i n g

1. Remove brake caliper (do not disconnect brake hose) and place on upper control arm or attach to suitable support with a piece of wire.

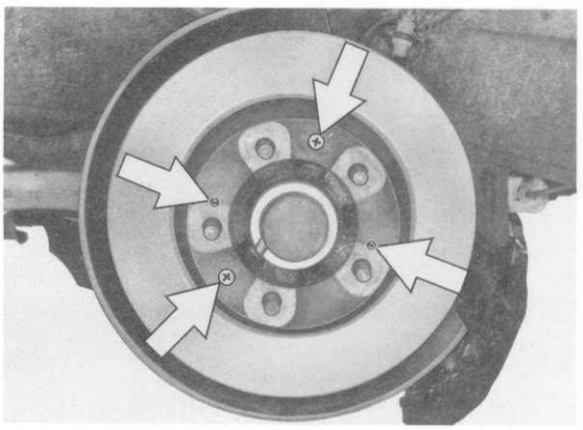
Mounting, until end of model year 85



Mounting, 86 models onward (fixed-caliper brake)



2. Take off brake disk after removing countersunk bolt (s). If a brake disk is so tightly seated that light blows with a nylon-headed hammer do not move it, screw hex bolts uniformly into the two 8 mm threads of the disk and press disk off. It is possible that the bolts do not sit squarely on the lugs. A modification has been incorporated.



A s s e m b l i n g

1. Inspect all parts and replace if there is any sign of damage.

2. Clean centering face for brake disk on wheel hub and apply a thin coat of Optimoly TA.

3. Install brake disk and brake caliper. Tighten caliper retaining bolts, torque: 85 Nm (62 ftlb). Ventilation ducts of brake disks used with floating-caliper and fixed-caliper brakes are involute: do not mix up right-hand and left-hand disks.

Distinguishing feature:
involute shape and

spare part number

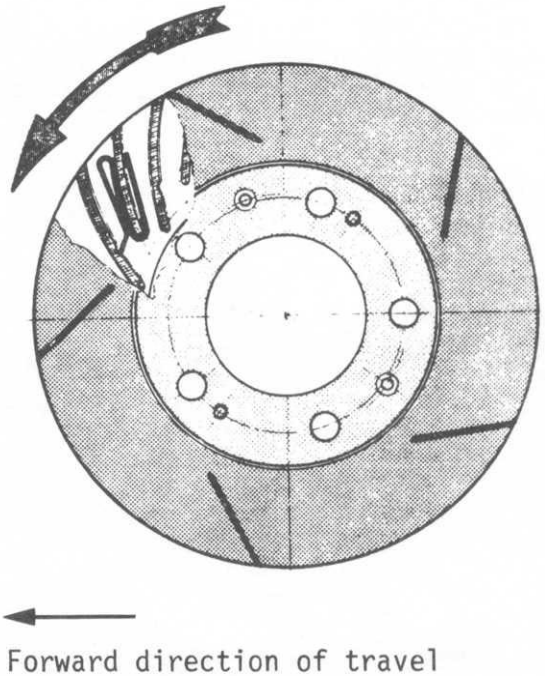
The spare part number is inscribed on the brake disk.

Spare part, left-hand side
- 3rd group number is odd

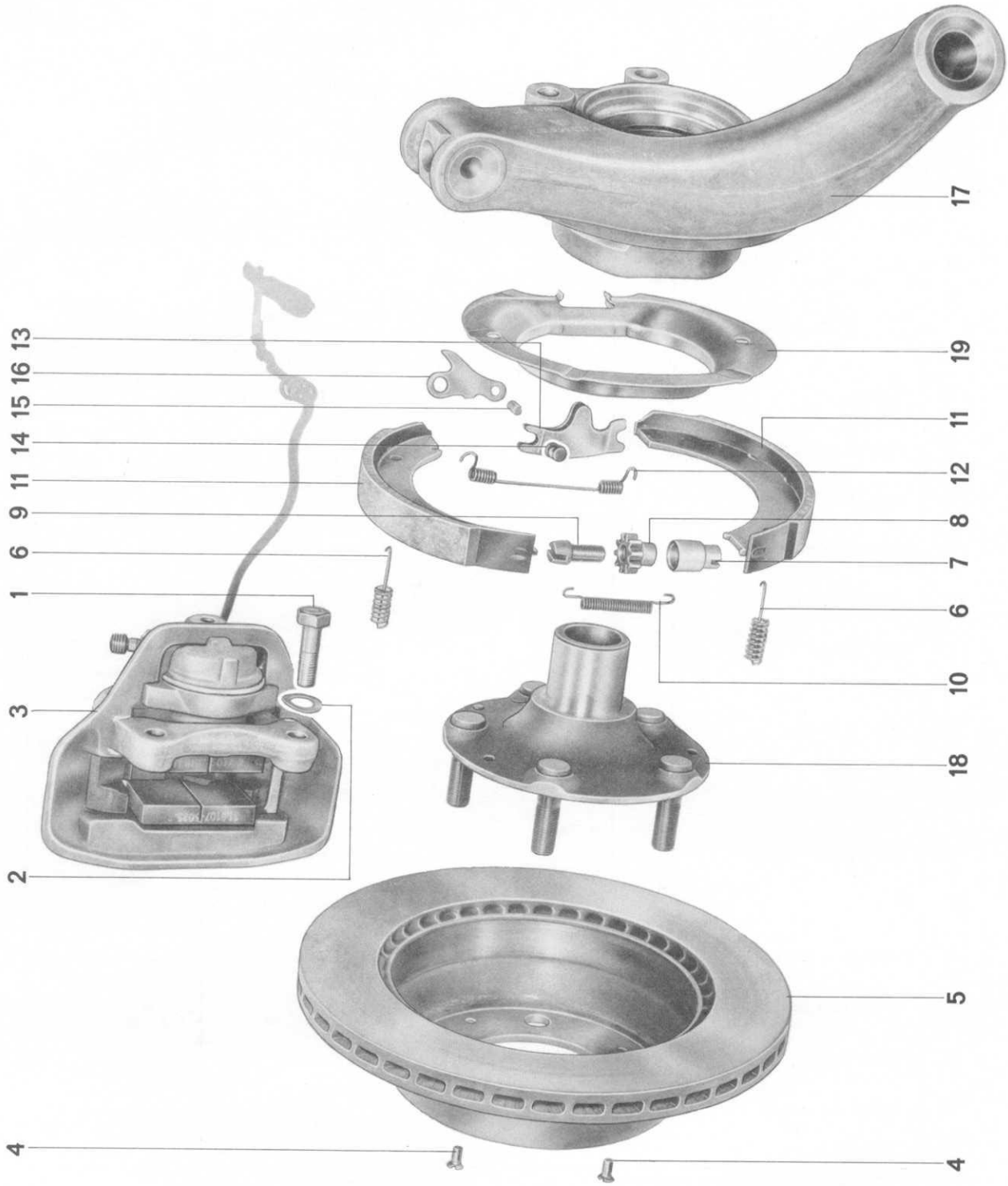
Spare part, right-hand side
- 3rd group number is even

Example:

Spare part No. left-hand brake disk:
928.351.043.03 left
Spare part No. right-hand brake disk:
928.351.044.03 right



Forward direction of travel


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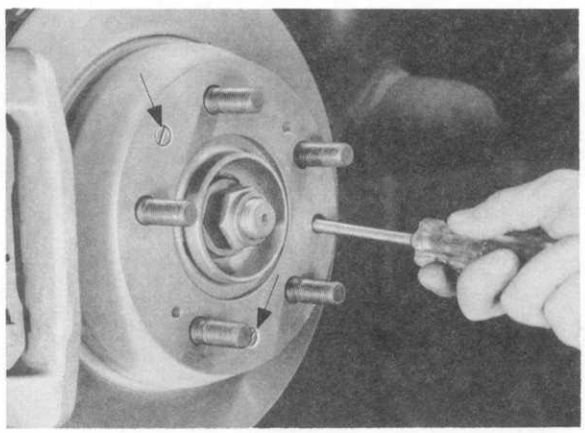
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Bolt	2		Tighten to specified torque	
2	Washer	2		Replace, if necessary	
3	Floating frame caliper	1	Suspend from suitable point on car that brake hose is without tension		
4	Bolt	2			
5	Brake disc	1	Set back brake	Check for wear and damage	
6	Spring	2		Position correctly	
7	Support bushing	1			
8	Adjusting nut	1			
9	Adjusting screw	1			
10	Return spring	1			
11	Brake shoe	2		Replace, if necessary. Wear limit 2 mm	
12	Return spring	1		Check for correct fit	
13	Pressure bar	1			
14	Joint pin	1		Lubricate lightly	
15	Pin	1		Lubricate lightly	
16	Operating lever	1			
17	Wheel carrier	1			
18	Wheel hub	1			
19	Brake backplate	1			

DISASSEMBLING AND ASSEMBLING REAR WHEEL BRAKE

Disassembling

1. Disconnect floating frame caliper.

2. Turn parking brake slack control toward loosening direction. Remove brake disc after unscrewing two countersunk bolts. If a seized brake disc can't be removed even with light knocks from a plastic hammer, screw two bolts in the 8 mm tapped bores of the brake disc to press off the disc.



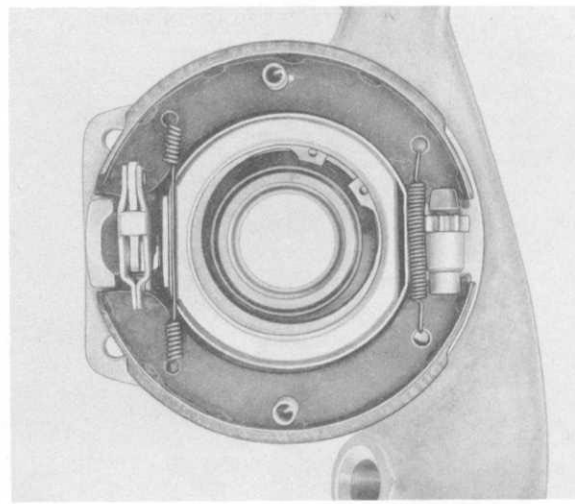
Assembling

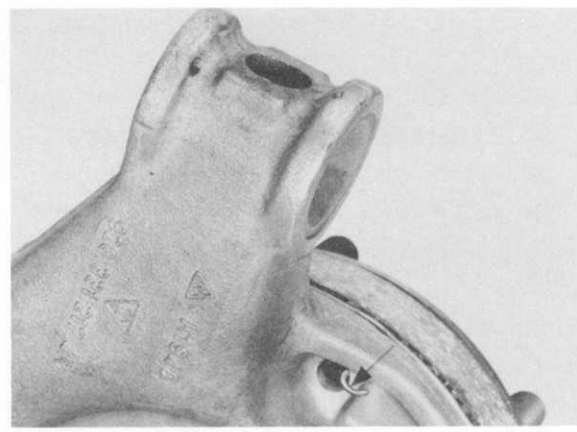
1. Lubricate slack control and sliding surfaces of brake shoes lightly.

2. Install spreaders, brake shoes, return springs, springs and slack control.

Note:

Install springs in correct position.





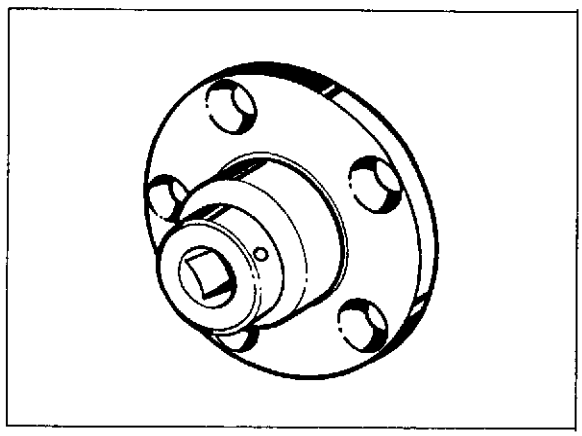
3. Clean centering surface on wheel hub for the brake disc and coat with Optimoly TA grease.

4. Adjust parking brake.

Checking brake disc lateral runout

1. Measuring requirements: No tilt play present at wheel. If required, adjust wheel bearing clearance of front wheels.

2. Fit adapter plate (Special Tool 9510/1) **to wheel hub**. Tightening torque of wheel nuts (mounting nuts): 130 Nm.



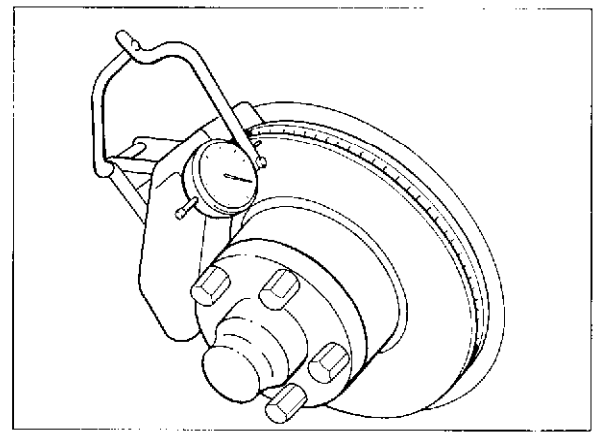
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3. Engage dial gauge holder, e.g. Ate Part No. 03.9314-5500.3/01, into brake caliper, determine center position and fit by turning the wing screw.

Notes

If required, fit dial gauge holder with Ate conversion kit, Part No. 03.9314-5510.3/01 (longer wing screw and bracket for dial gauge if required).
Four-piston fixed caliper brake: Make sure the spreader spring locating lug at the mounting plate of the fixed caliper is not damaged when the dial gauge holder is fitted in place.
Floating caliper and sliding caliper disc brake:
To fit the dial gauge holder, the brake pads must be removed.

4. Fit dial gauge with a slight preload. Place measuring pointer on maximum diameter of braking surface.



1036A - 46

5. Rotate brake disc and read off runout on dial gauge.
Max. permissible runout of fitted brake disc **max. 0.1 mm.**

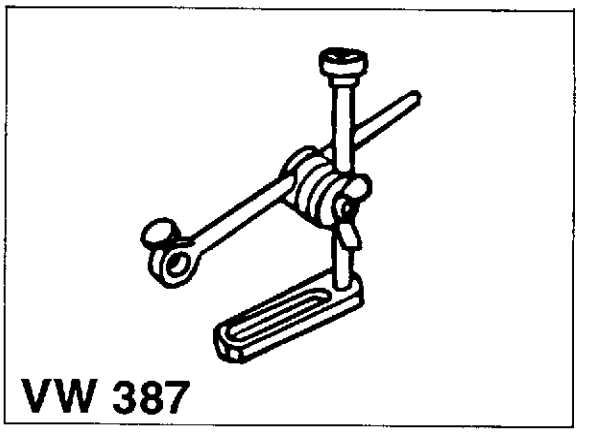
Note

Runout of removed brake disc	: max. 0.05 mm.
Runout of wheel hub	: max. 0.05 mm.

6. If the brake disc runout exceeds 0.1 mm, remove the brake disc and check runout of the wheel hub. Mark position of disc with regard to wheel hub.

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7. Check wheel hub runout as follows:
   Measure once outside (arrow) and once inside wheel stud area of hub face.
   Lift off dial gauge carefully in cutout area of wheel hub.
   To fit the dial gauge, use either a magnetic universal dial gauge holder, e.g. as supplied by SNAP-ON (Order No. PMF 137), or a **modified (lengthened)** dial gauge holder (VW 387).

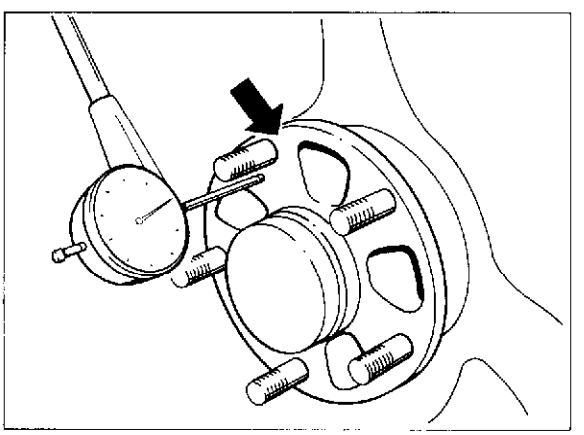


1039 - 46

Notes

Make sure the brake hoses and brake lines are not damaged when the brake caliper is removed and installed.

The above SNAP - ON order no. PMF 137 is valid for a complete dial gauge kit since the individual dial gauge holder is not available separately.
The dial gauge kit may also be used to check the brake disc lateral runout.



1038 - 46

8. **Excessive wheel hub runout:**
   Replace wheel hub.
   Wheel hub runout o.k.:
   Cleaning level and centering surfaces of brake disc and wheel hub. Then coat centering surface of wheel hub with a thin coat of Optimoly TA.
   Fit brake disc to wheel hub in another position, offset radially with regard to wheel hub.
   Repeat measurements with fitted adapter plate - Special Tool 9510/1.
   If the lateral runout is still in excess of 0.1 mm, the brake disc must be replaced.

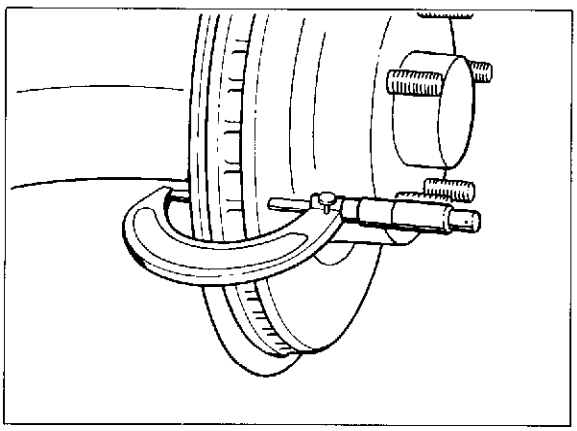
Note

If the brake disc runout has been reduced by offsetting the brake disc with regard to the wheel hub, one 6 mm countersunk screw may be omitted if two 6 mm countersunk screws had been fitted.

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Checking brake disc thickness

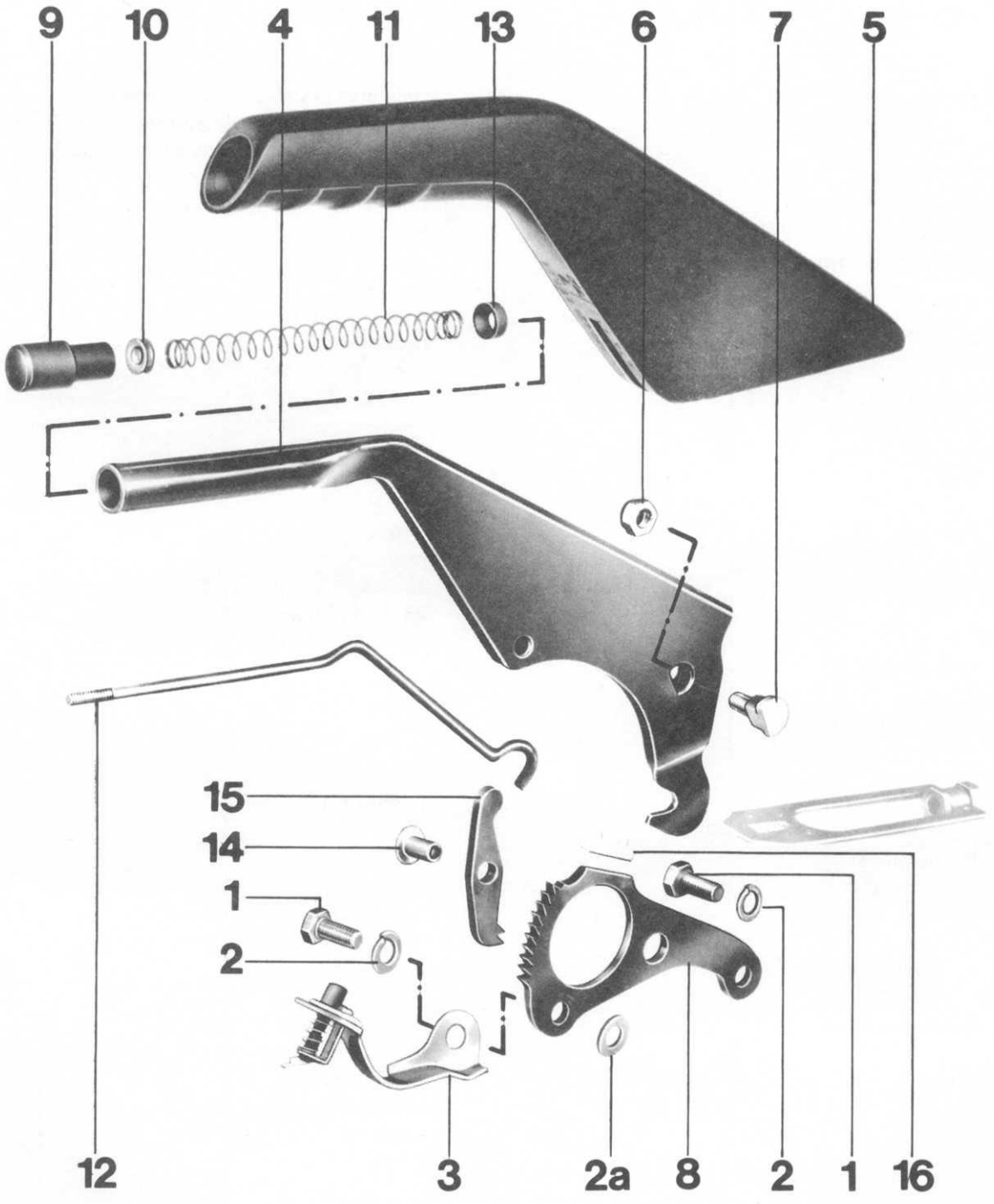
Measure brake disc thickness in approx. 8 places within the braking surface using a micrometer.



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DISASSEMBLING AND ASSEMBLING PARKING BRAKE LEVER



No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Bolt	2		Torque: 25 Nm (18 ftlb)	
2	Lock washer	2		Replace if necessary	
2a	Washer	1		Only used in some cases	Sometimes a washer is used to align parking brake lever
3	Bracket for parking brake switch	1		Switch must respond before first catch; align bracket if necessary	
4	Parking brake lever	1			
5	Sleeve	1		Paste on sides	
6	Lock nut	1		Replace if necessary. Torque: 23 Nm (17 ftlb)	
7	Bearing shaft	1			
8	Toothed element	1			
9	Push button	1		Lock with Loctite 221	
10	Plastic washer	1			
11	Spring	1			
12	Push rod	1			
13	Guide sleeve	1			
14	Rivet	1		Rivet that pawl still moves easily	
15	Pawl	1			
16	Stop	1			

DISASSEMBLING AND ASSEMBLING PARKING BRAKE LEVER

Disassembling

1. Remove parking brake lever/parking brake cable trim. Unscrew mounting bolts and take out complete parking brake lever.

2. Pull off sleeve forward from parking brake lever (pasted on sides of lever – loosen first).

3. Remove bearing shaft and move out locking element.

4. Unscrew push button (locked with Loctite). Take off washer, spring and guide sleeve toward front and push rod toward rear.

Assembling

1. Lubricate all sliding and bearing surfaces with multi-purpose grease.

2. Pawl must move easily even after riveting. Lock push button with Loctite No. 221.

3. Install parking brake lever and check function of contact switch. It should respind before the first catch. If necessary, adjust switch holding bracket.

Checking and Adjusting Parking Brake

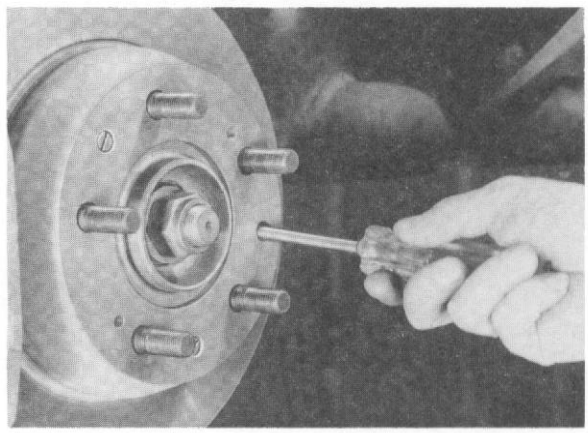
The parking brake has to be adjusted, if with medium force the parking brake lever can be pulled up more than 2 teeth without any braking effect.

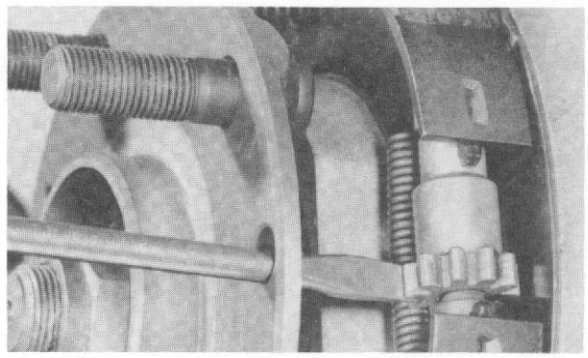
1. Jack up car and remove rear wheels.

2. Release parking brake and push back rear wheel disc brake pads until the discs can be turned easily.

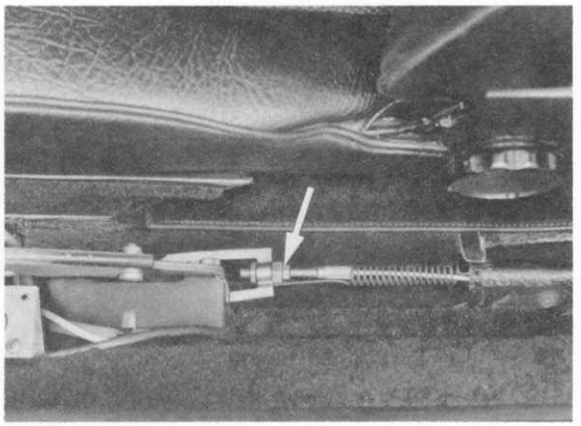
3. Loosen adjusting nut on spreader lock until cable is without tension.

4. Insert a screwdriver through the hole in the brake disk and turn the adjusting device until it is no longer possible to turn the wheel. Then turn back the adjusting device until it is possible to turn the wheel freely, then turn back a further 2 notches (undo).





5. Pull up parking brake lever 2 teeth and turn adjusting nut that the wheels can just be turned by hand (with 4 teeth the wheels must be stopped).



6. Release parking brake lever and check, whether wheels turn easily.

7. Lock adjusting nuts.

TIGHTENING TORQUES FOR BRAKES, HYDRAULIC PARTS

Location	Description	Thread	Torque Nm (ftlb)
Brake unit to bulkhead	Hex nut	M 8 DIN 934	23 (17)
Brake line to master cylinder, brake hoses, brake booster, T-distributor and hydraulic unit. Connecting line to four-piston fixed caliper	Union nut	M 10 x 1	12 (9)
Brake hoses to sliding caliper	Brake hose	M 10 x 1	14 (10)
Brake hose to floating caliper	Brake hose	M 10 x 1	14 (10)
Brake hose to floating and four-piston fixed calipers	Hollow screw	M 10 x 1	16.5 (13)
Brake hose, rear, to four-piston fixed caliper	Brake hose	M 10 x 1	14 (10)
Locknut to pressure rod (brake unit)	Hex nut	M 10 DIN 934	35 (26)
Bleeder screws in sliding and floating calipers	Bleeder screw	M 7	3.5 to 5.0 (2.5 to 3.6)
Bleeder screw in four-piston fixed caliper	Bleeder screw	M 10	8 - 12 (6 - 9)

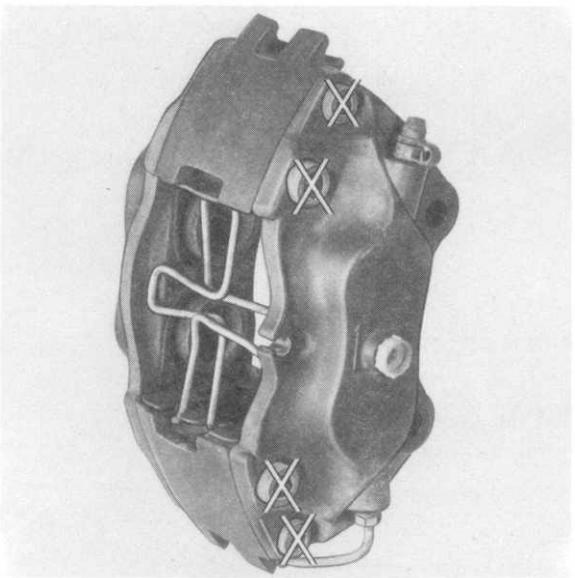
Location	Description	Thread	Torque Nm (ftlb)
Master cylinder to vacuum booster	Hex nut	M 8 DIN 934	23 (17)
Stoplamp switch to master cylinder	Stoplamp switch	M 10 x 1 tapered	15 + 4 (11 + 3)
Regulator to wheel arch	Hex bolt	M 8	23 (17)
Screw-in regulator to master cylinder or hydraulic unit	Screw-in regulator	M 10 x 1	14 (10)
Hydraulic unit bracket to wheel arch	Hex nut	M 8	23 (17)
Hydraulic unit to hydraulic unit bracket	Hex bolt	M 6	10 (7)
T-distributor to bracket	Hex bolt	M 6	10 (7)
Housing (caliper) to bracket	Guide pin	M 9	15 - 20 (11 - 15)

Notes on brake system from 1986 models on

Assembly instructions

The two halves of the brake caliper must not be separated.

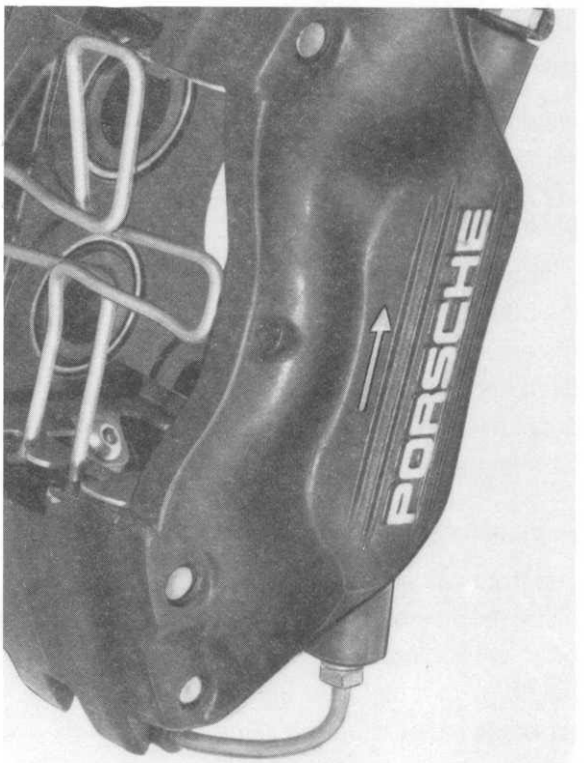
The piston sealing rings, dirt scraper rings and spring plates can be changed while the fixed caliper is assembled.
To remove the spring plates, heat the retaining screws with a hot-air blower to approx. 150°C; this is because the screws are inserted with a locking agent. Do not re-use the screws. Coat the threads of the new screws lightly with Loctite 270. When installing the brake pistons, use Unisilikon TK 44 N 2 brake cylinder paste (this also applies to **earlier types of brake caliper** if repairs become necessary). Unisilikon paste is available as a spare part. available as a spare part (part number 000.043.117.00).



86/937

X = Never unscrew and retighten these screws

So that correct brake caliper position can be checked with the brake pads installed, the fixed calipers have an arrow mark above the Porsche logo to indicate the correct direction of brake disk rotation.



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For modifications to front-wheel fixed brake calipers and notes on replacement, refer to Pages 47-04 / 47-05.

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Modifications to four-piston fixed calipers

Modification I

From 1987 models* on, the pistons in the front wheel fixed brake calipers were revised in design to minimize wear and optimize efficiency. The rear-wheel fixed calipers remained unchanged (Ø 30/28 mm).

Modification

Piston diameter increased from 42/36 mm to 44/36 mm.

Note

Pistons for the four-piston fixed calipers on the 928 S have no chamfered areas (recesses). This also applies to the 42 mm diameter front pistons on 1986 model cars, despite some information published to the contrary.

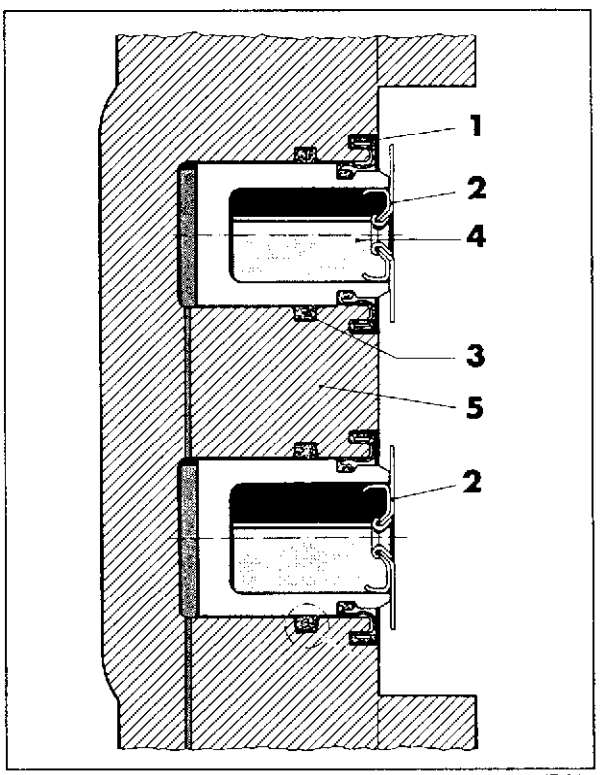
Replacement

The front wheel brake calipers with 44/36 mm diameter pistons can be retrofitted **as a pair only** to 1986 model cars. It is forbidden to mix the 36/42 mm diameter and 36/44 mm diameter brake calipers on the same car.

Modification II

During the 1989 model year, the front and rear wheel brake piston seals were modificed. A change was made from a scraper ring to a protective cap version.

Modified version.



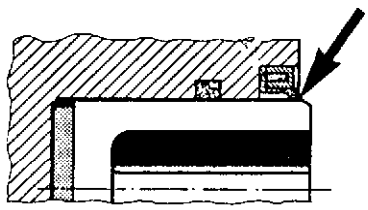
1 Dust protection cap
2 Damper plate
3 Rubber seal (rectangular-section ring)
4 Piston
5 Brake caliper housing

* Some cars in the 1987 model year (for the USA, Canada, Australia und Arab countries) continued to be fitted with brake calipers with 42/36 mm diameter pistons.

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Previous version

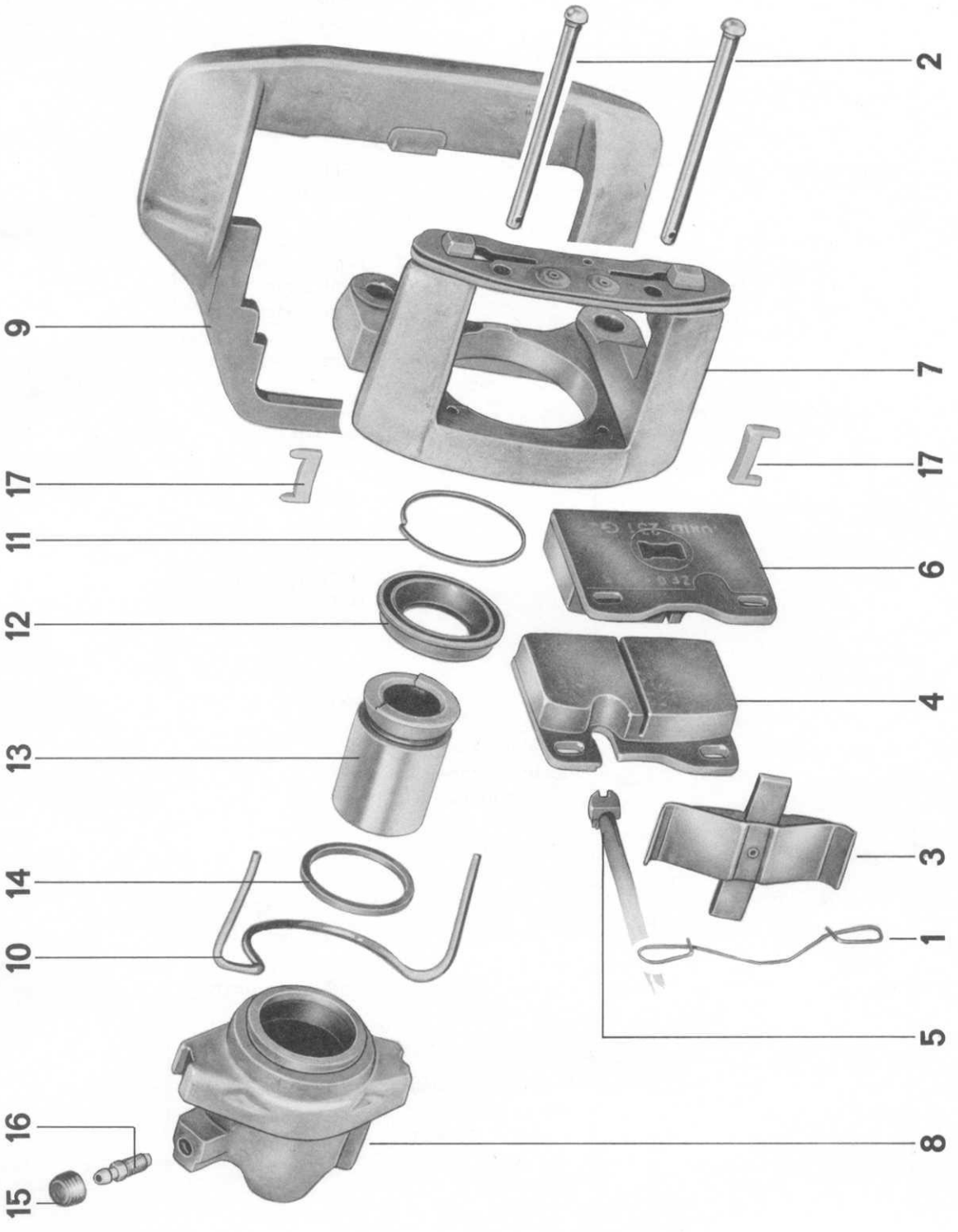
The scraper ring made a sliding-contact seal with the piston surface.



Replacement

Make sure that the two brake calipers on an axle are both of the same pattern.

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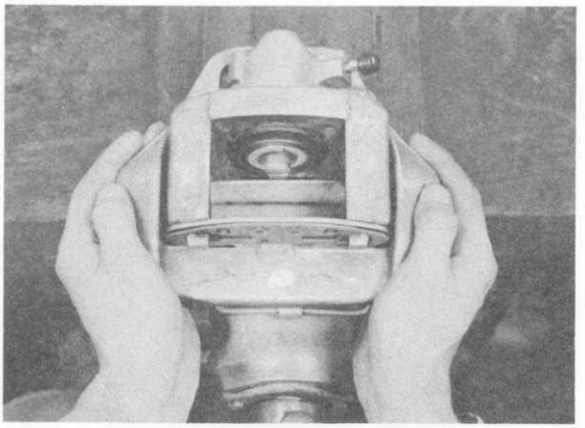
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Lock	1		Replace if necessary	New models have lock wire with wire guide
2	Retaining pin	2		Replace if necessary	
3	Cross spring	1		Replace if necessary	
4	Inner brake pad	1		Check, replacing if necessary. Wear limit: 2 mm. It is better to mount pad after installation of brake caliper	
5	Warning contact	1		Replace if wire core is ground through	
6	Outer brake pad	1		Check, replacing if necessary. Wear limit: 2 mm. It is better to mount pad after installation of brake caliper	
7	Mounting frame	1		Position slides correctly	
8	Brake cylinder	1	Drive off of floating frame with plastic hammer. Place piece of wood in caliper frame		
9	Floating frame	1			
10	Guide spring	1		Don't mix up left and right springs	
11	Clamp	1		Position correctly	
12	Dust cap	1		Replace	
13	Piston	1	Press out of cylinder with compressed air. Support piston on piece of wood. Danger!	Use brake cylinder paste. Adjust piston position with 20° gauge	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
14	Seal	1	Remove with a plastic rod	Replace, install with brake cylinder paste	
15	Dust cap	1			
16	Bleeder screw	1			
17	Slide	2		Replace, if necessary	

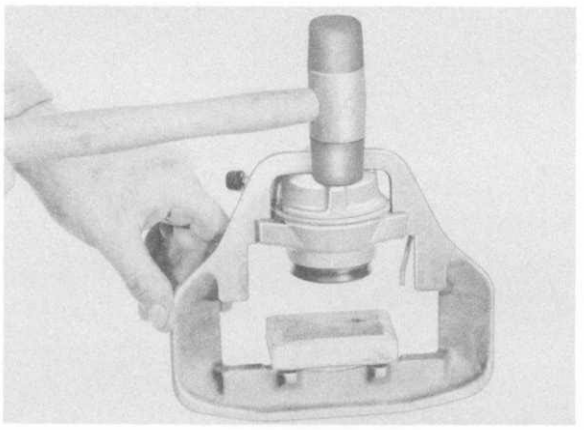
DISASSEMBLING AND ASSEMBLING FLOATING FRAME CALIPER

Disassembling

1. Press caliper frame off of mounting frame.



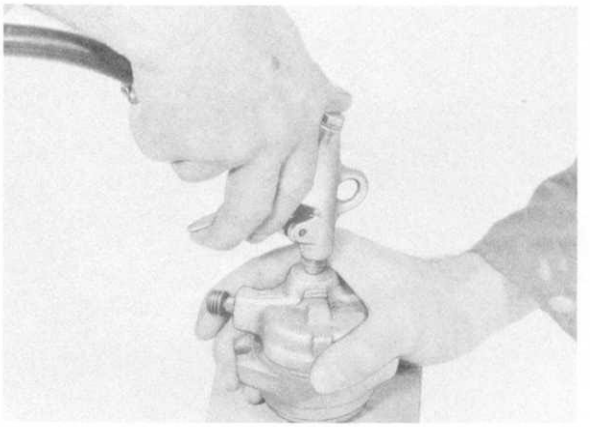
2. Drive brake cylinder off of caliper frame with a plastic hammer applied at different points all around. Place a piece of wood in caliper frame to prevent damage.



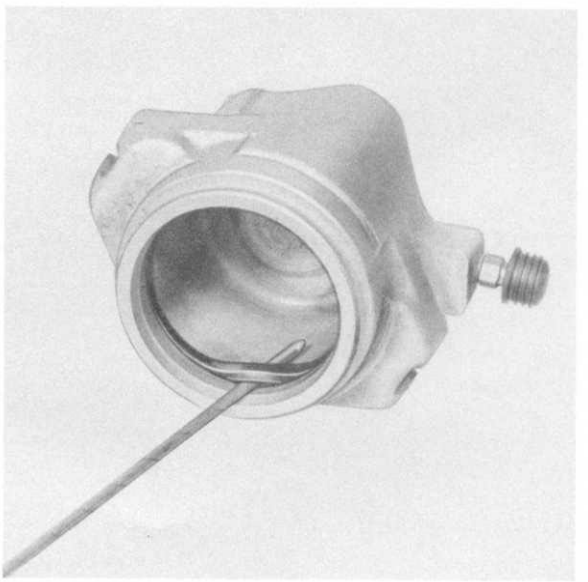
3. Press piston out of cylinder with compressed air.

Warning

Support piston on piece of wood.



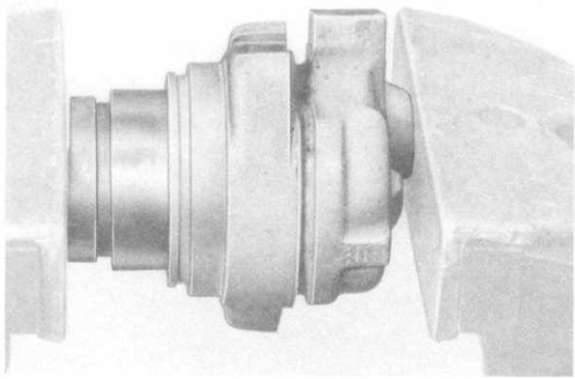
4. Remove seal with a plastic rod.



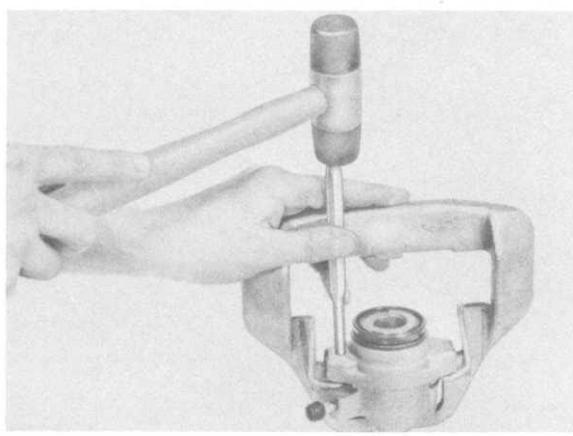
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Assembling

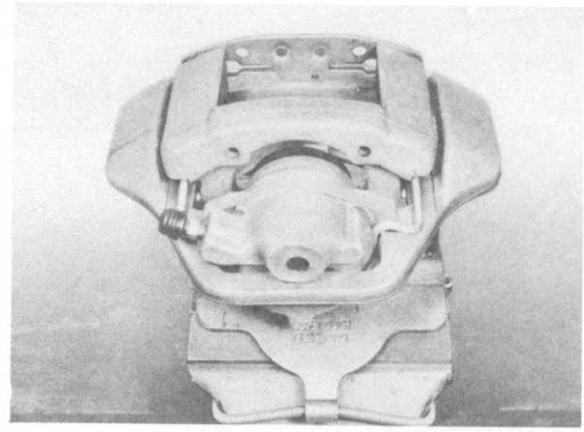
1. Apply a very thin coat of brake cylinder paste to cylinder bore, piston and seal. Press piston into cylinder in approximately correct position (20° chamfer).



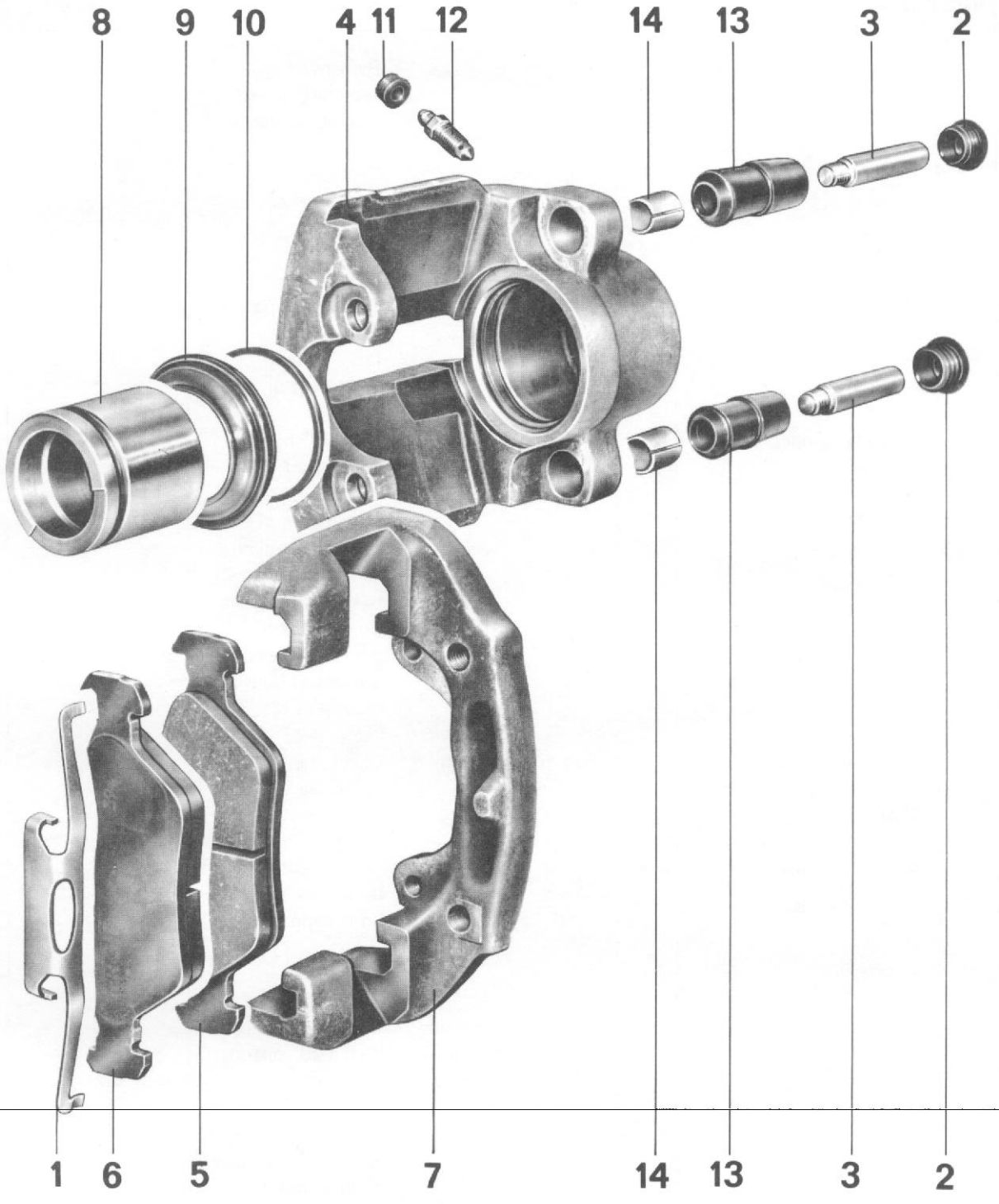
2. Drive brake cylinder with guide spring on to caliper frame with a soft mandrel applied at points all around.



3. Install mounting frame. Be careful not to damage slides.



4. Make final 20° adjustment of piston with piston turning pliers (see page 46 - 4).



Brake hose installation changed during 1983 model year. Brake hose mounted on modified fist caliper connection with a hollow union bolt from this time on to guarantee correct installed position.

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Housing retaining spring	1		Replace, if necessary. Make sure of correct fit	
2	Plug	2		Replace, if necessary	
3	Guide pin	2		Replace, if necessary. Tighten to specified torque (15—20 Nm/ 11 — 14 ftlb)	
4	Housing (caliper)	1		Note 20° piston position. If necessary, correct with piston pliers. Set back (milled) surface faces down to brake disc inlet side. Reference point is edge on bottom of housing (page 47 - 11)	
5	Brake pad, inner (with riveted retaining clip)	1	Pull out of piston	Check, replacing if necessary. Wear limit 2 mm	
6	Brake pad, outer	1		Check, replacing if necessary. Wear limit 2 mm	
7	Holder	1			
8	Piston	1	Press out of housing with compressed air. Use piece of wood - danger!	Use brake cyl. paste. Watch 20° piston position	
9	Dust cover	1		Replace; make sure sealing lips fit correctly in housing and piston groove. See instructions	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
10	Seal	1	Remove with a plastic rod	Replace, install with brake cylinder paste	
11	Dust cap	1			
12	Bleeder valve	1			
13	Damper sleeve	2		Replace when torn, brittle or swollen rubber	Page 47 - 12
14	Slide	2		Replace if necessary	Page 47 - 12

DISASSEMBLING AND ASSEMBLING FLOATING CALIPER

Disassembling

1. Remove housing retaining spring. Pull plugs out of guides. Remove guide pins.

2. Remove housing. Take outer brake pad off of holder. Pull inner brake pad out of piston.

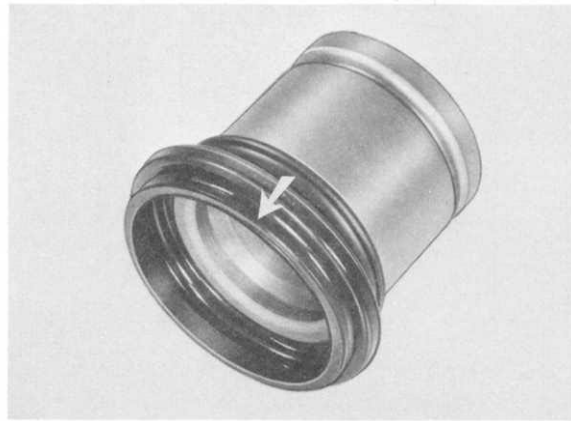
3. Support piston firmly on a piece of wood and press out of housing with compressed air. Press out piston only halfway at first and take sealing lip of dust cover out of piston groove.

4. Remove seal with a plastic needle.

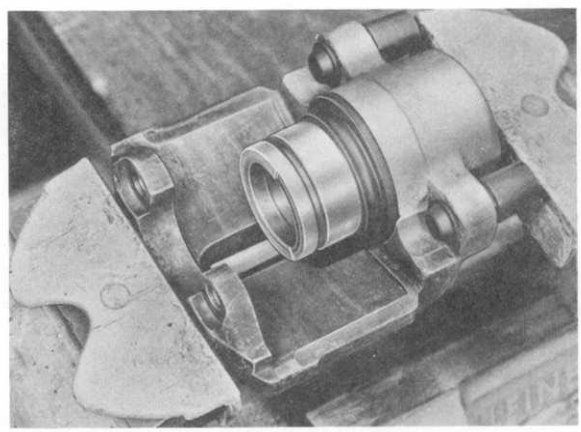
Assembling

1. Apply a very thin coat of brake cylinder paste on cylinder bore, piston and seal.

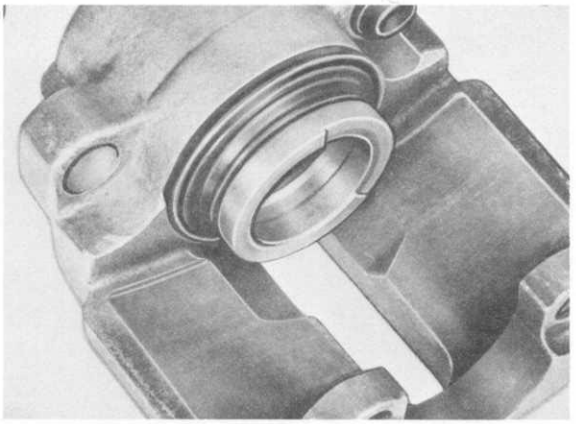
2. Push dust cover on inside of piston so far that large diameter sealing lip (arrow) extends over the piston.



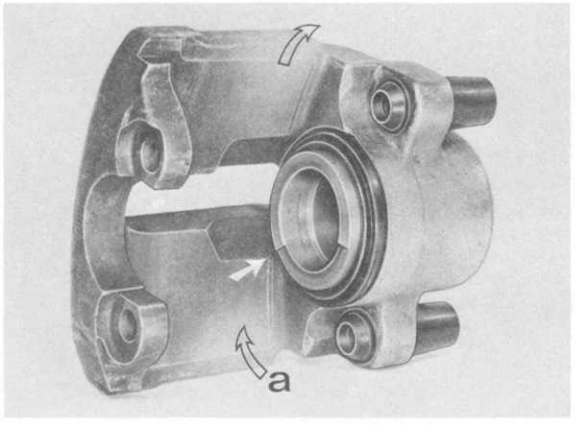
3. Press sealing lip of dust cover into housing groove with piston in approximately correct position (20° set back surface).
Make sure that seal fits properly around its entire periphery.



4. Press piston into housing slowly. Small diameter sealing lip should settle in groove of piston.



5. Adjust 20° piston position precisely with the piston pliers. Set back surface of piston faces down to brake disc inlet side.
   A reference point is the edge on bottom of housing (see arrow).
   Arrow a = brake disc inlet side.



6. Replace damaged dampers and guides.

7. Bolt holder to housing. Tighten guide pins to specified torque. Insert brake pads and housing retaining springs.

REPLACING DAMPERS AND SLIDES

Removing

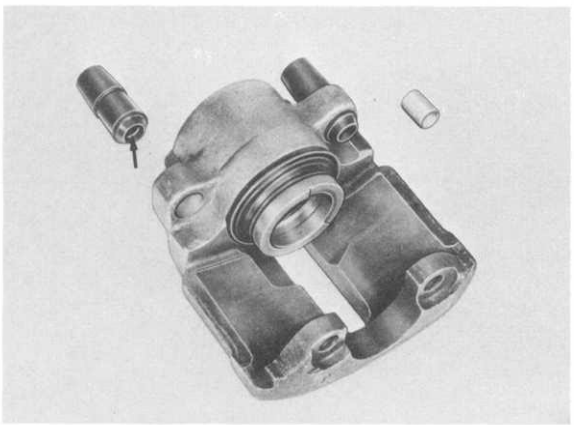
1. Separate housing from holder. Pull piston end brake pad out of piston.

2. Press out damper in direction of brake hose connection. Make sure that bearing surface in housing is not damaged.

Installing

1. Coat damper with brake cylinder paste.

2. Insert damper in housing from the brake hose connection side. Then guide slide from piston side into damper so far, that it is positioned between the lips provided for this purpose (arrow = visible lip).



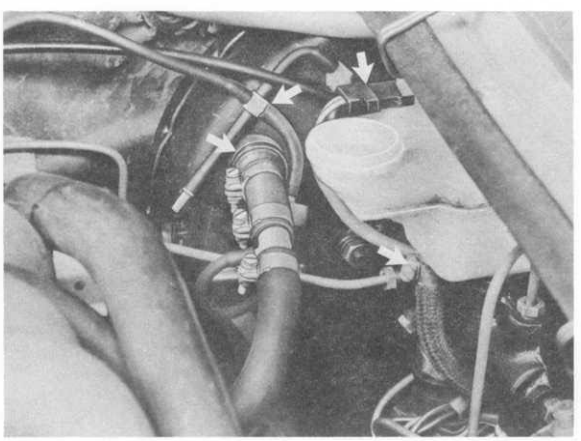
REMOVING AND INSTALLING BRAKE MASTER CYLINDER

Removing

1. Remove intake hoses and air cleaner upper section.

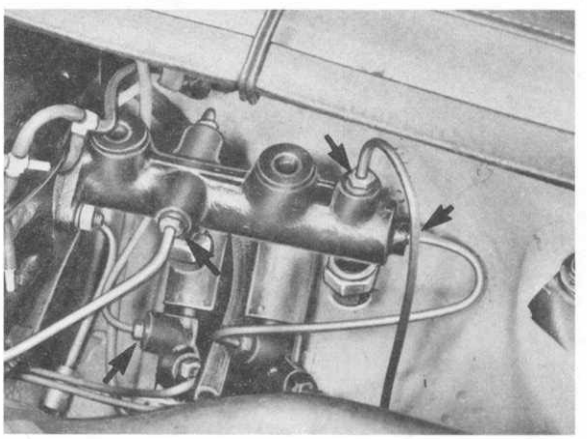
2. Drain both chambers of brake fluid reservoir by pumping out brake fluid via pertinent bleeder screws depending on brake circuit division.
   Diagonal brake circuit division up to 1983 models. Axle brake circuit division since 1984 models.
   Identification: stepped master cylinder and screw-in brake pressure regulator (see point 5).

3. Detach vacuum hose with check valve at brake booster.
   Pull off vacuum line on branch, plug for warning device and hose for clutch control.



4. Pull brake fluid reservoir out of master cylinder from above. If applicable, pull off plugs on hydraulic stop light switches.

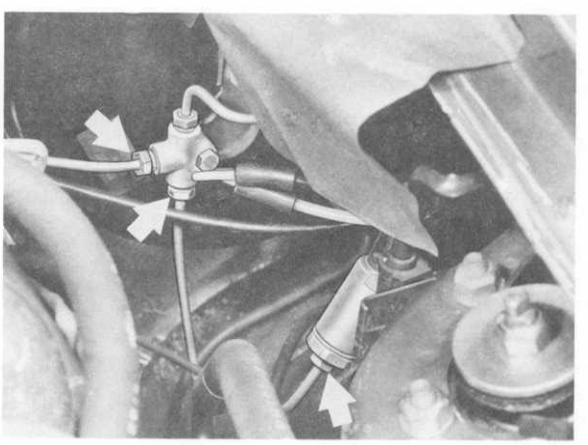
5. Detach brake lines.
   Up to 1983 models.



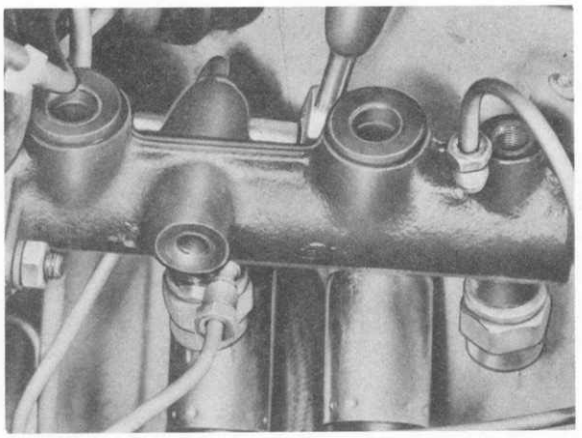
Since 1984 models

Note:

Counterhold on hexagon of regulator when unscrewing rear axle brake line on screw-in brake pressure regulator. Screw-in regulator of cars with ABS is installed on hydraulic unit.



6. Remove the master brake cylinder at its flange with a 1/4-inch ratchet, a 13 mm socket wrench insert and a suitable extension. Take out the master brake cylinder.



Note

On right-hand drive cars, the windshield washer filler pipe must also be removed. Take it out at the same time as the master brake cylinder.

Installing

1. Renew the O-ring between the master brake cylinder and the brake booster, or else a loss of vacuum may occur.

2. Install the master brake cylinder and connect up the brake pipes.

3. Press the fluid reservoir into the sealing plugs in the master brake cylinder. Use new sealing plugs each time the fluid reservoir is removed. When pressing in, the reservoir must pass 2 detents before firm seating can be guaranteed.

Note

Use only brake fluid or brake cylinder paste as an aid to installation. Substances containing mineral oil will destroy the rubber elements in the brake system and cause brake failure.
In the case of stepped brake master cylinders, there is a washer under the front sealing plug (intermediate piston brake circuit).

4. Bleed the brake/clutch with the filling and bleeding device. Check for leaks and for correct operation.

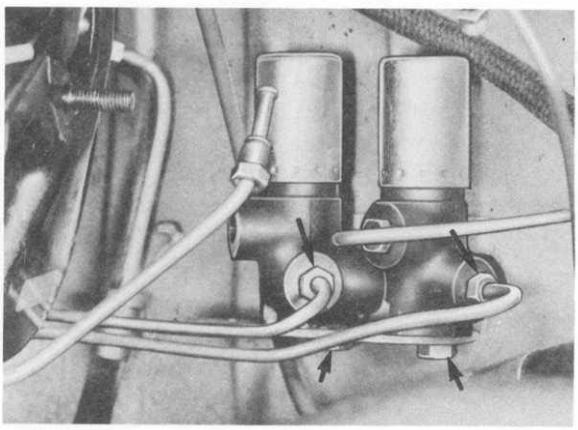
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REMOVING AND INSTALLING BRAKE BOOSTER

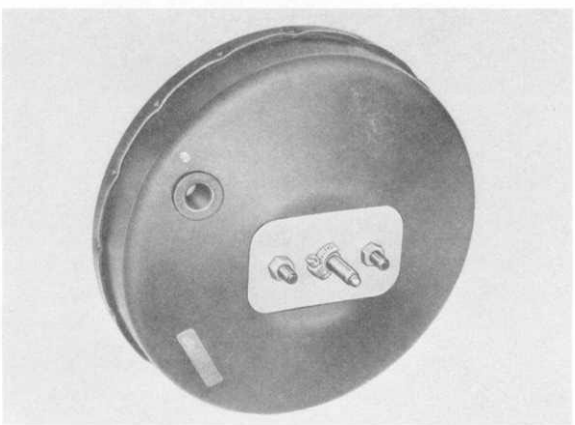
R e m o v i n g

1. Remove master cylinder (see page 47 - 13)

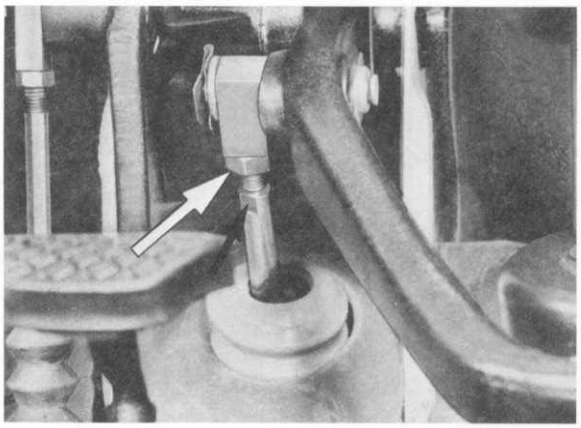
2. Remove brake pressure regulator from wheel arch (only cars earlier than model year 84).



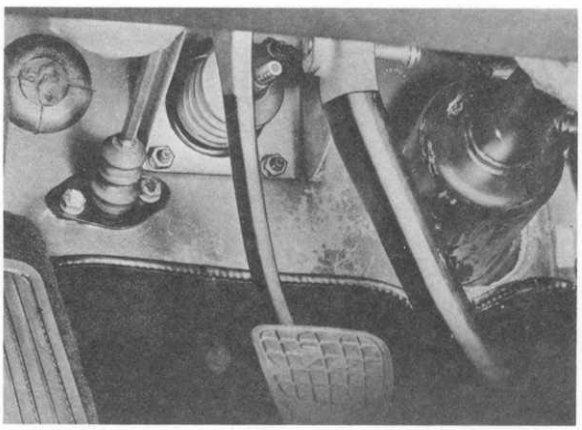
3. Depress brake pedal fully and using a hose clamp, fix pressure rod for master cylinder in this position. Place a strip of 2 mm sheet beneath clamp.



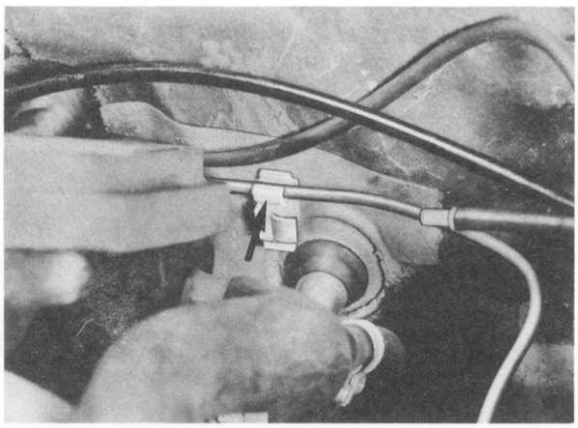
4. So that brake pressure rod (piston rod) protrudes as little as possible toward the footwell from the booster, adjust adapter, depress brake pedal again and correct position of hose clamp. Remove adapter.



5. Remove cover and unscrew mounting nuts of brake booster.



6. If necessary, unclip brake line from right-hand front wheel from its holder on bulkhead and carefully push toward engine. Position hose for clutch release cylinder and electric cables so that they do not obstruct during removal.



7. Remove brake booster. It may be necessary to make space by removing the lower section of the air filter to allow passage of a 10" brake booster.

I n s t a l l i n g

1. Renew seal ring between bulkhead and brake booster if damaged. The 10" boosters are fitted with 2 mm seals, or 1 mm seals as of model year 85. Use a 4 mm seal or two 2 mm seals for 9" boosters.

2. Install brake booster and tighten securing nuts. Check that the cover over the control housing is correctly seated.

3. Install brake pressure regulator and master cylinder. Always renew seal ring between brake booster and master cylinder. Mount brake pressure rod with adapter on brake pedal. Adjust pressure rod play and check setting of mechanical stoplamp switch, if fitted (page 46 - 10a).

4. Bleed brakes/clutch with charging and bleeding equipment. Check for leaks and correct operation.

REMOVING AND INSTALLING BRAKE PRESSURE REGULATOR

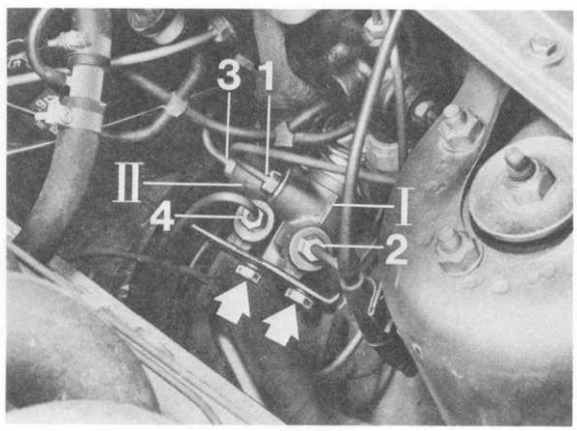
Regulator on Wheel House

Removing

1. Remove intake hoses and air cleaner upper section.

2. Drain both chambers of brake fluid tank by pumping out brake fluid through bleeder valves of front and rear wheel brake calipers (diagonal brake circuit division).

3. Detach brake lines. Remove brake pressure regulator after unscrewing mounting bolt(s).



I Regulator for right rear wheel
II Regulator for left rear wheel

1 – Inlet of intermediate piston brake circuit
2 – Outlet to right rear wheel
3 – Inlet of push rod brake circuit
4 – Outlet to left rear wheel

Installing

1. Check brake pressure regulator/car application on page 47 - 18.

2. Install brake pressure regulators. The mounting plate has a retaining tab for each brake pressure regulator to guarantee correct installed position and prevention of turning when tightening bolts.

3. Connect brake lines. Bleed brakes.

Note

If applicable, cancel the brake circuit failure indicator lamp by disconnecting the battery (ground wire on body).

Screw-in Regulator
(since 1984 models)

Arrangement

Cars with ABS: connect h screwed in hydraulic unit.

Cars without ABS: screwed in master cylinder (intermediate piston circuit).

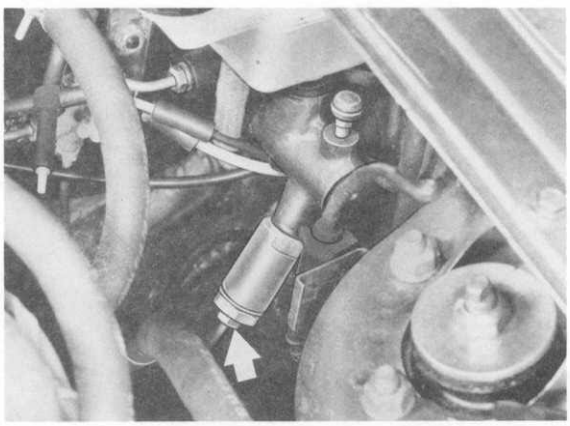
Removing

1. Remove left intake hose.

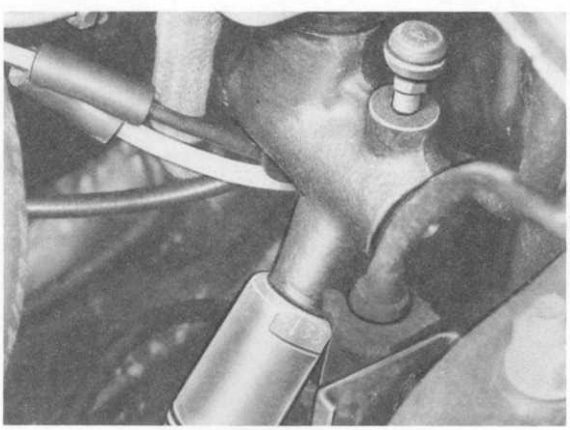
2. Unscrew brake line on brake pressure regulator, counterholding on hexagon of regulator.

Note:

Place cloths underneath to avoid damage from escaping brake fluid.



3. Disconnect brake pressure regulator on brake master cylinder or hydraulic unit, never turning on the hexagon.
Plug open connection with a plug.



Installing

1. Screw in brake pressure regulator. Mount brake line on brake pressure regulator while counterholding on the hexagon.

2. Bleed brakes (begin at bleeder valve of master cyl.).

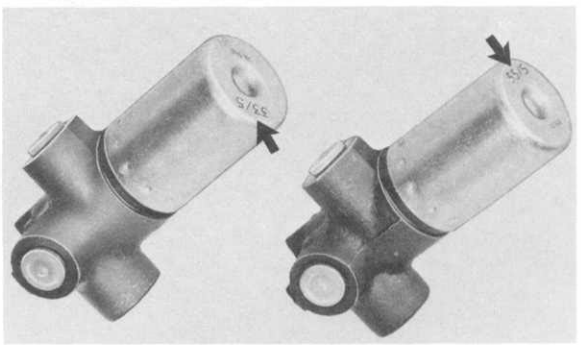
BRAKING-FORCE REGULATORS - INSTALLATION OVERVIEW

Braking-Force Regulators Until End of Model Year 83
(Diagonal braking circuits/2 regulators per vehicle)

	9" Brake Boosters		10" Brake Boosters	
	previously installed	replace by	previously installed	replace by
Switchover pressure in bar	55	33	33	33
Part No.	(---------) discontinued	928.355.083.02	(928.355.083.01) discontinued	928.355.083.02
Identification (color + switchover pressure)	Painted black	Painted black green dot in center of cap	Painted blue*	Painted black, green dot in center of cap
Switchover pressure & reduction factor (stamped on cap)	55/5	33/5	33/5	33/5
Remarks	When replacing only use 928.355.083.02 as a pair. Under no circumstances may 33 and 55 bar regulators be used together in a car.		When replacing only use 928.355.083.02 as a pair. Under no circumstances may 928.355.083.01 and 928.355.083.02 regulators be used together in a car.	

Switchover pressure and reduction factors stamped on cap.

55 or 33 = switchover pressure (bar)
5 = reduction factor 0.46



* For a brief period, brake pressure regulators painted black and marked only with a blue dot were installed. Note switchover pressure on cap.

Braking-Force Regulators, 84 Models Onward
(stage-type tandem master cylinder, separate brake circuits for each axle, 1 screw-in regulator per car)

Installed in	Part No.	Switchover pressure
84 models	928.355.305.00	33 bar
85 models	928.355.305.01	33 bar
86 models onward (with four-piston fixed-caliper brakes)	951.355.305.00	18 bar

Installation:

Cars with ABS: Screwed into port h of hydraulic unit.

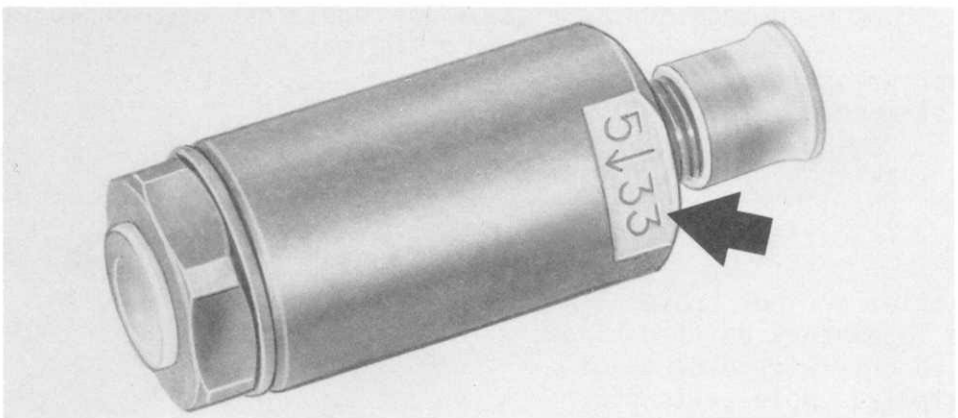
Cars without ABS: Screwed into master cylinder (inter-piston circuit).

Identification / Remarks

Switchover pressure and reduction factor stamped on regulator.

33 or 18 = switchover pressure (bar) 5 = reduction factor 0.46

It is essential to ensure that the appropriate parts are installed. Under no circumstances may braking-force regulators with different reduction factors (e.g. 3 = 0.3) be installed.



INSPECTING BRAKING-FORCE REGULATOR

General

A braking-force regulator is integrated in the brake lines to the left-hand and right-hand rear wheels (diagonal braking circuits). This version was retained until the end of model year 1983. From model year 1984 onward, only one braking-force regulator is installed for both rear wheels (separate braking circuits for each axle). This regulator is smaller and lighter. It is screwed directly into the modified master cylinder or into the hydraulic unit of vehicles with ABS (screw-in regulator).

The braking-force regulators have a permanently set switchover pressure of 18, 33 or 55 bar (see overview, page 47 - 18a/18b). Until pressure rises to the switchover point, the same overpressure is applied to the input and output sides of the braking-force regulator. As the pressure on the input side rises further, the output overpressure (rear-axle overpressure) is reduced.

To check the braking-force regulators of diagonally-split braking circuits, the pressure which is not reduced (front axle) and the reduced pressure (rear axle) must be read simultaneously on manometers installed independently in the separate circuits.

To check the braking-force regulator (screw-in regulator) of brakes with separate circuits for each axle, the pressure which is not reduced (front axle) and the reduced pressure (rear axle) must be read simultaneously on independent manometers in the separate circuits.

Preparation

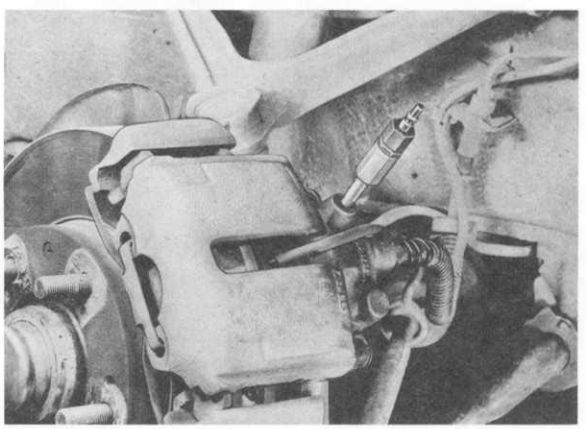
1. Connect brake calipers concerned and pressure tester by screwing test adapters into holes for bleeder valves in brake calipers.

Diagonally-split Brake Circuits

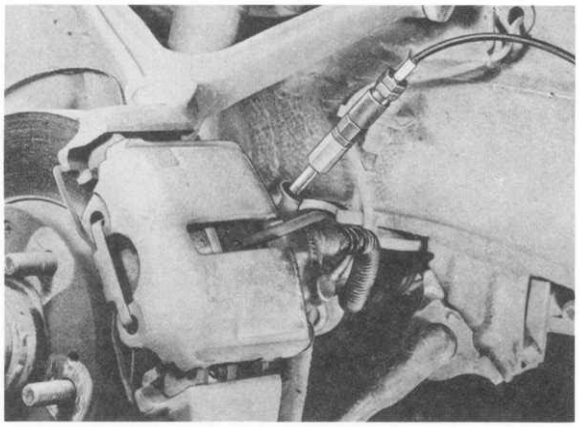
Test connections for braking-force regulator of left-hand rear wheel: on the left behind and on the right in front of the right-hand rear wheel:
rear right and front left

Separate Braking Circuits for Each Axle (84 models onward)

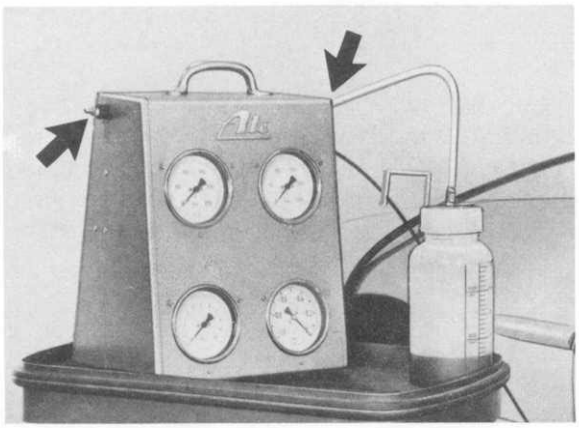
Test connections for the screw-in regulator:
front axle left or right and rear axle left or right.



2.Connect line from tester (miniature coupling) to test adapter.



3.Bleed test lines and manometers of pressure tester.



4.Check switchover pressure of braking-force regulator installed in car (18, 33 or 55 bar). Before testing, check against table (page 47 - 18a/18b) to ensure that correct regulator is installed.

T e s t I

Build up input overpressure (shown on manometer) of front brake caliper (unregulated wheel) in accordance with table. Read output overpressure on manometer of rear brake caliper (regulated wheel) (specified reading, see table below).

N o t e :

If the input overpressure (unregulated wheel) is inadvertantly exceeded, do not reduce pressure to adjust. Pressure must be built up again from 0 bar (also applies for test II).

T e s t I I

Increase input overpressure (shown on manometer) of front brake caliper (unregulated wheel) to 100 bar. Read output overpressure on manometer of rear brake caliper (regulated wheel).

Test	Switch-over pressure of brake regulator	Input over-pressure (front axle)	Output over-pressure (rear axle)
	Regulator at wheel arch		
I	55 bar	70 bar	62 ±3 bar
	33 bar	48 bar	40 ±3 bar
II	55 bar	100 bar	75 ±5 bar
	33 bar	100 bar	64 ±5 bar
	Screw-in regulator		
I	33 bar	48 bar	40 ±2 bar
	18 bar	33 bar	25 ±2 bar
II	33 bar	100 bar	64 ±3 bar
	18 bar	100 bar	55 ±3 bar

A d j u s t m e n t

1. If the measured values do not correspond to those stated in the table or if the pressure in the regulated circuit increases while the force exerted on the brake pedal remains constant, renew the braking-force regulator. When replacing, see note on page 47 - 18a/18b.

2. After testing and removal of the equipment, bleed the brake system.

3. Reset the brake circuit failure warning by disconnecting the battery (ground lead to body).

Changing the brake fluid / bleeding the brakes

General

To ensure fast and efficient servicing, is is recommended to use a filling and bleeding device. The procedures described below were carried out with a Teves unit. For a detailed description of the unit, refer to the operating manual of the unit.

Important notes

Bleed both bleeder valves of each wheel of the four-piston fixed caliper brake.
When changing the brake fluid, also drain some brake fluid from the bleeder valve of the clutch slave cylinder.

Use only fresh DOT 4 brake fluid.
Observe change intervals and brake fluid grade.
Total brake fluid change quantity: 1 liter.
Change quantity per wheel: approx. 250 c.c.

On vehicles up to end of MY '92, the brake fluid must be replaced **every 2 years** as a minimum.

As of MY '93, the brake fluid change interval has been **increased to 3 years** - along with the use of special DOT 4 brake fluid.

The 3-year change interval is valid as of MY '93, but only in conjunction with the use of the special Porsche brake fluid. The brake fluid is available under Part No. 000.043.202.04.
Container contents: 5 liters (as of May, 1992).

This special brake fluid may also be used on pre-MY '93 vehicles. However, the **two-year** fluid change interval will remain valid for those vehicles.

Brake fluid

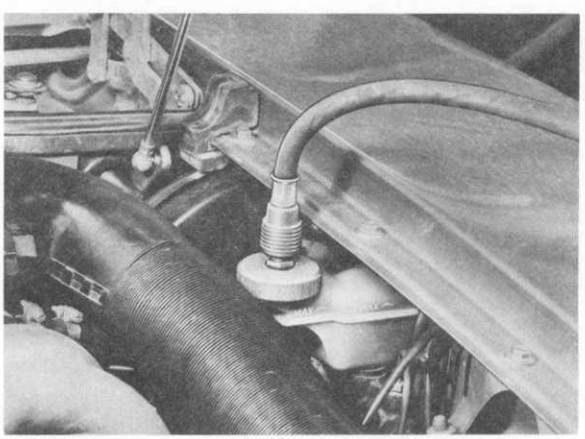
The new brake fluid - Part No. 000.043.202.04 - offers superior properties. Compared to the brake fluid specified previously, its main features are **further reduction of water absorption and increased wet and dry boiling points**.
Note on water absorption: Water contents of only 2% in the brake fluid will cause the boiling point to drop by approx. 60 deg.C.

As of MY '93, only the new brake fluid may be used when topping up the reservoir.
Any mixture of former brake fluid with new brake fluid causes the safety margin of the fluid to be narrowed down unnecessarily.
Both the former and the new brake fluid are of amber color.

Procedure for bleeding and changing the fluid

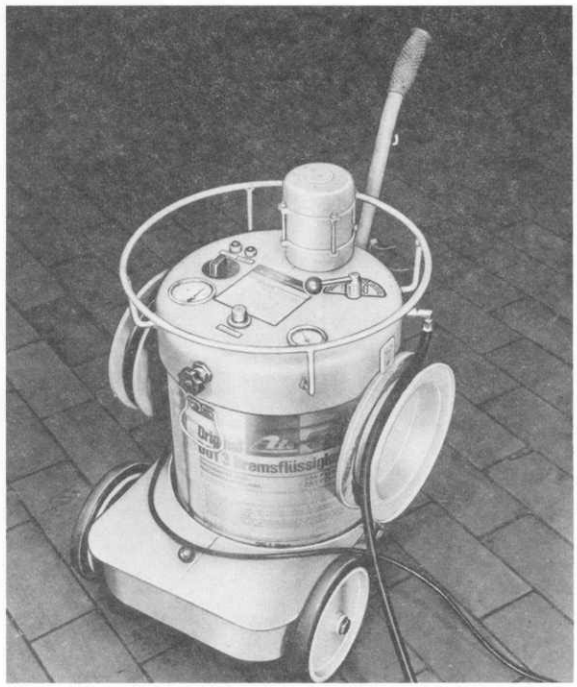
1. Top up reservoir with fresh brake fluid up to upper edge. Take out strainer insert.

2. Connect bleeder flange to reservoir and fit quick coupling of filler hose to the nipple on the bleeder flange.



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3. Switch on bleeder. Move selection control lever to filling and bleeding position.

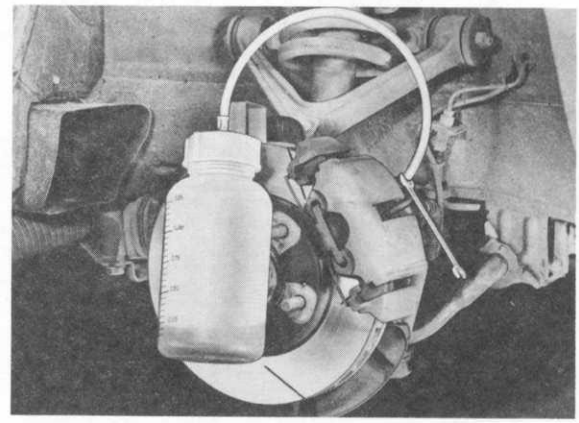


4. Open each bleeder valve until escaping brake fluid is without air bubbles.

N o t e

First bleed the clutch, if the brake master cylinder or brake fluid tank had been removed.
The stepped brake master cylinder (since 1984 models) has a bleeder valve for the intermediate piston brake circuit (rear axle brake circuit), see point 6.

5. Use a bottle to catch the escaping brake fluid for accurate inspection regarding cleanliness, air bubbles and determination of brake fluid consumption.



6. Operate the brake pedal firmly several times during bleeding procedures and with the bleeder valves open, in order to remove all air bubbles in the brake master cylinder.
If there is a bleeder valve on the master cylinder, begin bleeding of brakes on this valve.

N o t e

There is no difference in bleeding procedures for cars with ABS.

7. It is recommended to perform a low Pressure leak test after finishing the bleeding/brake fluid change procedures. This, of course, requires that the bleeding adapters and filling hose are connected 100 % tight. All bleeder valves of the system must be closed. Keep the selection control lever at "filling and bleeding" and read pressure on the operating pressure gauge.

8. Now set lever to leak test. The pressure value displayed on the operating pressure gauge must not drop during the next 5 minutes.
   There is a leak in the brake or clutch system, if pressure does drop during the test time.



9. Install dust caps on bleeder valves. Draw off brake fluid in tank, which is higher than the MAX mark. Install strainer and screw on brake fluid tank cap.

TECHNICAL DATA

Steering	Rack-and-pinion type with tie rods and hydraulic assistance (power steering)
Steering wheel dia.	380 mm/15 in.
Steering wheel ratio at center	17.75 : 1
Turning circle dia. (wall-to-wall)	11.5 m/37.7 ft
Turning circle dia. (curb-to-curb)	9.6 m/31.5 ft
Steering wheel turns from lock to lock	3.13

STEERING TORQUE SPECIFICATIONS

Location	Description	Threads	Material	Torque Nm (ftlb)
Steering gear to engine carrier	Self-locking nut	VM 10	5	46 (33)
Tie rod to steering arm	Self-locking nut	VM 12 x 1.5	8	65 (47)
Universal joint to steering gear	Self-locking nut	VM 8	8	28 (20)
Tie rod to ball joint	Nut	M 14 x 1.5	04	45 (33)
Steering tie rod to rack	Tie rod	M 16 x 1.5	16 Mn Cr 5	150 (108)
Universal joints to steering and intermediate shafts	Self-locking nut	VM 8	8	28 (20)
Pressure and return lines to steering gear	Hollow bolt	M 14 x 1.5		30 (22)
Steering wheel to steering shaft	Nut	M 18 x 1.5	8	50 (36)
Stabilizer clamp to side member	Bolt	M 10	8.8	46 (33)
Pulley to power steering pump	Self-locking nut	M 14 x 1.5	8	50 (36)
Steering protective tube to body	Bolt	M 6 with 4 mm socket		9.7 (7)
		M 6 with 5 mm socket		12 (9)
Suction hose nipple to power pump	Hollow bolt	M 18 x 1.5	C 35	60 (43)

Replacing the steering in case of accident damage

A. General

Accidents or **driving conditions similar to accidents** may cause various types of damage to steering gears. **If the outside of the steering gear is undamaged,** tracing of damage is sometimes difficult and requires considerable effort. This, however, constitutes an incalculable risk for the safety of the vehicle as it may lead to steering failure.

Due to the fact that a comprehensive check of all steering gear components requires considerable effort and is therefore not normally justifiable or even impossible to be carried out with standard shop equipment, the condition of other components that are easier to be checked must be considered as a **replacement solution**.

The following guidelines (item B) should be observed to decide if the steering gear of an accident vehicle requires replacement or may be used as it is.

B. Assessing the Condition of the Steering System of an Accident Vehicle

The steering gear **may** remain on the car **if all the following conditions** are met:

- No visible damage to front-axle components such as wheels, king pins, control arms, steering arms, tie rods, to frontaxle crossmember, steering shaft, as well as to the suspension mountings at the body.
- No inadmissible increase of torque and no binding or stiffness when the steering gear is turned from lock to lock. When moving the steering form lock to lock, the front wheels must be off the ground (front axle raised) and the engine must be stopped (no drive to power steering pump).
- Admissible suspension alignment tolerances must not be exceeded.

The steering box **must be replaced or exchanged if any of the following points apply:**

- **Damage to steering gear is visible or can be felt**
- **Burning damage (e.g. bellows of steering burnt)**

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- **Permanent deformation or cracking of:**

  Steering gear mounts

  Tie rods

  Steering arms

  King pins

  Control arms

  Front-axle crossmember (engine mounts)

If the above criteria are **not** sufficient for a decision, it is recommended to exchange or replace the steering gear.

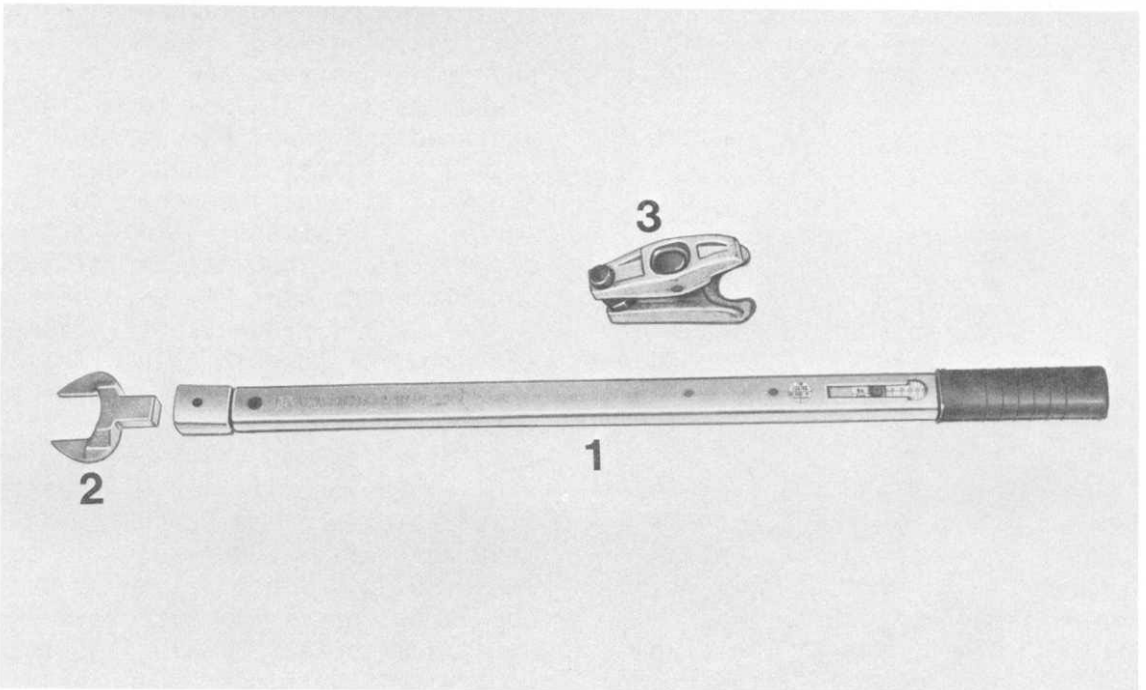
C. Exceptional regulations / order processing

If the **steering gear replacement proposed** by the shop is refused by the customer or insurance company for financial reasons, an expert or, if this is not possible in foreign contries, the importer should be consulted (to be charged to the refusing party). If a decision is made against the above guidelines, it is recommended to file a note to this effect and have it signed by the expert.

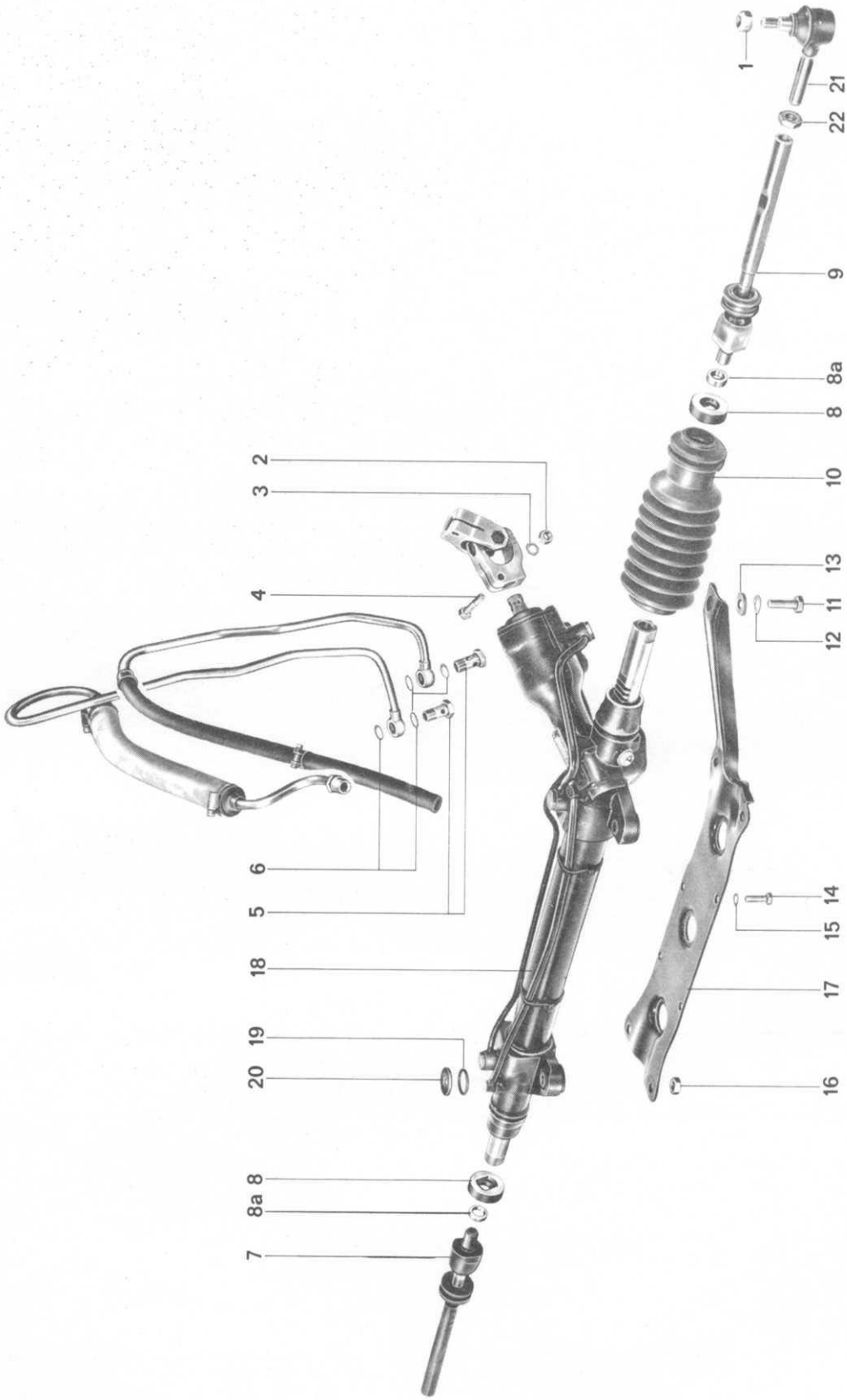
Power steering gears with no visible outside damage that require replacement can be supplied on an exchange basis.

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TOOLS



No.	Description	Special Tool	Remarks
1	Torque wrench (Stahlwille 730 R/20 or Hazet 6292-1 CT)		
2	Wrench socket	9183	
3	Tie rod puller		e. g. Nexus 168-1


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8
8a
7

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Self-locking nut	2		Replace. Tighten to specified torque	
2	Self-locking nut	1		Replace. Torque: 28 Nm/20 ftlb	Watch position of universal joint Page 48 - 6
3	Washer	1		Replace if necessary	
4	Setscrew	1			
5	Hollow bolt	2		Tighten to specified torque	
6	Seal	4		Replace	
7	Tie rod assembly	1		Torque: 150 Nm/108 ftlb. Tighten while holding rack and use torque wrench with special tool 9183	
8	Stop	2		Note arrangement	
8a	Spacer	2		Note arrangement	
9	Tie rod	1		Torque: 150 Nm/108 ftlb. Tighten while holding rack and use torque wrench with special tool 9183	
10	Dust boot	2		Check, replacing if necessary	
11	Bolt	1			
12	Washer	1		Replace if necessary	
13	Washer	1			
14	Bolt	4			
15	Washer	4		Replace if necessary	

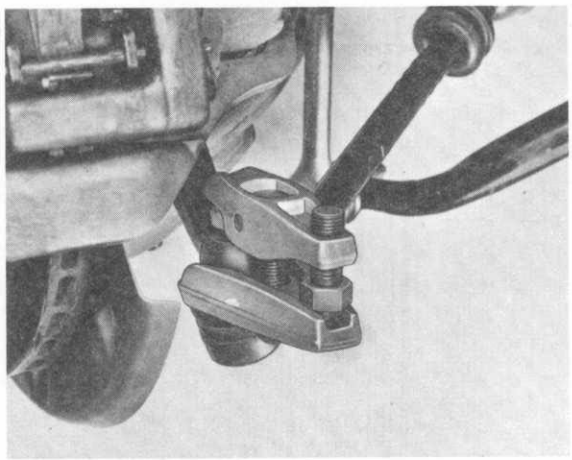
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
16	Self-locking nut	4		Replace. Tighten to specified torque	
17	Reinforcement plate	1			
18	Steering gear	1		Run out rack ends completely and coat with VW steering gear lube AOF 086 000	Note position of universal joint Page 48 - 6
19	O-ring	4		Replace if necessary. Position correctly	Not for new steering gears with bushings in mounting bosses
20	Washer	4			Not for new steering gears with bushings in mounting bosses
21	Tie rod end	1		Screw into tie rod 18 to 19 turns	
22	Nut	1			

REMOVING AND INSTALLING STEERING GEAR

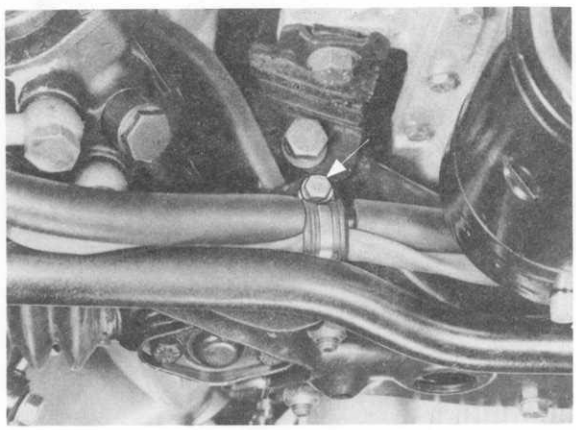
Removing

1. Draw hydraulic fluid out of tank.

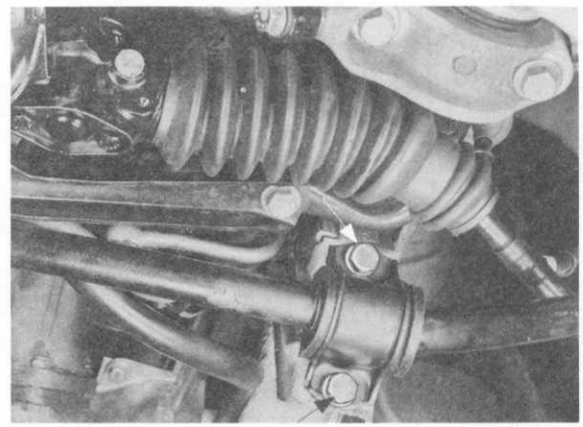
2. Press out tie rods with a standard extractor.



3. Pull back hose strap with harness after removal of screw on side.



4. Remove bolts from stabilizer mounts. Let stabilizer hang down.



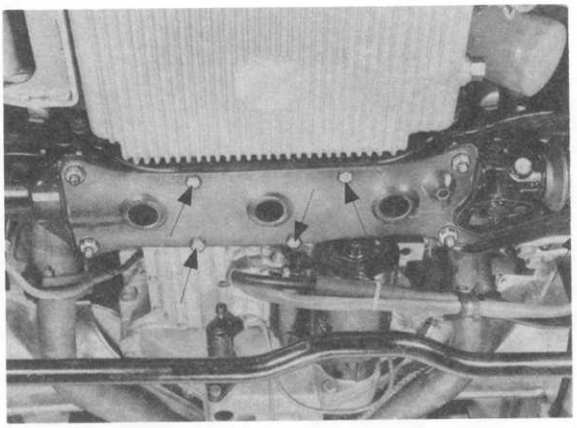
5. Unscrew pressure line and return line at steering gear.



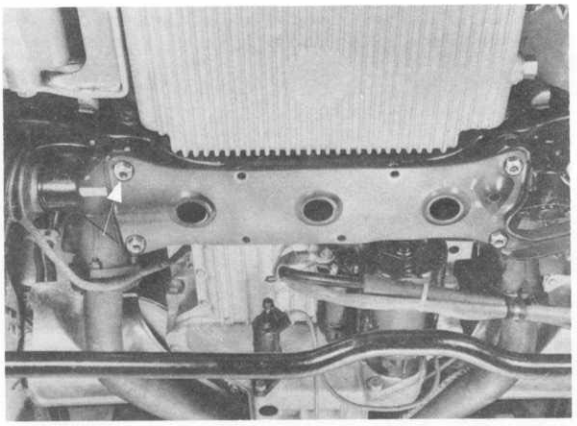
1 - Pressure line

2 - Return line

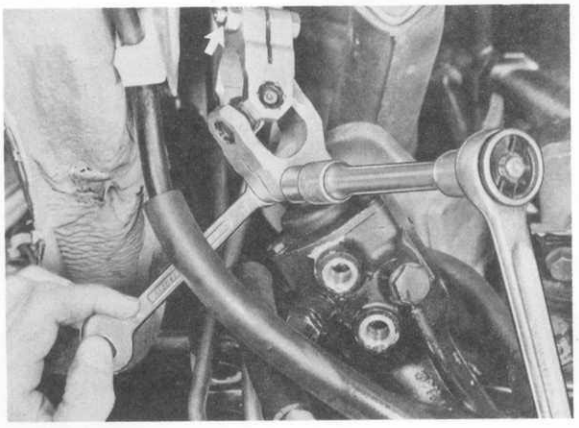
6. Remove five bolts from reinforcement plate on engine carrier.



7. Loosen four self-locking nuts of steering gear, but do not remove them.



8. Remove bolts on universal joint. Push universal joint in direction of steering intermediate shaft.



9. Now remove the four mounting nuts and take steering gear out of studs on engine carrier.

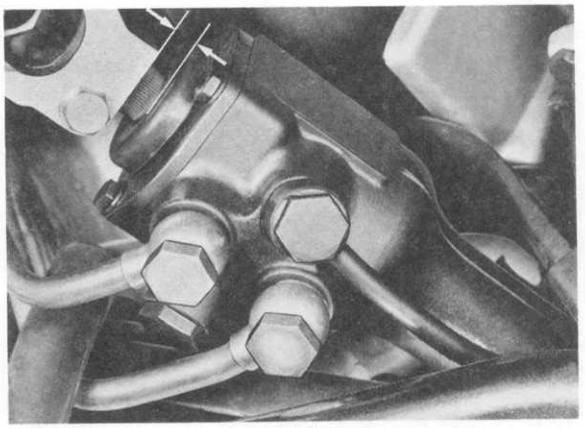
Installing

1. Slide universal joint on to steering gear in correct position (steering wheel and steering gear in center position). Nuts on steering should only be screwed on slightly (facilitates assembly).

2. Mount steering gear. Produce 8 mm clearance between steering gear and universal joint with gauge 9208. Tighten mounting bolts for universal joint to 28 Nm.

Note

On cars with a longer universal joint the clerance will definitely be less than 8 mm after inserting clamping bolt on the steering gear.
In this case it is important to make sure that there is only a small gap between the steering gear and universal joint.



3. Fill system with hydraulic fluid, bleed and check for leaks as well as correct operation (see page 48 - 9)

4. If necessary (with new parts), adjust toe. **In conjunction with this matter**, remember taht there are different steering stop versions (see text below). As of Model Year 1986, the tie rod was changed as well. **Be sure to observe this difference when replacing parts (also refer to page 40 - 17).**

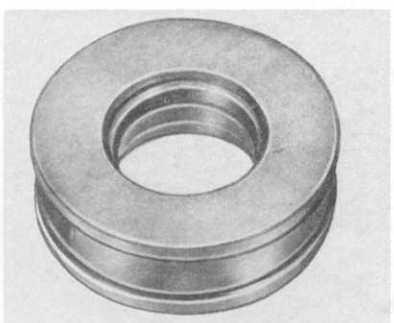
Steering stop versions

The steering stop has also been changed because of changes on the steering gear (rack deep-bore drilled and 15 mm longer, smaller diameter on ends of rack).

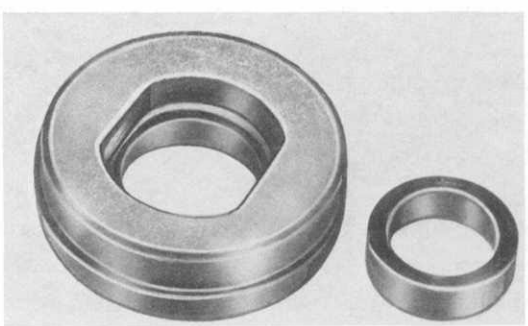
Stop of Changed Version
Part No. 928.347.329.03 or
Present Version
Part No. 928.347.329.04

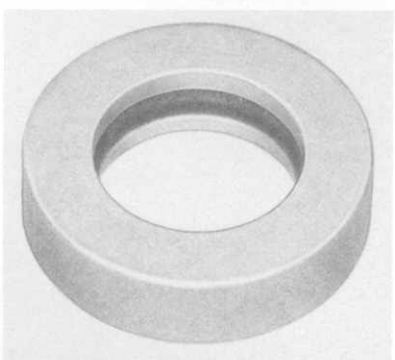
Stop 928.347.329.03 is no longer available for replacements. See cross reference **survey on page 48 - 6 b.**

Stop of Old Version
Part No. 928 347.329.00
- opening on one side with two surfaces in conjunction with spacer, Part No. 928.347.331.00



928.347.329.03 (rubber / metal)





928.347.329.04 (aluminium)

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Cross Reference Survey:

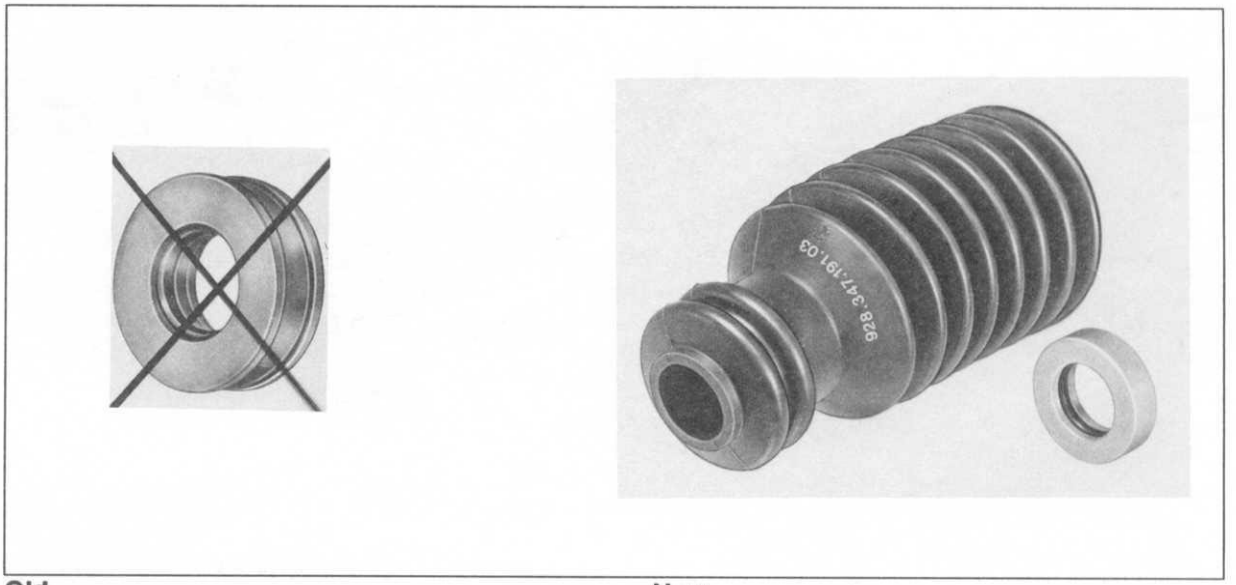
Steering Gear Version Identification	Steering Gear (LHD only)	Stop Part No. (left and right)	Spacer Part No.
1. Old version Rack **795 mm** long Rack end dia. **left 26 mm,** **right 25 mm**	928.347.010.22	928.347.329.00	928.347.331.00
2. Interim version Rack **795 mm** long Rack end dia. **left 26 mm** **right 23 mm**	928.347.010.22	928.347.329.00	928.347.331.00
3. New/current version Rack length **810 mm** Rack end **dia. left and right 23 mm**	(928.347.010.24) (928.347.010.26) **928.347.010.27***	928.347.329.03 bzw. 928.347.329.04 see text below	none

The steering gears with Part No. 928.347.010.22 (former version and interim solution) are no longer available. They should be replaced with the new/current version.

The steering gears of the new version 928.347.010.24 and 928.347.010.26 indicated in brackets have since been deleted as well (status as of December, 1994).
All former steering gear versions are to be replaced with the current version, 928.347.010.27.

The elastic steering stop, 928.347.329.03, for left and right sides is replaces by a solid steering stop, 928.347.329.04, for improvement in quality. At the same time it was necessary to replace the dust cover, 928.347.191.02, with a new version dust cover having a supporting lip, Part No. 928.347.191.03.

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Old New

Instructions for Repair Sector:

Only the new steering stop 928.347.329.04 and the new bellows 928.347.191.03 are supplied for steering gear 928.347.010.24. The bellows 928.347.191.03 and the steering stop 928.347.329.04 are also applicable to steering gears 928.347.010.26 / 928.347.010.27 (as of MY '91 or 928 GTS).

The new steering stop may only be installed together with the new dust cover.

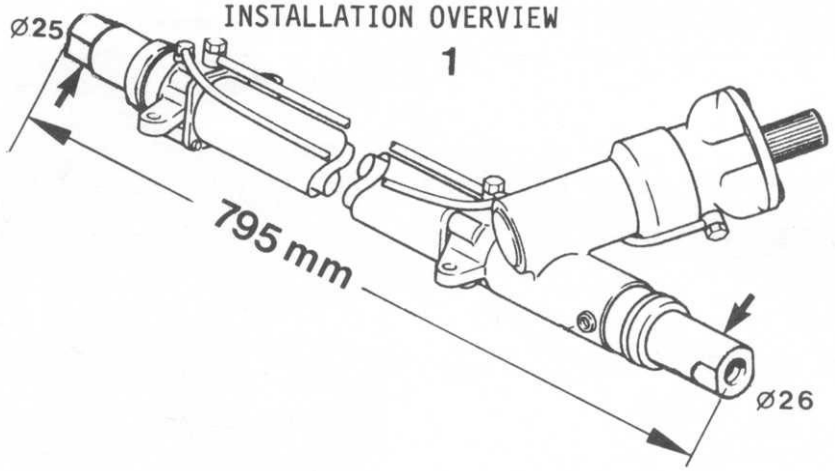
When installing a solid stop for the first time, stops and dust covers must be replaced on both sides.

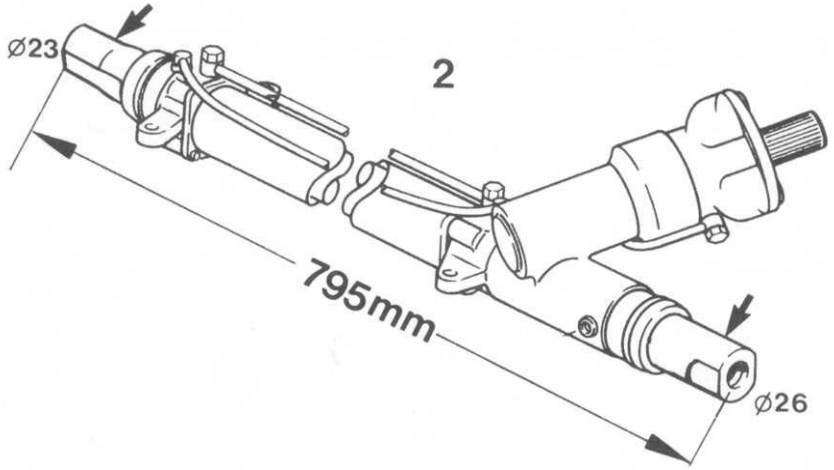
The new version dust cover can also be installed together with the old version elastic stop.

See cross reference survey on page 48 - 6d.

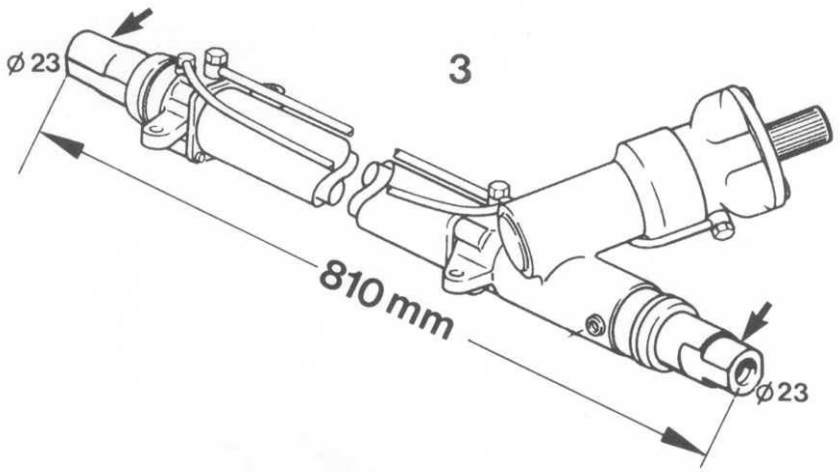
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INSTALLATION OVERVIEW











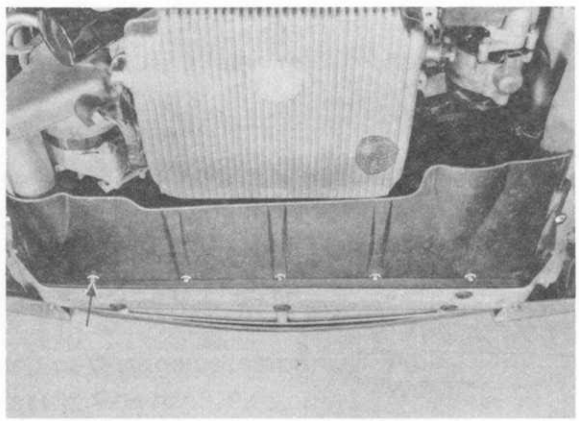
928.347.329.03 et
928.347.329.04 (page 48 - 6 c)

REMOVING AND INSTALLING POWER STEERING PUMP

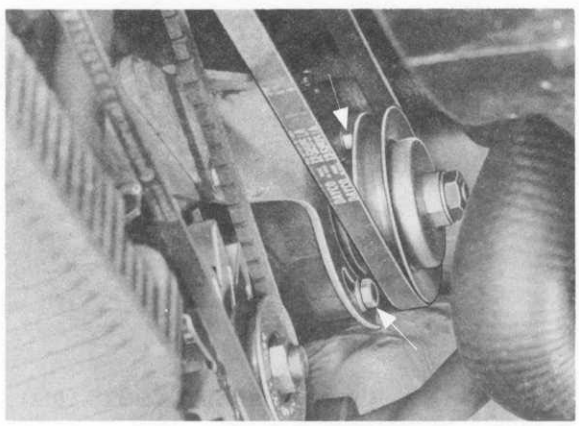
Removing

1. Detach intake hose to air cleaner on left side. Draw hydraulic fluid out of reservoir.

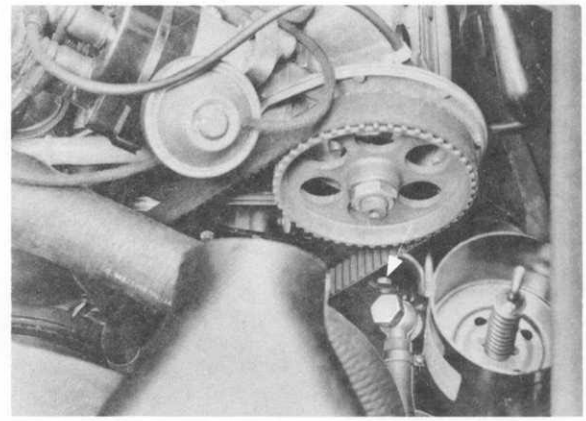
2. Remove splash shield.



3. Loosen front bolts on power steering pump a little.

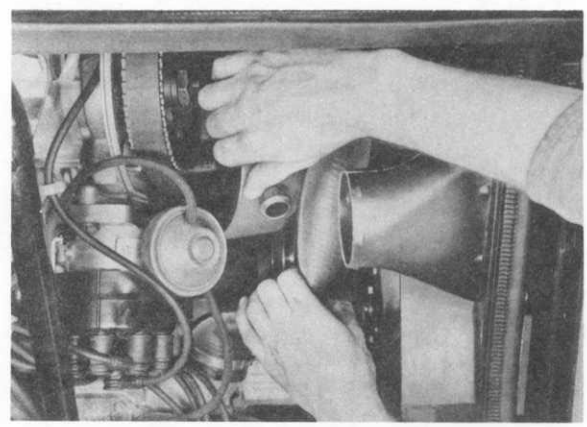


4. Remove rear bolt from power steering pump.

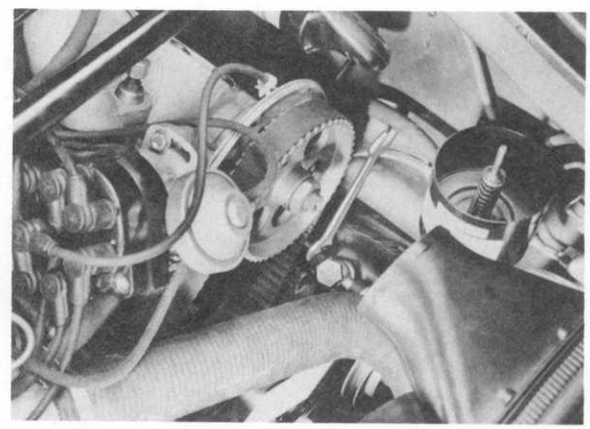


5. Remove v-belt.

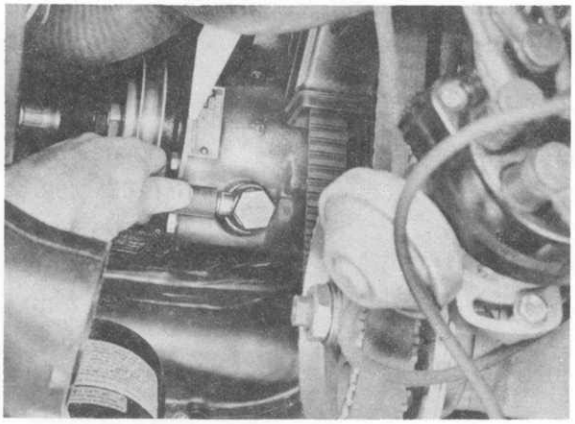
6. Take off left upper section of drive belt cover to facilitate procedures.



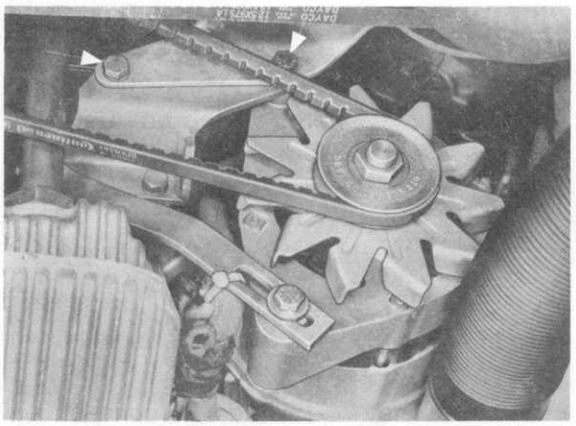
7. Detach pressure hose.



8. Remove suction hose after loosening clamp.



9. Remove bolts on front holder of power steering pump.



Installing

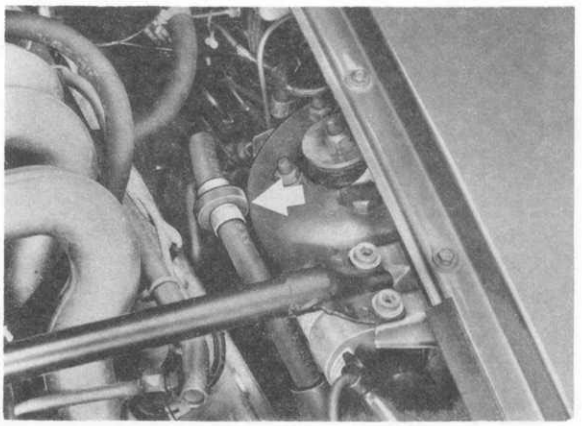
1. Tighten two bolts on front holder; only insert rear one (belt tightness).

2. Install pressure hose so that in installed position the protective ring (arrow) rests on spring strut mount. (Installed position: install drive belt, do not finish installation yet because of point 3.)
Pressure hoses in initially manufactured cars had an asbestos sleeve.
Install this pressure hose leaving not mope than 25 mm between inner wheel well and hose.

Note:

If hose is routed too close to exhaust manifold, the hose could come loose from its holder and cause failure of the power steering.

Asbestos protected hoses are no longer available for replacements.



3. Install upper section of drive belt cover.

4. Install suction hose.

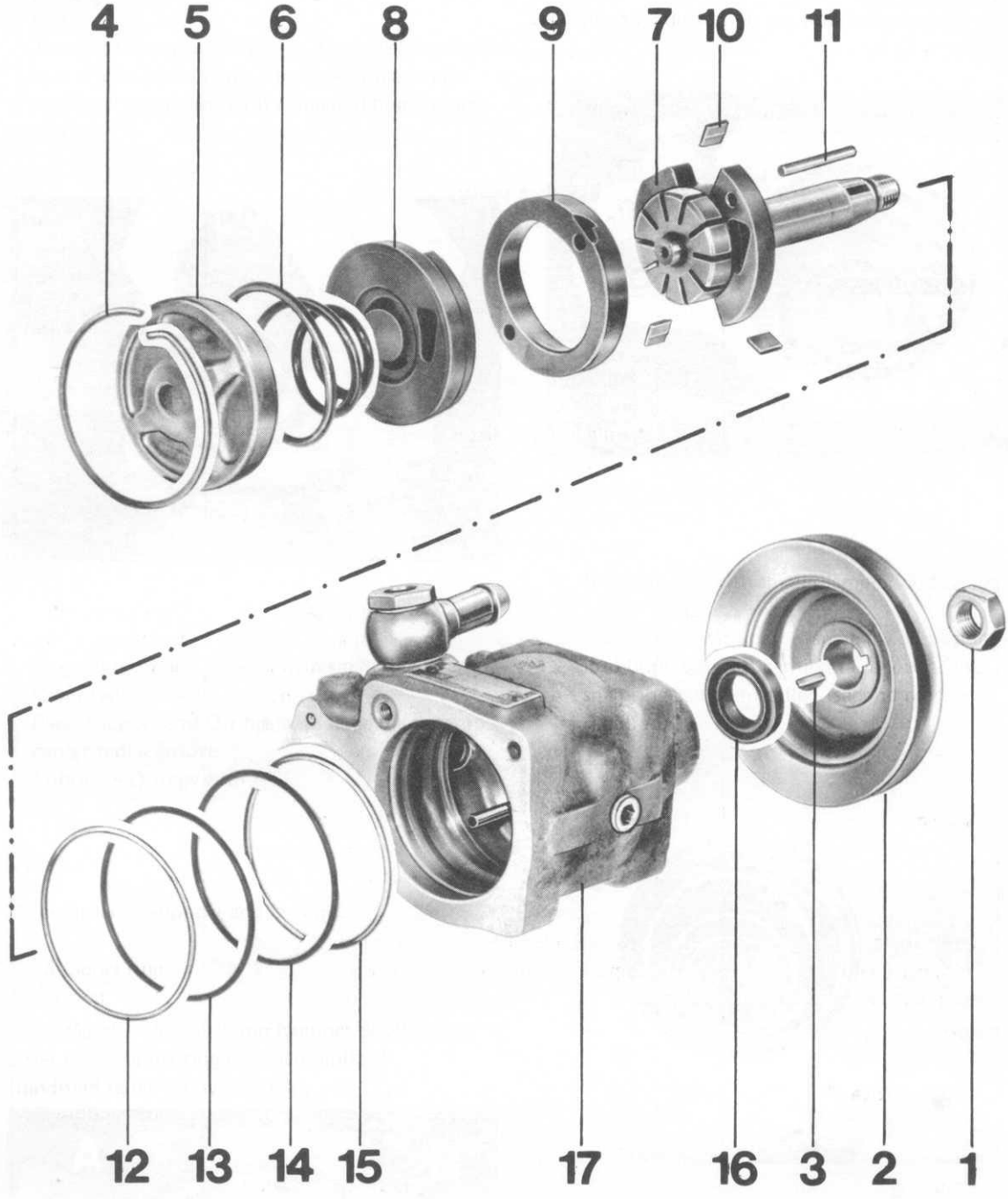
5. Install belt and adjust to remove tension. Also check tightness of alternator belt (slight corrections could be made).

6. Bolt on splash shield. Add hydraulic fluid. Bleed steering system. Check for leaks and operation.

Note:

Make sure that no hydraulic fluid is spilled on alternator belt while disassembling and assembling.

REPLACING SEALS FOR ALUMINUM POWER STEERING PUMP



Note:

Body of power steering pump is made of aluminum as of 1981 models to reduce weight. Worn seals can be replaced on these aluminum power steering pumps, but pump has to be disassembled.

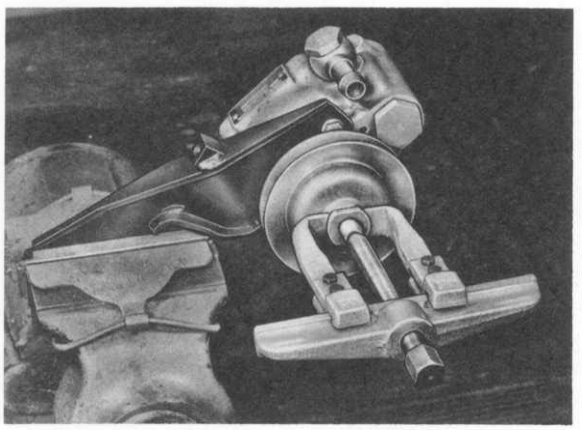
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Self-locking nut M 14 x 1.5	1	Hold on pulley with open-end wrench	Replace if necessary. Torque: 50 Nm (36 ftlb)	
2	Pulley	1	Use standard puller, e. g. Kukko 20/1		
3	Woodruff key	1		Replace if necessary	
4	Hook snap ring	1	Pull out of radial groove with pliers, while holding down cap no. 5 to prevent it from popping up and causing injury		
5	Cap	1		Bevel faces inside of pump. Only press on far enough that hook snap ring can be installed	Don't cant cap when removing and installing
6	Spring	1		Position correctly; large diameter end faces cap	
7	Drive shaft with drive end face plate and rotor	1	Knock out with a plastic hammer	Install face plate in correct position	see assembly instructions
8	Cap end face plate	1		Position correctly	
9	Cam ring	1		Position correctly	
10	Pump impeller	10		Position correctly, must move easily in rotor	
11	Dowel pin	2		Insert in power steering pump body	

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
12	Support ring, large dia.	1	Remove with plastic needle or air pressure	Replace – watching out for different diameters and installed positions	p. 48-8g, point 5
13	O-ring, large dia.	1			
14	O-ring, small dia.	1			
15	Support ring, small dia.	1			
16	Shaft seal	1	Lift out being careful not to damage bearing surface	Pack space between both sealing lips with multi-purpose grease. Don't damage sealing lips on groove in drive shaft (cover up)	
17	Aluminum body	1			See disassembling power steering pump, point 2 p. 48-8g, point 5

REPLACING SEALS FOR ALUMINUM POWER STEERING PUMP

Disassembling Power Steering Pump

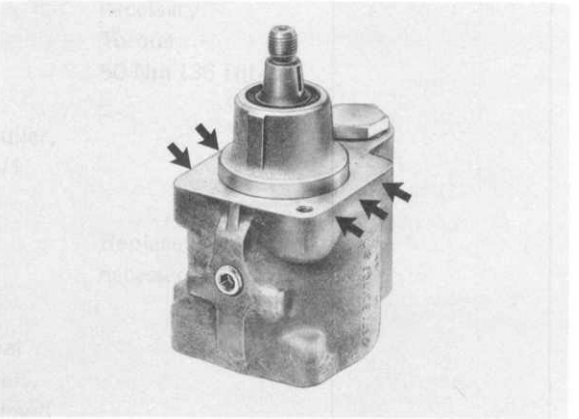
1. Use a standard puller (e. g. Kukko 20/1) to take pulley and woodruff key off removed pump.



2. Remove front bracket on power pump.

Note:

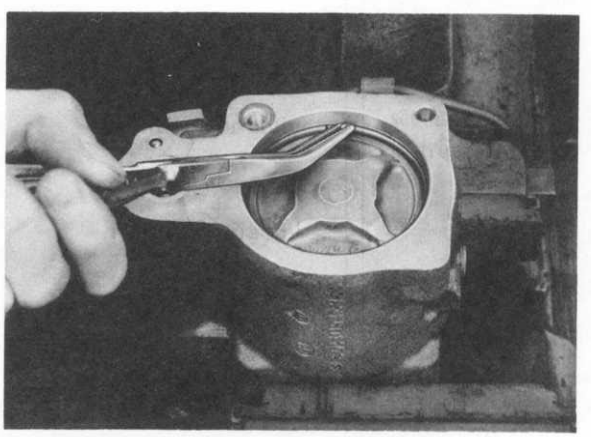
Pump may only be clamped in a vise on the marked surfaces (arrows) when replacing seals. Always use soft jaws in vise and keep clamping force as low as possible.



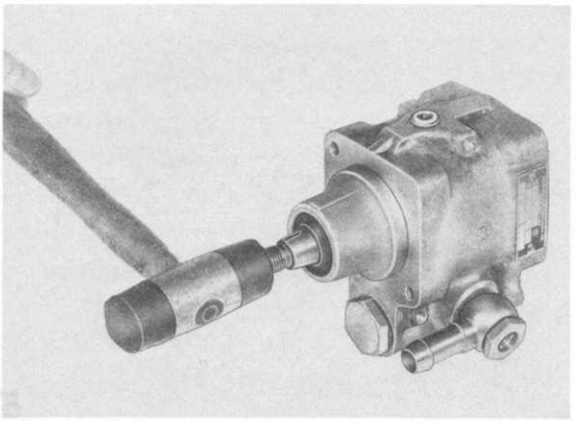
3. Pull hook snap ring out of radial groove with pliers. Press down on cover during this step to prevent snap ring from popping up and causing injury. Do not cant cover while removing, to prevent damage to the sealing surface.

Note:

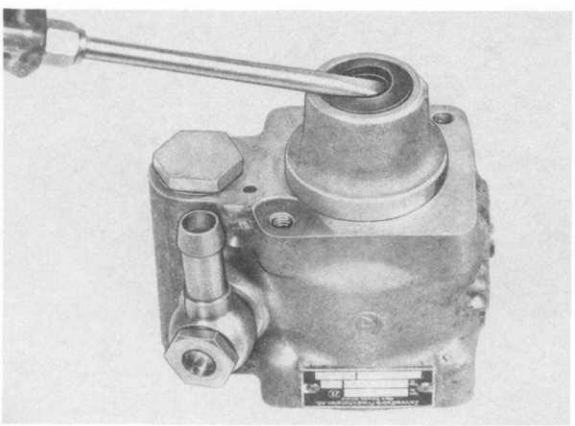
Loosen a canted cover by removing deposits in cylinder opening and tapp lightly with a plastic hammer. If necessary, remove cover together with rotor set and face plates (step 4).



4. Drive out drive shaft with face plates and rotor set by tapping with plastic hammer.



5. Lift out shaft seal, being careful not to damage bearing surface and bearing sleeve.
Remove support ring and O-ring in radial grooves of body (use plastic needle or air pressure).



Inspecting Components

Clean parts with a cleaning fluid and check visually.

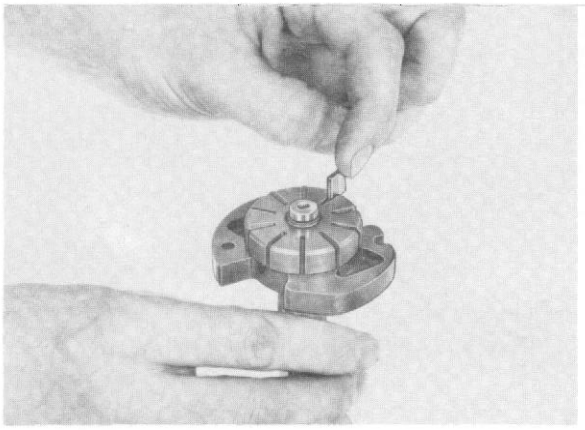
Checking Points:

- Drive shaft: bearing surface of shaft seal and bearing sleeve (for wear). Threads, taper and groove for woodruff key.
- Bores for dowel pins in body (for wear).
- Bearing sleeve.
- Bearing surfaces and radial grooves of seals. Bores in body.
- Sealing surface of cover.
- Connection threads for pressure line.
- Rotor set:
Cam ring (cam surface – seizure marks, wear) and rotor (guide slots – wear).
Pump impellers (seizure marks and wear especially on round bearing surface and guiding surfaces on sides).
- Face plates (seizure marks and wear on face surfaces).

Assembling Power Steering Pump

1. Insert dowel pins in body.

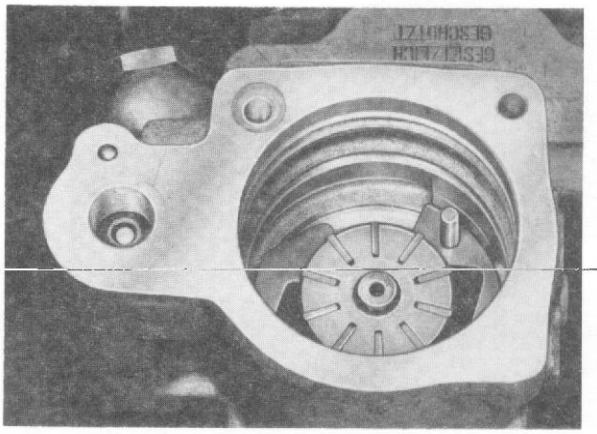
2. Install ten impellers in slots of rotor so that their polished and round outer surfaces face the cam ring.
   Make sure impellers move easily.

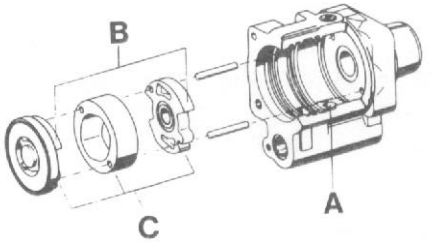


3. Install drive shaft, face plate and rotor assembly in body. Slide face plate on dowel pins with wide element opposite valve bore.

Note:

Lubricate all parts lightly with ATF before installing.



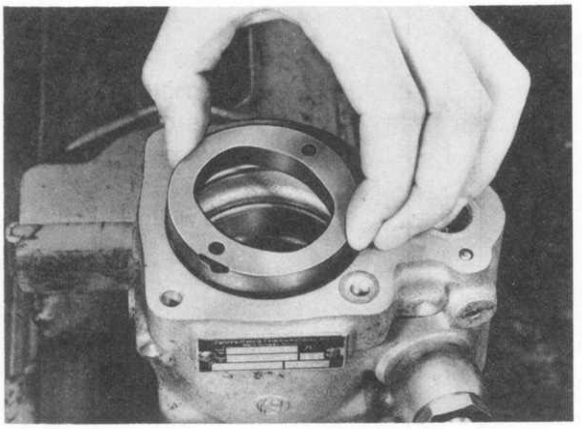


A = Valve bore

B = Wide side of face plates opposite valve bore

C = Slots in both face plates and cam ring aligned

4. Install cam ring. Cast arrow in cam ring circumference indicates pump driving direction. Since the pump turns clockwise, arrow must be on cover end.
   There are elongated holes for the dowel pins in the cam ring and face plate. Elongated hole in cam ring must be aligned with elongated hole in face plate.



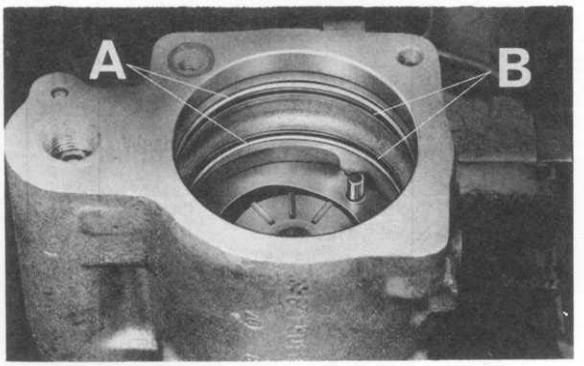
5. Place support and O-rings with small diameter in lower radial groove.
   Place support and O-rings with large diameter in center radial groove.
   Lubricate O-rings with ATF.

Note:

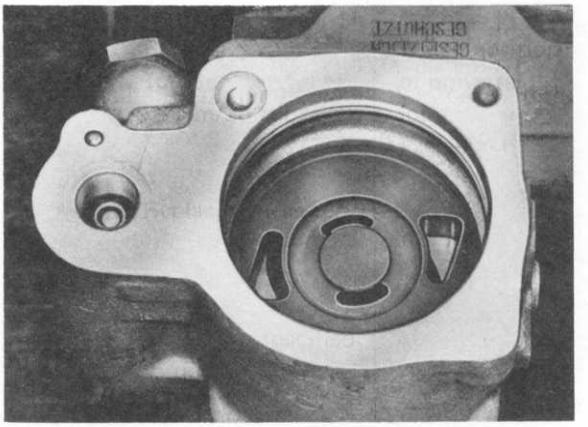
Check order of support and O-rings.

A = Support ring
B = O-ring

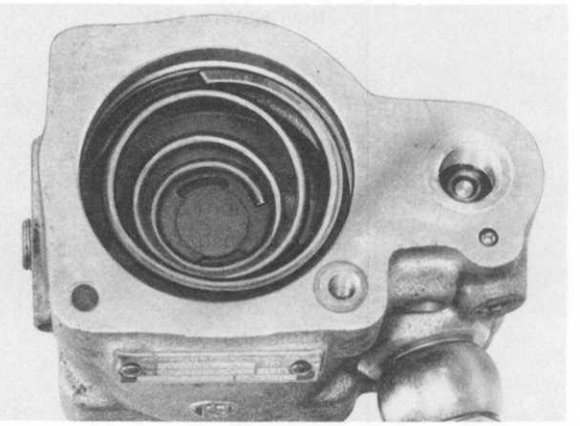
Since March, 1983 or Pump Number 866201 the cover end support ring has been omitted (modified radial groove in case).



6. Press face plate on to rotor set. Dowel pins must engage in bores provided for this purpose. Slot must be aligned with slots in cam ring and face plate (wide section opposite valve bore).

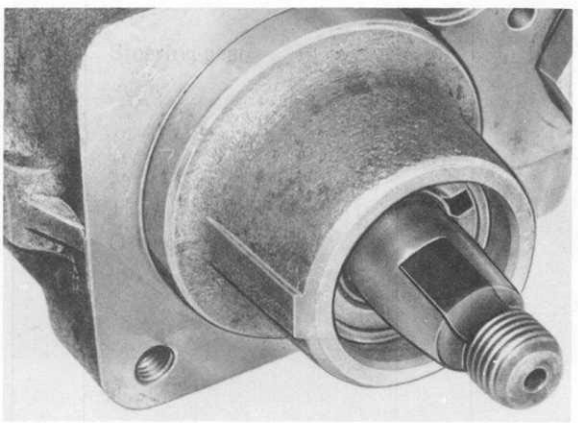


7. Install spring with small diameter end facing face plate.
   Press cover (with bevel facing inside of pump) into body without canting far enough, that hook snap ring can be installed (second mechanic required).

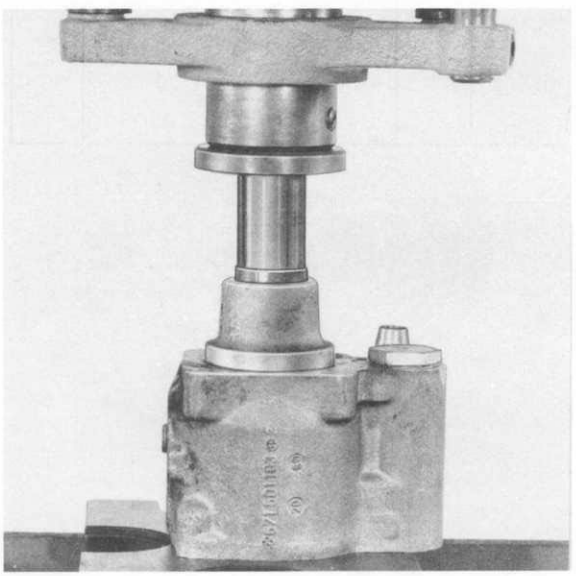


8. Pack multi-purpose grease in shaft seal between both sealing lips and install seal on drive shaft.

   Use a suitable sleeve or cover woodruff key groove with a narrow strip of tape to avoid damaging shaft seal on groove.



9. Press on shaft seal against stop with a suitable mandrel.



10. Install front bracket. Install woodruff key and pulley. Tighten self-locking hexagon nut to 50 Nm (36 ftlb).

11. Install power pump. Fill and bleed steering system.
    Check pump operation and for leaks.

Checking and adjusting the rack-and-pinion power steering

General

Defects in the power steering arise as the result of a lack of oil in the hydraulic system. Because of the high oil pressure which builds up in the hydraulic circuit, even small leaks may lead to a loss of fluid, damaging the servo pump.

Rumbling noises from the steering as ist is turned or foam in the fluid reservoir indicate low oil level and / or air in the system. Before refilling the reservoir, eliminate any leaks on the intake side or replace the defective component on the delivery side.

Note:

It is not permissible to repair or disassemble rack and pinion steering gear. Repairs to servo pumps are impermissible, altough the pumps can be resealed (page 48 - 8a).
Replacement steering gear and servo pumps are available on an exchange basis in a number of countries. In some cases, it may be possible to have the steering gear and the servo pump repaired by a main service agent in countries without exchange facilities.

Checking drive belt tension

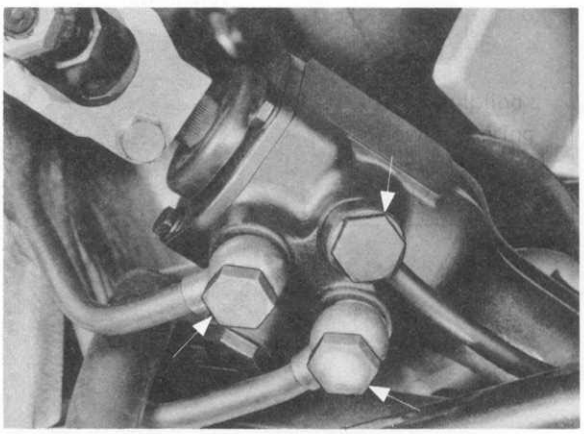
Tension is correct when light thumb pressure applied at a point midway between the two pulleys deflects the belt by approx. 10 mm.

Checking steering system for leaks (visual check)

With the engine running, turn steering wheel to full lock and keep it in this position. This causes the maximum possible line pressure to be built up.

Check all line connections for leaks in this position and retighten if required.

Run this check for max. 10 seconds. If checks are made for a longer interval, allow for a short break approx. every 10 seconds.



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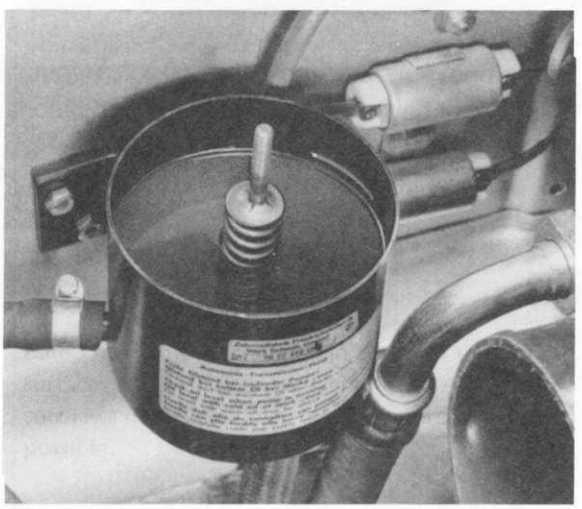
Checking fluid level of power steering

1. Pull off or unscrew cap of hydraulic fluid reservoir.

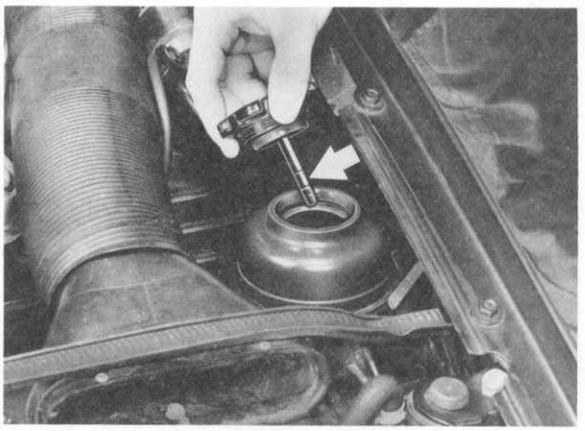
Note

Reservoir is mounted on wheel housing in Engine compartment. The reservoir installed in cars earlier than model year 83 has a fluid-level mark (version A).
As of model year 83, a modified reservoir is installed with a dipstick mounted on the cap (version B).

2. Start engine and allow to idle. With version A, the fluid level should be at the mark stamped on the reservoir.
   With version , wipe dipstick, screw cap down and remove. The fluid level must be between the two marks.
   If necessary, top up with ATF DEXRON II D.



Version A



Version B

Bleeding steering system

1. To refill the entire system after installing new steering equipment or lines or after a heavy loss of hydraulic fluid, start engine briefly and switch off again immediately after starting. Repeat this process several times. This will cause the fluid level in the reservoir to drop quickly: keep the level up to the max. mark by continously adding fluid. Do not allow the reservoir to empty.

2. Continue the process described in point 1 until the fluid level in the reservoir stops dropping, then restart engine and allow to idle.

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3. Quickly turn steering wheel several times from lock to lock, to drive all air out of the cylinders (when end position of piston is reached, do not pull harder on steering wheel than required to turn steering; avoid building up unnecessary pressure at this stage).

4. Observe fluid level during this process and, if level continues to drop, keep adding fluid unitl the level in the reservoir remains constant and air bubbles cease to rise in the hydraulic fluid when the steering wheel is turned.

5. When the engine is stopped, the level of fluid in the reservoir should not rise by more than 10 mm.

Note:

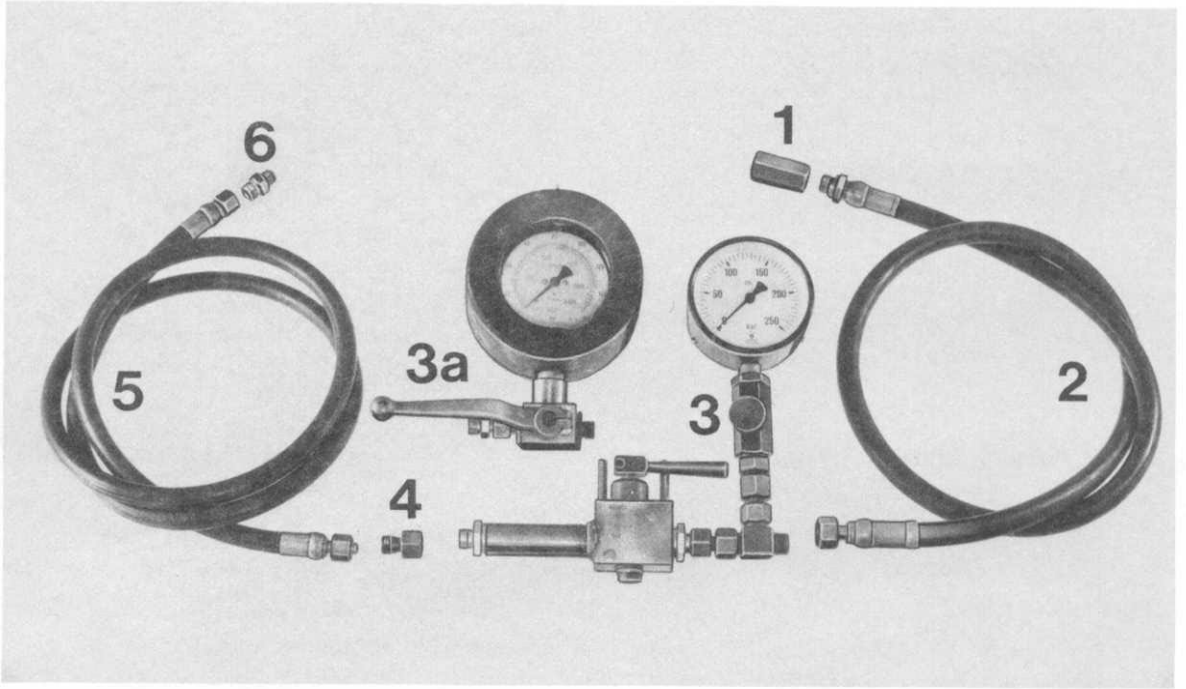
If the difference between fluid levels with engine stopped and engine running is more than 10 mm, there is too much air trapped in the hydraulic fluid.

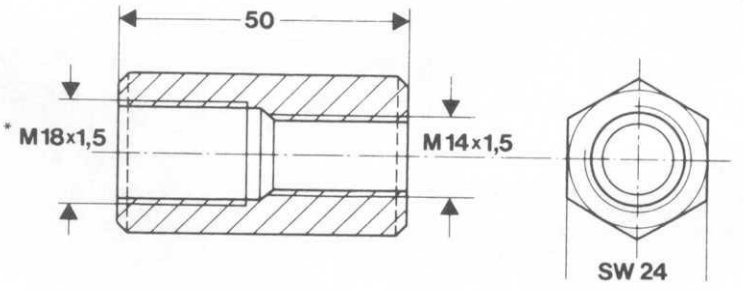
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TOOLS

Note:

All parts (1 through 6) can be used for 928 and 944 cars.
Pressure gauge is connected between pressure line and steering gear (944: between power pump and pressure line).
If old pressure gauge no. 3 (see below) is used, make sure high pressure hoses no. 2 and no. 5 are connected on pressure gauge in correct position (opposite sides as for 944).
Connection of high pressure hoses on pressure gauge no. 3 a, on the other hand, can be made on any side.





TOOL TABLE – PAGE 48 - 10

* Threads will be M 18 x 1.5 or M 16 x 1.5 depending on pressure gauge version (see Tool Table).

TOOLS

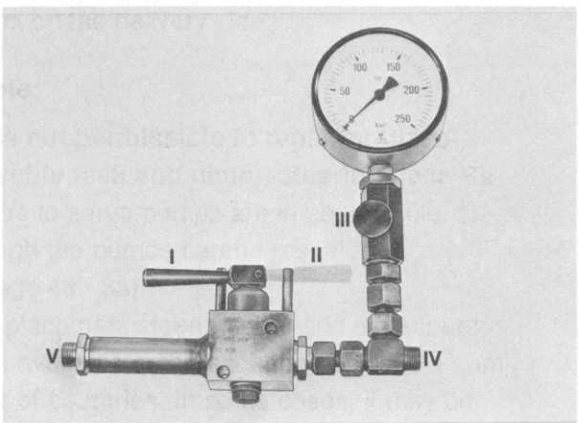
No.	Description	Special Tool	Remarks
1	Adapter		For pressure gauge 3: local manufacture (see sketch, page 48 - 9). For pressure gauge 3 a: local manufacture, deviates from sketch. Threads not M 18 x 1.5 (for gauge no. 3) but M 16 x 1.5.
2	High pressure hose up to 200 bar, 1.5 meters long		Standard, for gauge no. 3: M 18 x 1.5 and sealing head on one end and M 18 x 1.5 with flat seal on other end. for gauge no. 3 a: M 16 x 1.5 with sealing head on one end and M 16 x 1.5 with flat seal on other end.
3	Pressure gauge 0 – 250 bar		Old version, no longer available.
3a	Pressure gauge 0 – 160 bar	V.A.G. 1402	Order No. Z 401 103 WE from: Volkswagenwerk AG KD - Gerätevertrieb Wolfsburg Tel.: 05361/9-25431
4	Adapter (not required for press. gauge 3 a)		Standard, M 18 x 1.5 and M 16 x 1.5
5	High pressure hose up to 200 bar, 2.0 meters long		Standard, M 16 x 1.5 and sealing head on both ends
6	Connector		Standard, M 16 x 1.5 with sealing head on one end and M 14 x 1.5 with flat seal on other end

CHECKING HYDRAULIC FUNCTION OF STEERING (PRESSURE TEST)

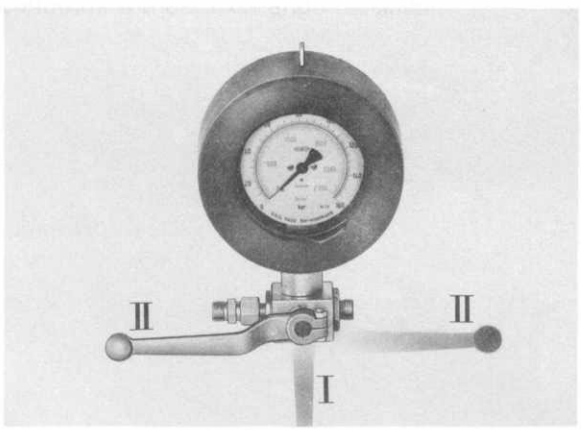
General Information

Tester (pressure gauge) is installed between pressure line and steering gear (rotary piston valve).
Make sure of correct installed position when using old pressure gauge.
Connections and lever positions are marked with numbers for better understanding of the following instructions.

Old Version



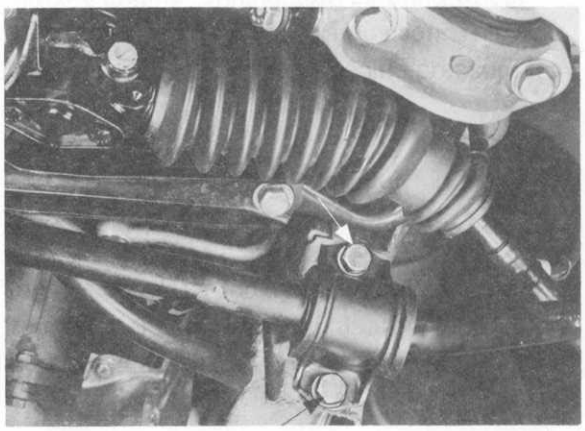
V. A. G. 1402



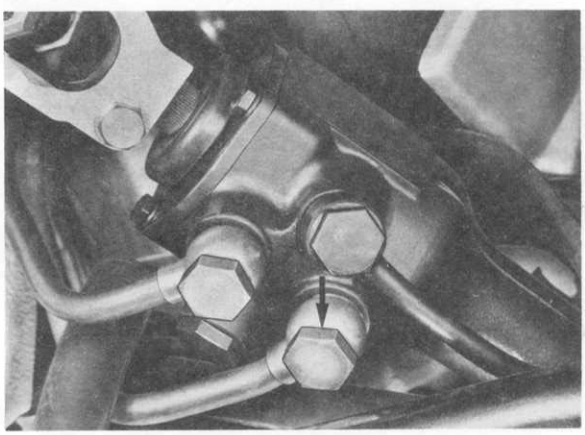
I – Shut-off valve open
II – Shut-off valve closed
III – Damping orifice
IV – From pressure line
V – To steering gear

Installing Pressure Gauge

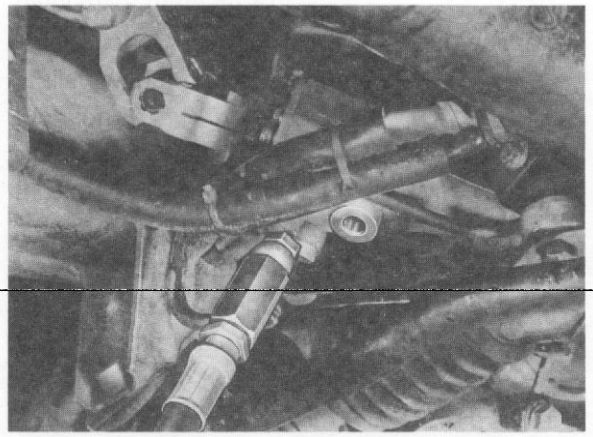
1. Unscrew bolts from stabilizer bearings and pull down stabilizer far enough that pressure line hollow bolt is accessible.



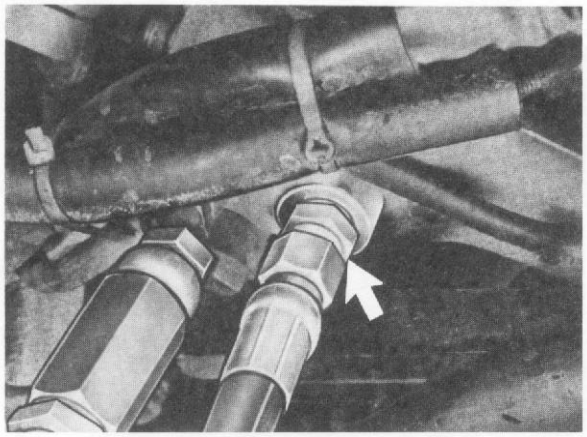
2. Detach pressure line at steering gear. Catch hydraulic fluid, but do not reuse.



3. Pull down pressure line, which does not require loosening mounting clamp of lines. Connect 1.5 meter long high pressure hose no. 2 to pressure line using the hollow bolt and adapter no. 1 (seals required: 2 x 14 x 18 and 1 x 18 x 22 or 1 x 16 x 20).



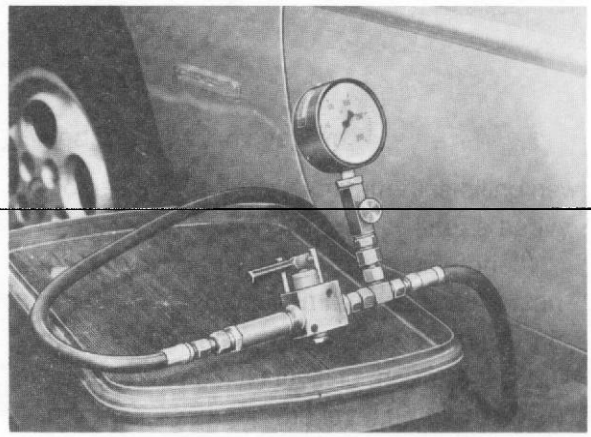
4. Screw connector with high pressure hose no. 5 on steering gear (seal required: 14 x 18).



5. Mount pressure gauge between high pressre hoses and place on a base (e.g. toolbox) next to driver's door.

Note

Use adapter no. 4 for old version pressure gauge and connect high pressure hose no. 5 on connection V of pressure gauge.



6. **Open shut-off value of pressure gauge (lever position I)**, fill supply tank and bleed steering system (see page 48 - 8j).

7. Check delivery pressure of power steering pump and system pressure (page 48 - 13).

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Checking the delivery pressure of the power steering pump

1. With the engine running at idle, close shutoff valve (lever position II) and read off pressure. Open shutoff valve again at once.
   Specification 68 to 82 bar for power steering pump 928.347.431.04, 928.347.431.05 and 928.347.089.00.
   Specification 110 to 110 bar for power steering pump 928.347.089.01 (as of MY '91)
   Identification: Nameplate on pump. Part No. and pressure specification are indicated on the nameplate.

Note

To limit wear, the suthoff valve should not be closed for more than 5 seconds. In the case of pressure gauge version 3a, select lever position II right or II left according to the way that high-pressure hoses are connected to the pressure gauge. (No reading is possible if lever position II is incorrect).

2. If specifications are not reached or exceeded, replace pump.

Checking Delivery Pressure of Power Pump

1. Run engine at idle speed. Shut-off valve must be open (lever position I).

2. Turn steering wheel to left and right full lock and read off fluid pressure at pressure gauge.
   Specification 68 to 82 bar for power steering pump 928.347.431.04, 928.347.431.05 and 928.347.089.00.
   Specification 110 to 110 bar for power steering pump 928.347.089.01 (as of MY '91).
   Identification: Nameplate on pump. Part No. and pressure specification are indicated on the nameplate.

Note

It is not sufficient to make sure that the steering stop limiter becomes effective. The reset force of the rotary piston valve must also be overcome. Force required at steering wheel: approx. 100 N (10 kP).

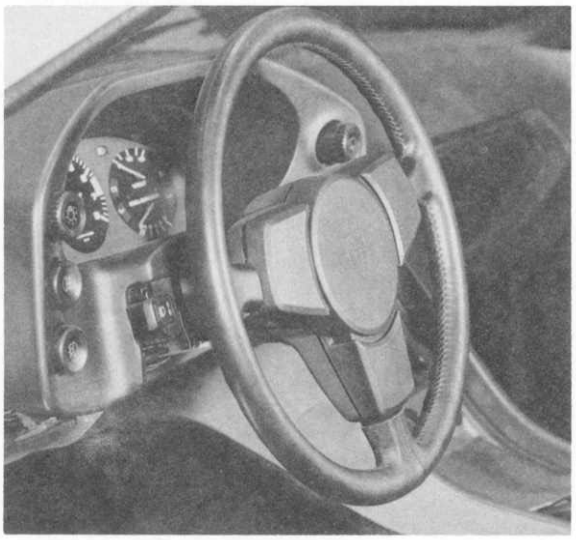
3. Replace steering gear assembly, if specified value is not reached at left/or right locks (excessive leak oil flow).

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REMOVING AND INSTALLING STEERING WHEEL

Removing

1. Pull impact pad off of steering wheel and take off horn wires.



2. Mark position of steering wheel to steering shaft for reinstalling.

3. Unscrew nut and remove steering wheel and washer.



Installing

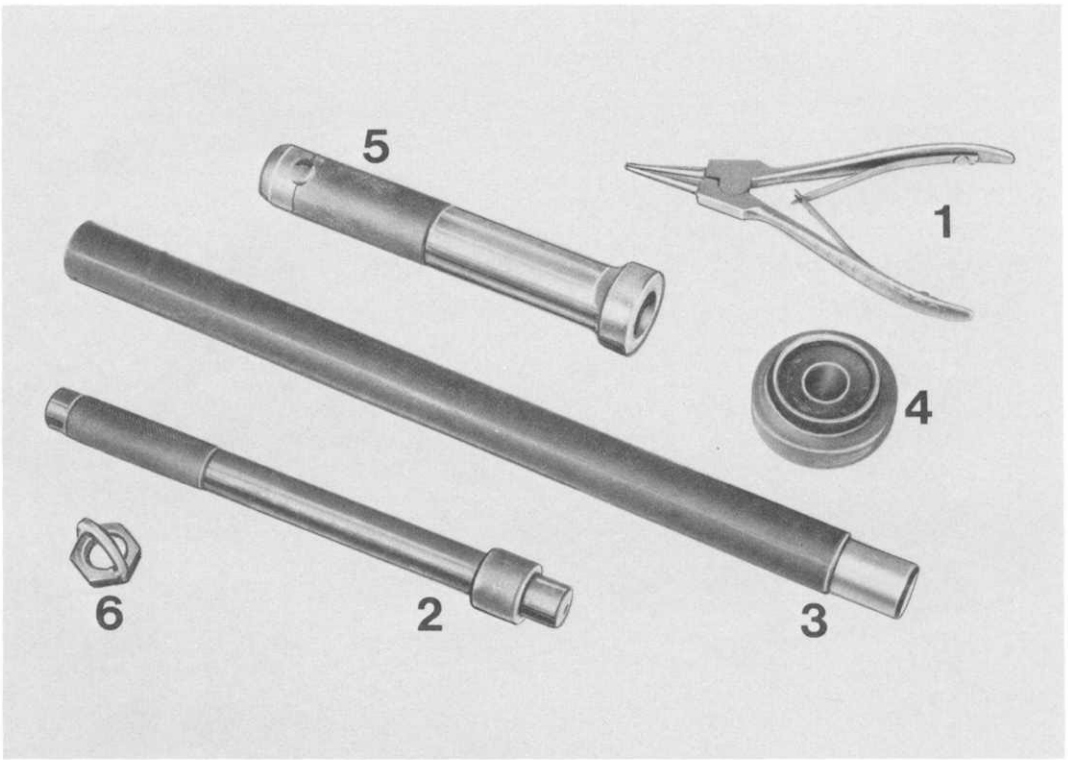
1. Install steering wheel with road wheels pointing straight ahead or according to disassembly mark in such a manner, that steering wheel spokes are horizontal.

2. Install hexagon nut with spring washer and tighten to specified torque.

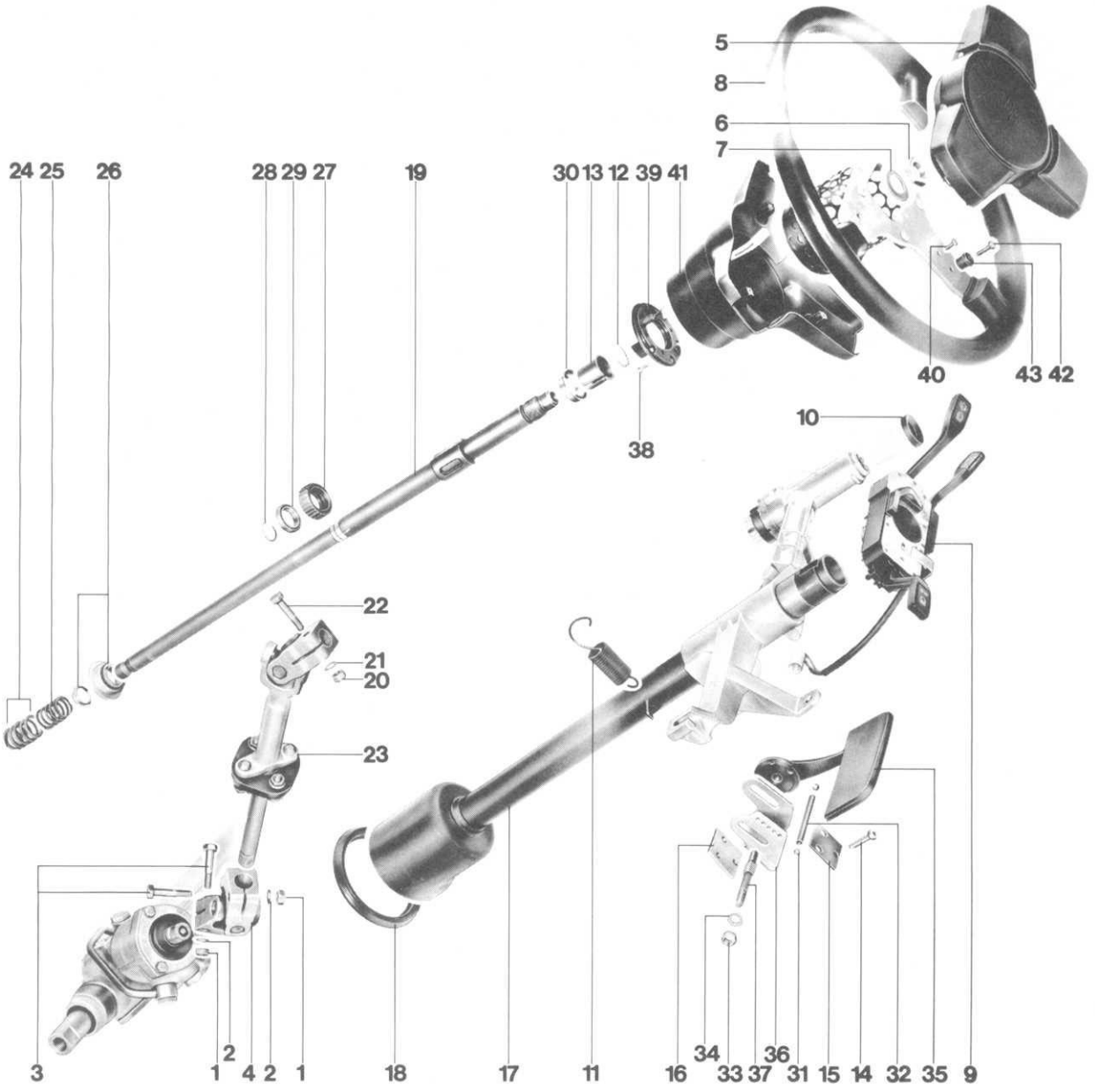
3. Mount horn wires on impact pad and press impact pad on to retaining pins.

4. Check function of horns and direction indicator switch.

TOOLS



No.	Description	Special Tool	Remarks
1	Circlip pliers		Standard tool
2	Mandrel	VW 295	
3	Mandrel	VW 214 f/20	
4	Pressure pad	VW 433	
5	Sleeve	30 - 21	
6	Locally made tool		Half of an approx. 4 mm thick washer welded on steering wheel mounting nut (M 18 x 1.5 hexagon nut)


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No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
1	Self-locking nut	2		Replace, torque: 28 Nm (20 ftlb)	Watch installed position of universal joint no. 4, see page 48 - 23
2	Washer	2		Replace if necessary	
3	Setscrew	2			
4	Universal joint	1		Produce 8 mm gap for short version with tool 9208 (page 48 - 23). Check for damage	
5	Pad	1			
6	Nut M 18 x 1.5	1		Torque: 50 Nm (36 ftlb)	
7	Washer	1		Replace if necessary	
8	Steering wheel	1		Steering wheel spokes horizontal with steering gear in center position (centered with tool 9132)	Remove tool 9132 immediately after installing steering wheel
9	Steering column switch	1	Unscrew mounting bolt	Align with cover	
10	Rubber cover	1			
11	Spring	1			
12	Circlip	1			
13	Support	1			
14	Screw	3			Different torque depending on type of screw (see point 6 of installing)
15	Spacer 2 mm thick	1			

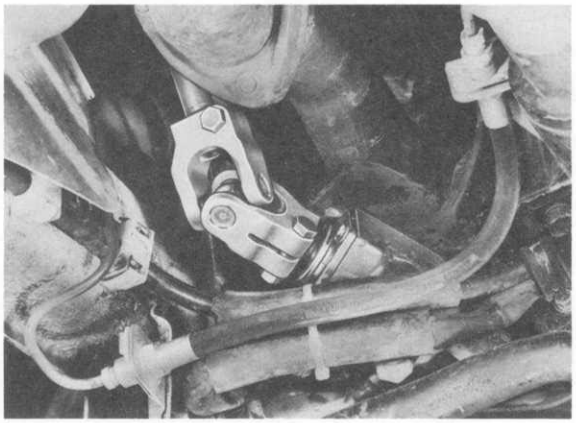
No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
16	Washer	X		6 mm (one thick 4 mm and one thin 2 mm) for leather or 4 mm (one thick 4 mm) for leatherette	
17	Steering tube with steering lock	1			
18	Seal	1		Replace if necessary; position correctly	
19	Steering shaft	1		Adjust axial play to 0.5 . . . 1.0 mm	
20	Self-locking nut	1		Replace, torque: 28 Nm (20 ftlb)	Axial play of intermediate shaft will be changed as soon as steering shaft/inter-mediate shaft conn. is disconnected
21	Washer	1		Replace if necessary	
22	Setscrew	1			
23	Intermediate steering shaft	1			Changed from steel to forged aluminum to save weight
24	Shim	X		Set: four 1.5 mm and one 0.5 mm thick shims	See repair manual for adjusting steering shaft axial play
25	Spring	1			
26	Steering shaft mount, lower, with support	1		Install with sleeve 30 - 21	
(27)	Sleeve	1			Deleted in 1981 models, no longer available as replacement, if necessary install old steering shaft without mount
(28)	Snap ring	1			
(29)	Steering shaft mount center	1			

No.	Description	Qty.	Note When: Removing	Installing	Special Instructions
30	Steering shaft mount, upper	1	Drive out with a suitable pipe	Drive in with VW 433	
31	Ball	2			
32	Spring	1			
33	Self-locking nut	1			
34	Washer	1			
35	Adjusting lever	1			
36	Bracket	1			
37	Stud	1			
38	Screw M 3.5 x 10	3			Same part as no. 40
39	Contact ring	1		Position correctly	
40	Screw M 3.5 x 10	3			Same part as no. 38
41	Hub trim	1			
42	Bolt	3			
43	Insulator	3		Replace if necessary	

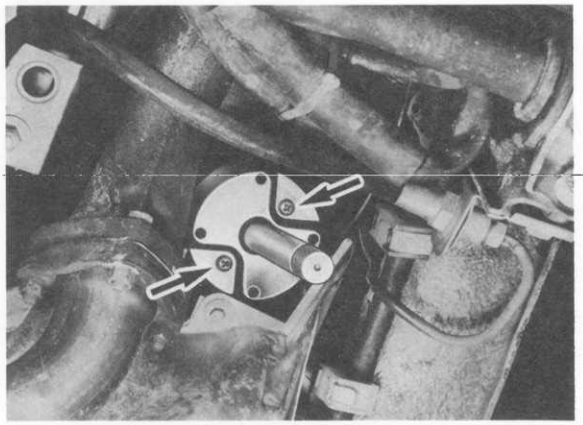
REMOVING AND INSTALLING STEERING TUBE

Removing

1. Remove universal joint after unscrewing two hexagon head setscrews.



2. If applicable, take off cover on steering intermediate shaft.

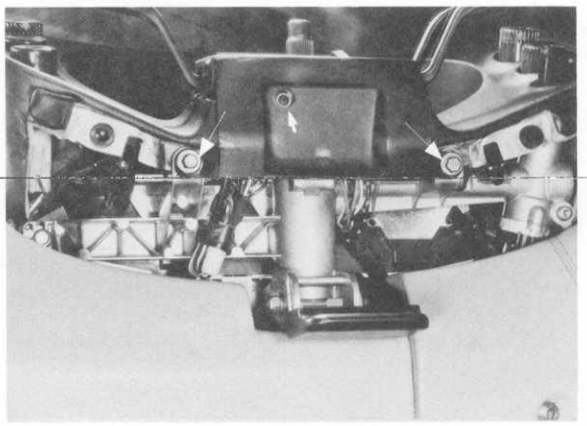


3. Disconnect battery ground wire at body. If car has electric seats, move them completely back to make assembly work easier.

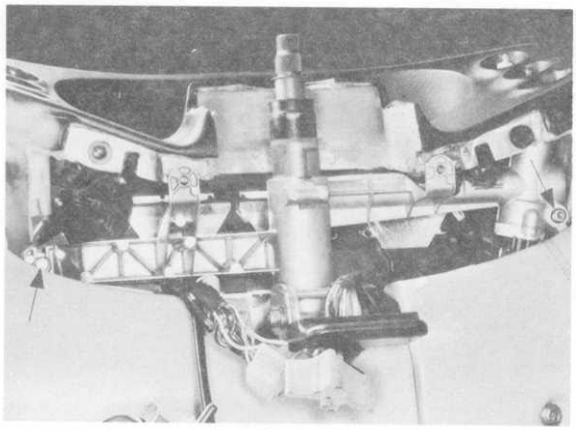
4. Pull off impact pad on steering wheel and remove horn wires. Mark position of steering wheel on steering shaft. Unscrew hexagon nut and take off steering wheel with washer.



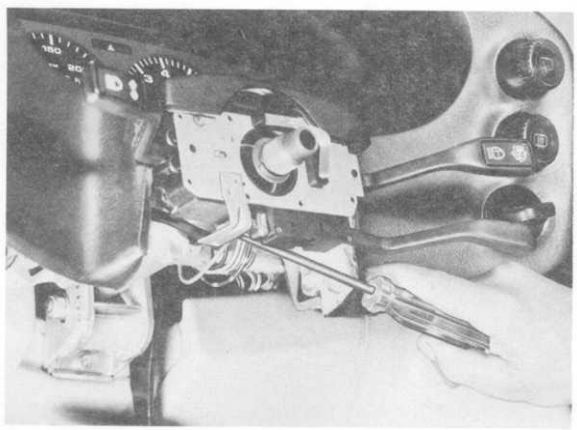
5. Unscrew cover underneath instrument cowl (not on older models) and cover underneath steering column switch.



6. Unscrew mounting bolts for instrument cowl.



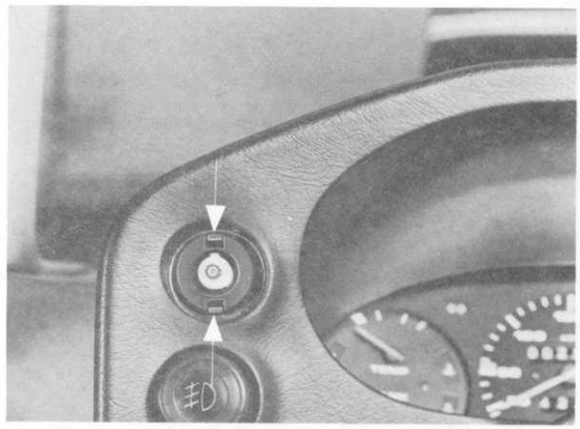
7. Unscrew mounting bolt for steering column switch.

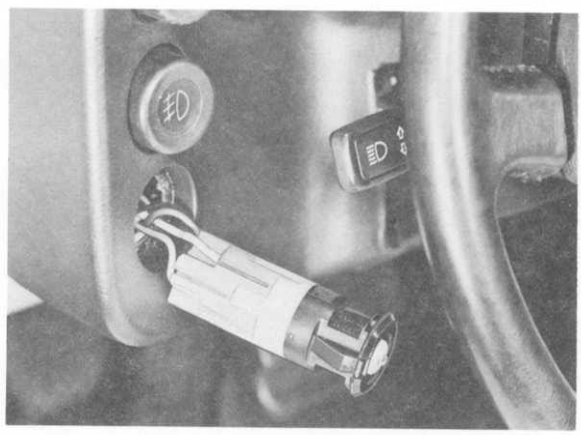


8. Remove steering column switch after disconnecting plug connector and pulling off plug. Lift instrument cowl for this purpose.



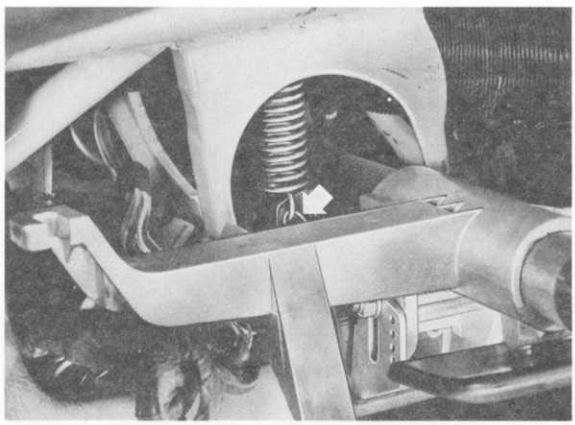
9. Remove 5 switches in instrument cowl by pulling off switch knobs, compressing both spring clips of each switch, pulling out switches and pulling off plugs. Remove rubber cover (ignition lock cover).



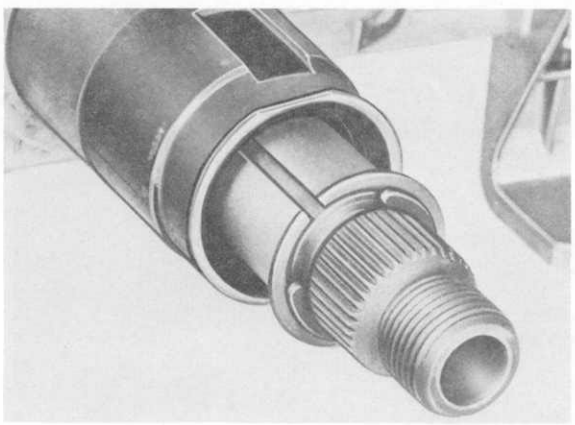


10. Pull plugs out of plug guides on back of instrument cowl (printed circuit) and lift off instrument cowl. Mark plugs for reinstallation.

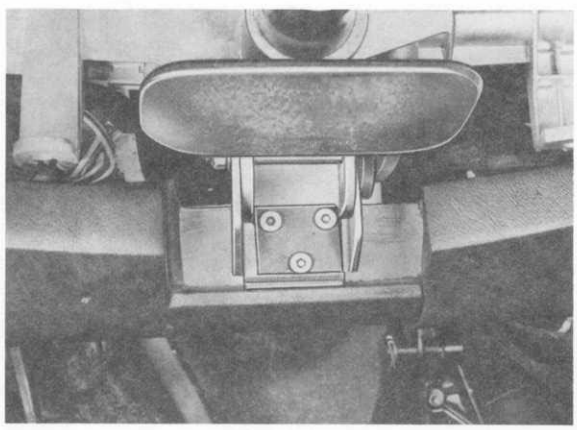
11. Pull off plugs on ignition switch. Disconnect spring for steering wheel height control with a piece of suitable wire.



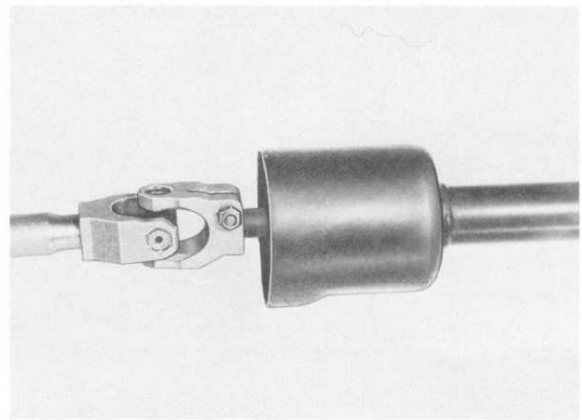
12. Remove circlip and support on steering shaft.



13. Unscrew mounting bolts on steering tube bracket.



14. Move up steering tube combined with steering and intermediate shafts. To prevent seizure of intermediate shaft on firewall while moving up, keep to the following procedures. Pull up steering tube slightly and then push down the now accessible steering and intermediate shafts in the steering tube against the stop on the steering shaft mount. Push down very carefully to prevent changing sit of mount.

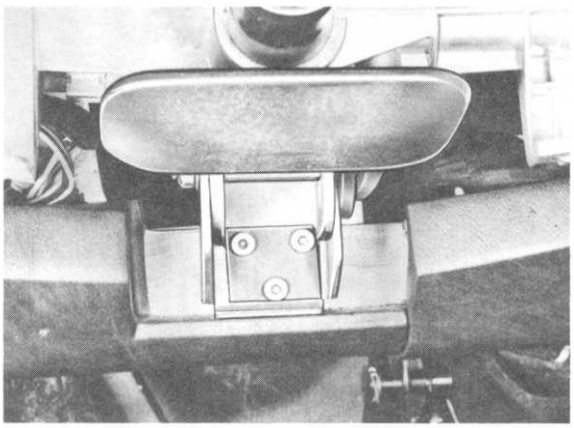


Installing

1. Insert seal in firewall in correct position. Coat pertinent area and seal with tire assembly paste to make installation of steering tube easier.

2. Install steering tube with steering and intermediate shafts in car.
   Preparations:
   Circlip and support of steering shaft removed, steering shaft pushed down in steering tube, intermediate shaft pushed through firewall. Slide up steering shaft again before moving steering tube into firewall. Install support and steering wheel mounting nut temporarily instead of the circlip.

3. Mount steering tube with appropriate spacers, see pages 48 - 17 and 18. Only tighten the socket head bolts finger tight.



4. Attach spring for steering wheel height control. Install circlip on steering shaft. Connect plugs on ignition switch.

5. Install steering column switch and instrument cowl. Tighten mounting bolts of cowl.

6. Align instrument cowl (horizontal position and equal distance to instrument panel on left and right sides). Then tighten 3 mounting bolts of steering tube to specified torque.

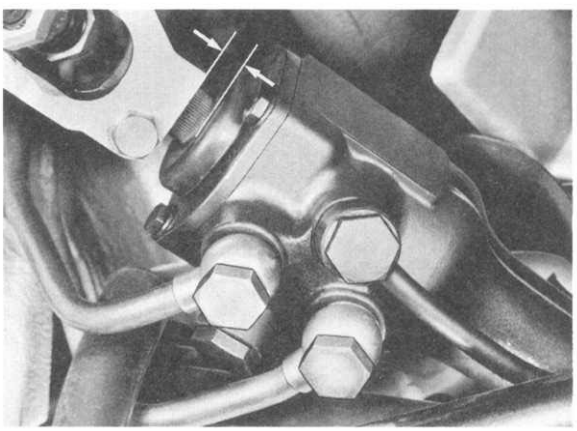
   M 6 x 25 socket head bolt
   with 4 mm socket: 9.7 Nm (7 ftlb)
   with 5 mm socket: 12.0 Nm (9 ftlb)

7. Align steering column switch and tighten mounting bolt. Screw on cover(s). Connect battery ground wire.

8. If applicable, mount cover on intermediate shaft.
   Install universal joint between steering and intermediate shafts. First slide up universal joint on intermediate shaft fully (facilitates installation). Produce 8 mm gap between steering gear and universal joint with Special Tool 9208. Tighten universal joint mounting bolts to 28 Nm (20 ftlb).

Note

For cars with a longer universal joint the gap will definitely be less than 8 mm after installing clamping bolt on the steering gear. In this case only make sure that there is a small gap between the steering gear and universal joint. The steering gear might have to be lowered to install the long universal joint.



9. Install steering wheel so that its spokes are horizontal when road wheels are pointing straight ahead or by mark made during removal operations.

   Install mounting nut with washer and torque to 50 Nm (36 ftlb).
   If necessary, correct position of steering wheel after test drive (not positioned horizontally before removal and slightly different universal joint position).

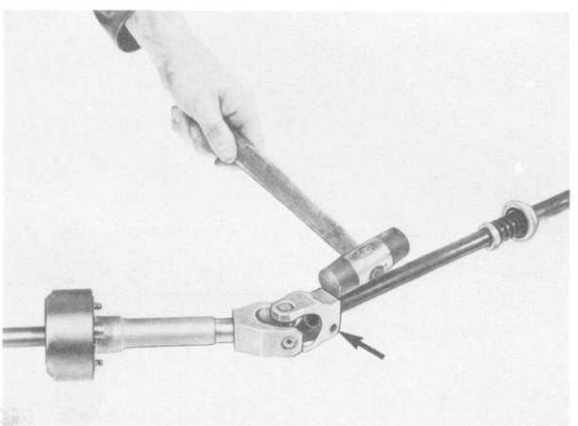
10. Check function of electrical system and pertinent parts.

REMOVING AND INSTALLING STEERING SHAFT / STEERING SHAFT BEARINGS ADJUSTING AXIAL PLAY OF STEERING SHAFT

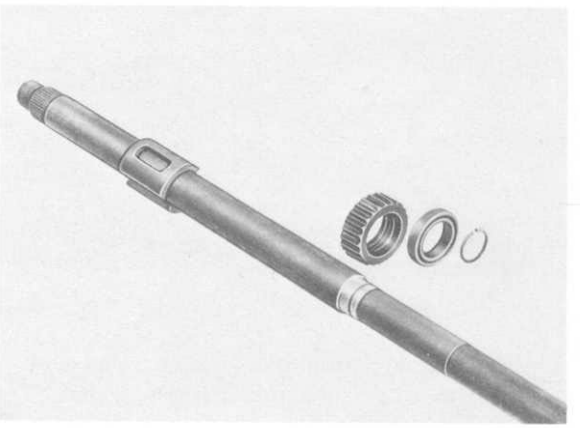
Removing

1. Pull intermediate and steering shafts down out of steering tube quickly (circlip and support removed, steering wheel lock unlocked). This will also remove the lower steering shaft bearing.

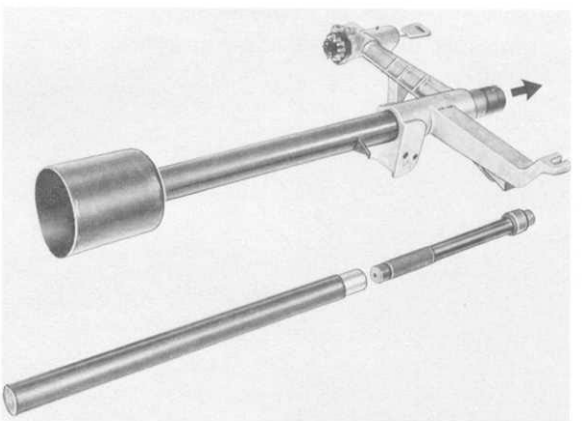
2. Disconnect intermediate shaft on steering shaft after removing setscrew (arrow). Be careful not to damage the aluminum universal joint (use plastic hammer). Remove lower steering shaft bearing, spring and shims (if applicable) on steering shaft.



3. If steering shaft has three bearings (also refer to page 48 - 18), only remove the center bearing when damaged (must run easily) since replacement parts are no longer available.
   If necessary, install a steering shaft designed for three bearings without the center bearing.

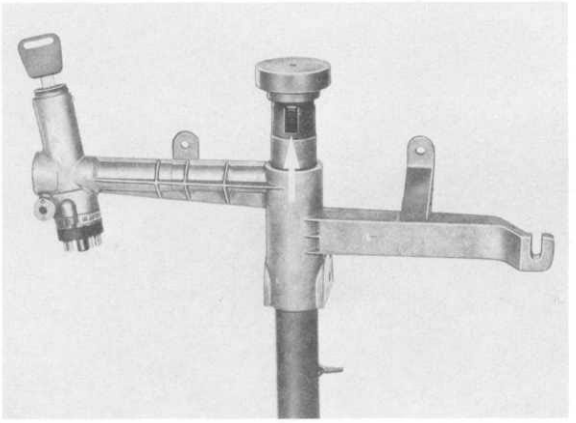


4. Drive upper steering shaft bearing out of outer tube with a suitable piece of pipe.



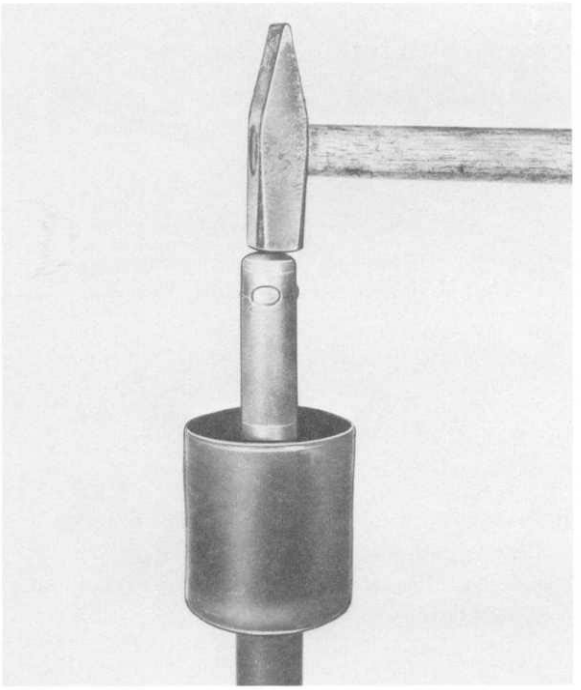
Installing / Adjusting Axial Play

1. Drive or press in upper steering shaft bearing flush with Special Tool VW 433. Surface on bearing collar faces opening for steering column switch (arrow).

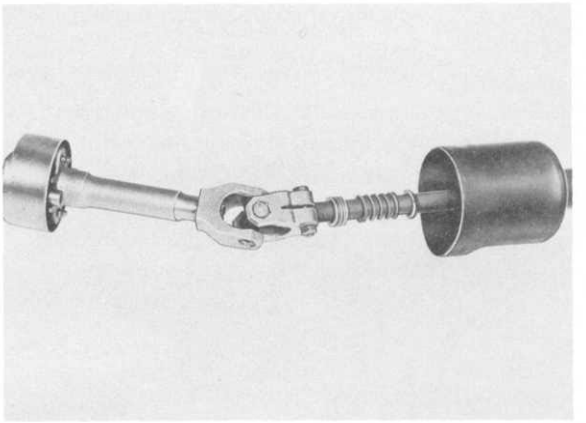


2. Move steering shaft into outer tube from below. If steering shaft still has three bearings, coat inside of outer tube as well as sleeve of center bearing with a multi-purpose grease for this operation.

3. Drive lower steering shaft bearing into steering protective tube against stop with Special Tool 30 - 21.



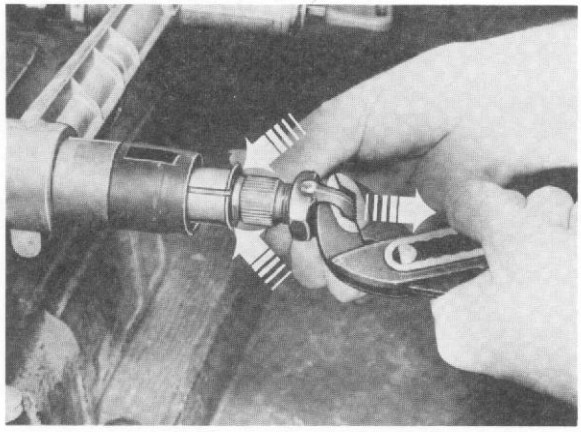
4. Move steering shaft down out of steering tube partially (at most up to stop of shaft on lower bearing). Install support, spring and shims (basic set: 4 x 1.5 mm and 1 x 0.5 mm) on steering shaft. Mount intermediate shaft on steering shaft. Before tightening the self-locking hexagon nut, push down (in direction of steering) intermediate shaft on steering shaft all the way against stop of setscrew on opening of steering shaft.

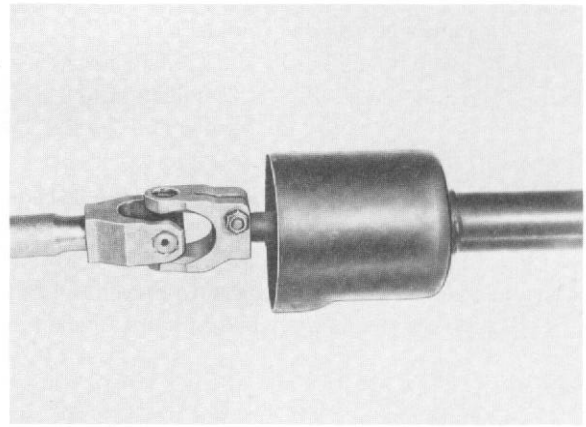


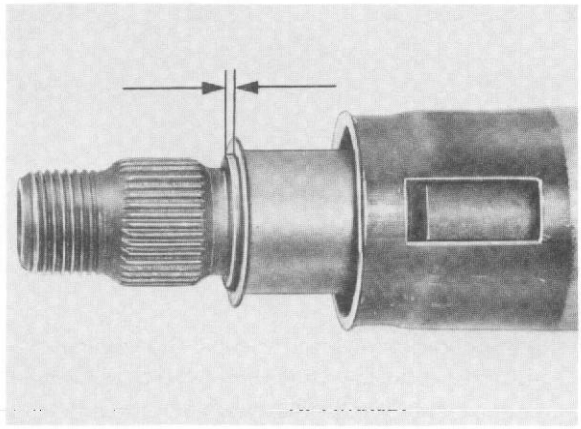
5. Clamp steering tube in a vise on the steering lock housing. Slide steering shaft into steering tube completely. Mount support and screw on locally made tool.

6. Check steering shaft axial play. Pull up steering shaft far enough so that spring is definitely against block (force approx. 30 kp/66 lb). In this state press support firmly against inner race of upper steering shaft bearing (with help of a tool if necessary). If necessary, center steering shaft slightly while support is being pushed down. The distance between edge of groove and support should be 0.5 mm (equals axial play). Check with help of a second mechanic and a 0.5 mm thick shim or a feeler gauge blade.

Adjusting value:	0.5 mm
Nominal value:	0.5 – 1 mm







7. a) Axial Play (Distance) Correct:
Move intermediate and steering shafts out of steering tube far enough so that the setscrew is accessible.
Tighten self-locking hexagon nut to 28 Nm (20 ftlb).

7. b) Axial Play (Distance) Excessive:
Move intermediate shaft on steering shaft in direction of steering wheel until the axial play is correct.
Torque hexagon nut to 28 Nm (20 ftlb).
If the steering shaft opening is not sufficient for adjustment, use a larger shim set (6.5 mm basic set).

7. c) Insufficient or No Axial Play (Insufficient Distance or Support Positioned Above Edge of Groove):
Use smaller shim set (6.5 mm basic set).

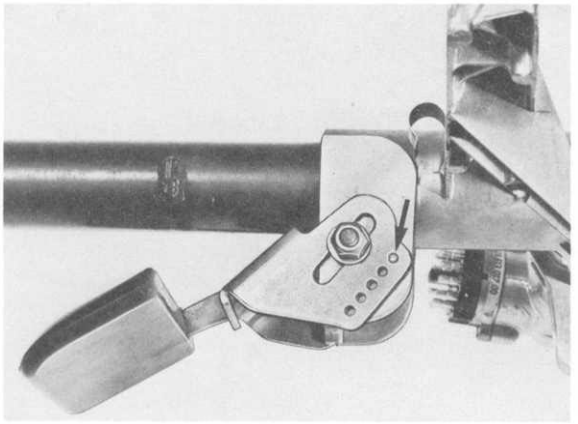
8. After finishing adjustments always make sure that washer and nut still have a locking effect. Recheck axial play after tightening the self-locking hexagon nut to 28 Nm (20 ftlb).

9. Install support and circlip. Install steering wheel and check easy movement of steering shaft and locking effect of steering wheel lock.

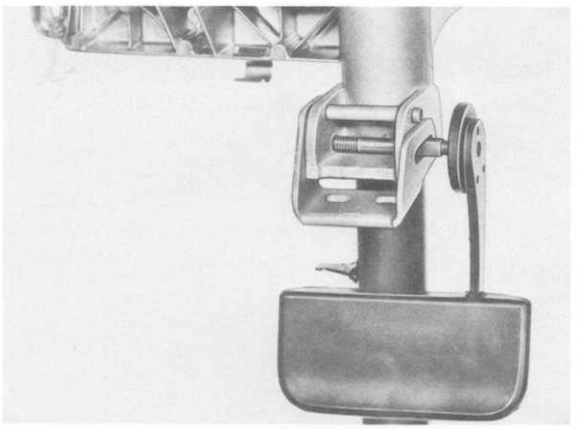
DISASSEMBLING AND ASSEMBLING STEERING WHEEL HEIGHT CONTROL

Disassembling

1. Move steering wheel height control lever to release position.
   Remove balls and spring. Make sure that a cloth is held above the area of the balls (to prevent injury) and catch the first ball after turning the bracket.

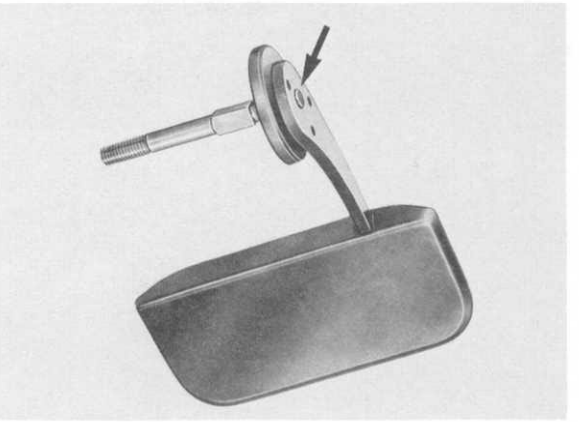


2. Unscrew self-locking hexagon nut. Move out control lever with stud and take off bracket.



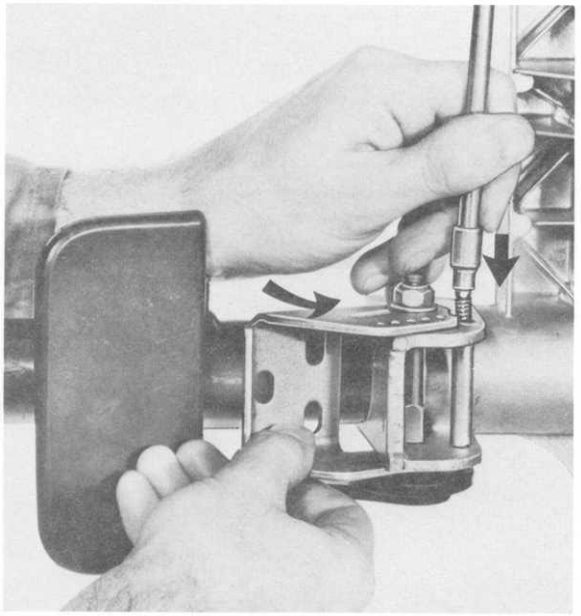
Assembling

1. Screw stud in control lever. Threaded part must protrude slightly (arrow).



2. Mount bracket on steering tube. Give sliding surfaces a thin coat of Optimoly HT paste. Insert control lever with stud and screw in mounting nut. Only screw in mounting nut finger tight.

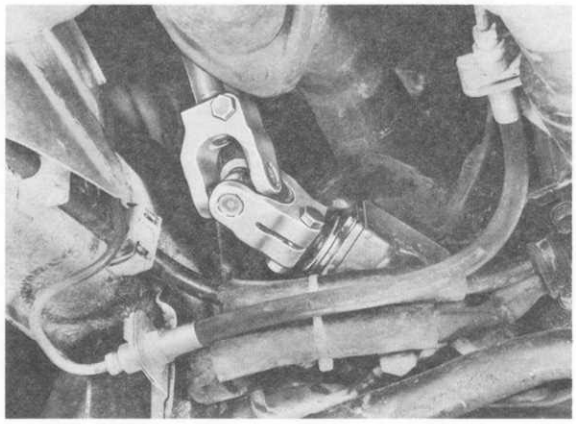
3. Install balls and springs. First install one ball with spring. Then apply second ball with spring, using a suitable piece of pipe or a socket wrench, until the bracket can be turned on the balls. Balls must engage in one of the 5 holes in the bracket.



4. Tighten mounting nut of control lever so that the locking position is reached with a medium amount of force. When more force is applied, it should be possible to turn the control lever further in locking direction.

REPLACING UPPER STEERING SHAFT BEARING

1. Remove universal joint after unscrewing two hexagon head setscrews.

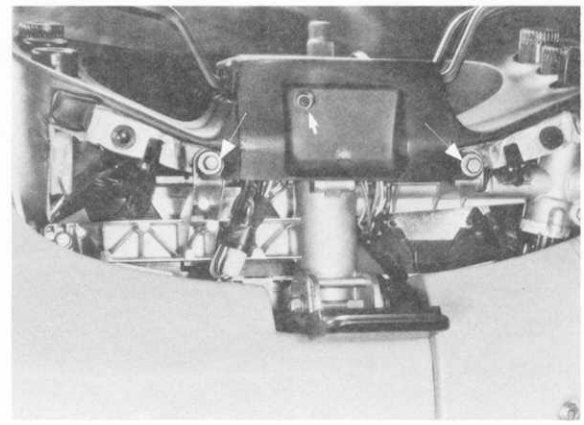


2. Disconnect battery ground wire at body. If car has electric seats, move them back completely to make work easier.

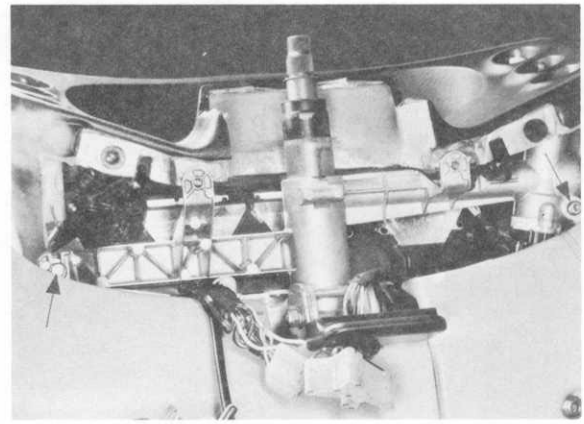
3. Pull off impact pad on steering wheel and remove horn wires. Mark position of steering wheel on steering shaft. Unscrew hexagon nut and remove steering wheel with washer.



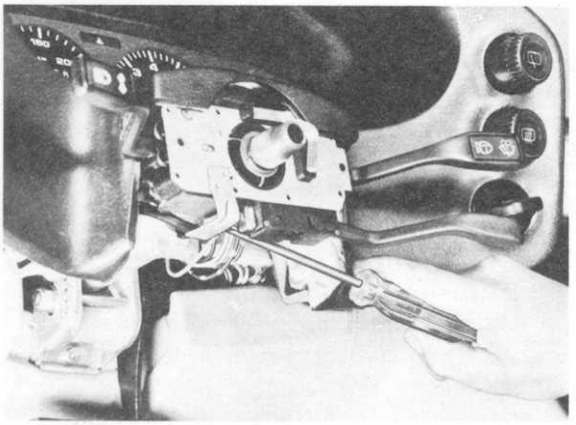
4. Unscrew cover underneath instrument cowl (not on older models) and cover underneath steering column switch.



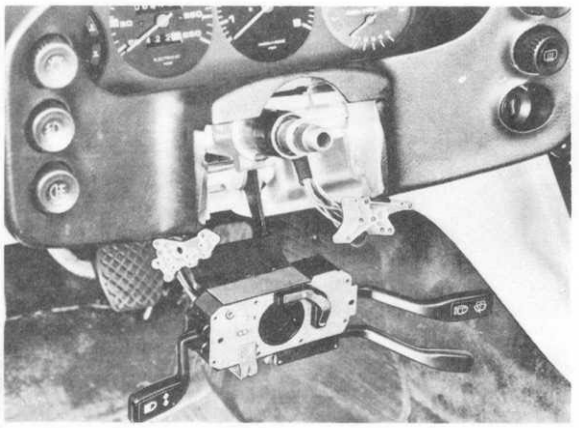
5. Unscrew mounting bolts for instrument cowl.



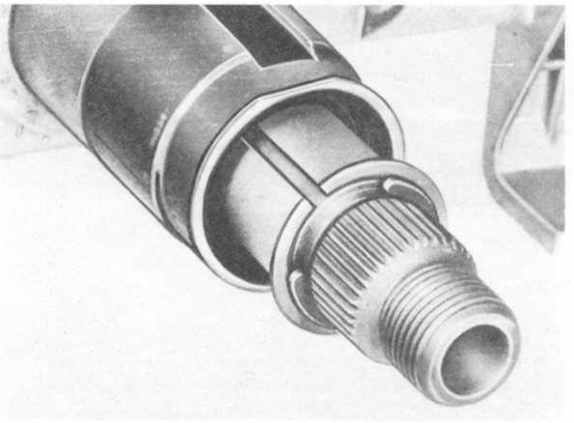
6. Unscrew mounting bolt for steering column switch.



7. Remove steering column switch after disconnecting plug connector and pulling off plugs, lifting instrument cowl for this.

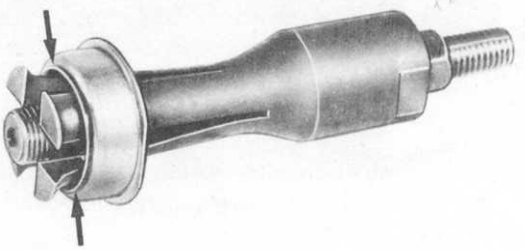


8. Remove circlip and support on steering shaft.

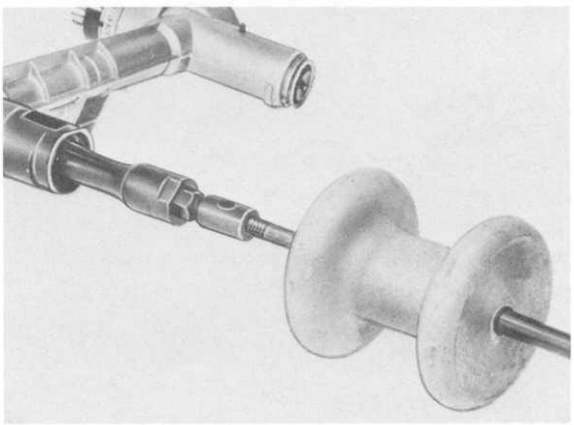


9. Unlock steering lock and push steering shaft into steering protective tube far enough so that intermediate shaft in engine compartment rests on camshaft housing.

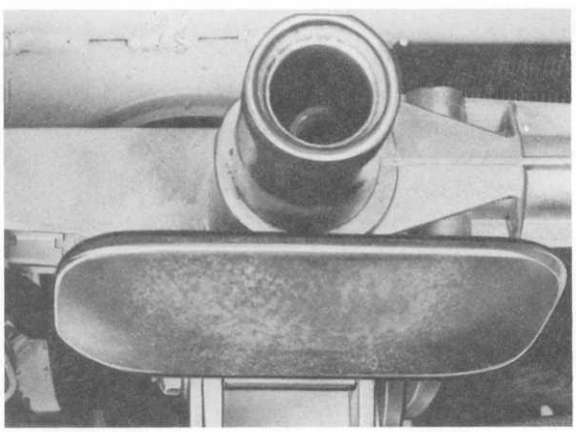
10. Apply a standard internal-claw puller, e. g. puller 62 - 020 from Schrem in Giengen, in upper steering shaft bearing. Spread puller enough so that bearing inner race is not pulled out of bearing outer race while driving out bearing (arrow), since otherwise the balls would fall down into the steering tube.



11. Connect Special Tool VW 771 with internal-claw puller and drive out upper steering shaft bearing.



12. Drive in new steering shaft bearing flush with Special Tool VW 433. Surface on bearing collar must face up because of steering column switch guide tab.



13. Pull or push up steering shaft in steering tube. Check axial play of steering shaft, see page 48 - 25.
If there is no axial play, it must be adjusted since otherwise the new bearing could be destroyed in a short time. Install support and circlip.

14. Install steering column switch and covers. Connect battery ground wire.

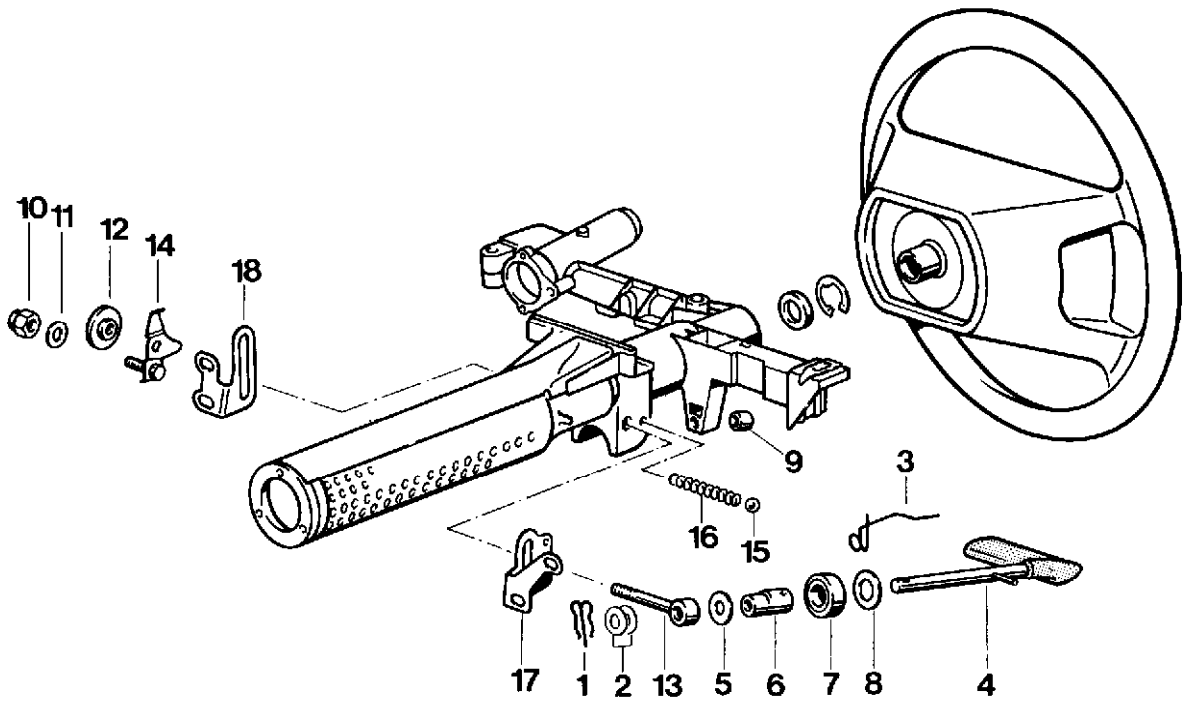
15. Install universal joint between steering and intermediate shafts. If necessary, adjust 8 mm gap (see page 48 - 23).

16. Install steering wheel so that its spokes are horizontal when road wheels point straight ahead or according to mark made before removing.
Install mounting nut with washer and torque to 50 Nm (36 ftlb).
If necessary (not positioned horizontally before removing and slightly different universal joint position), correct steering wheel position after test drive.

Dismantling and assembling steering wheel height adjuster of airbag vehicles

Printed in Germany – XXVII, 1991

Dismantling and assembling steering wheel height adjuster of airbag vehicles



976-48

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No.	Designation	Qty.	Note: Removal	Note: Installation
1	Spring clip	1		if not present, retrofit to modified steering wheel height adjuster (p. 48 - 40). Affected parts: No. 1, 2, 4 and 6.
2	Spring washer	2		
3	Spring	1		always fit a new spring, making sure it is not bent when fitting
4	Adjuster lever	1		fit modified version only (p. 48 - 40).
5	Washer with small inside dia.	1		
6	Eccentric	1		fit modified version only
7	Needle-roller bearing	1		replace if required
8	Washer with large inside dia.	1		
9	Bushing	1		replace if required. Coat inside with multi-purpose grease.
10	Lock nut	1		replace if required. After adjustment, tighten setting nut (No. 12).
11	Washer	1		
12	Setting nut	1		Adjust (p. 48 - 39)
13	Through bolt	1		
14	Drag lever	1		
15	Ball	1		
16	Thrust spring	1		
17	Left-hand console	1		
18	Right-hand console	1		

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Dismantling and assembling instructions

Important notes

If the scope of assembly deviates from the following instructions, the safety requirements for the operation of vehicles with airbag equipment must be observed.
Example: Removing the airbag steering wheel, working on the contact unit (steering column switch) etc.

Safety requirements

Test and assembly operations must only be carried out by qualified personnel.

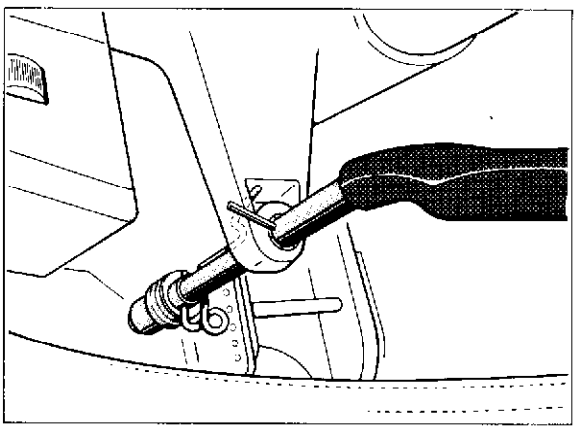
Before working on the airbag system or on adjacent components that entail a risk of live components getting near the airbag system, the following safety requirements must be observed at all times:
1. Switch off ignition.
2. Disconnect and cover negative battery terminal.

After the battery has been disconnected, assembly operations or other jobs that require the use of a hammer or similar tools must only be performed after a waiting time of 20 minutes has elapsed. This is required to ensure that the power supply to the airbag system is interrupted and to make sure the airbag is not triggered inadvertently.

For further safety requirements, refer to Repair Group 68.

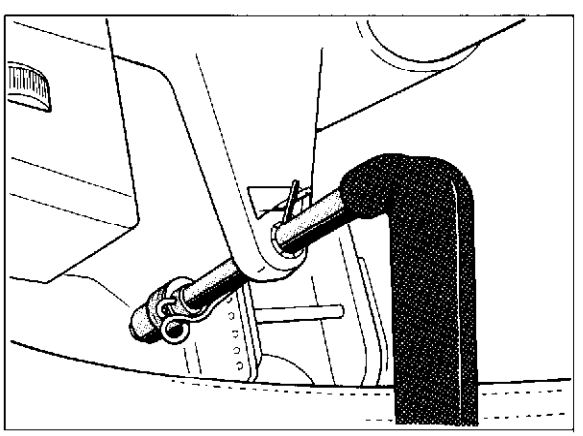
Adjuster lever positions

Adjusting mechanism of steering wheel height adjuster closed.



977 - 48

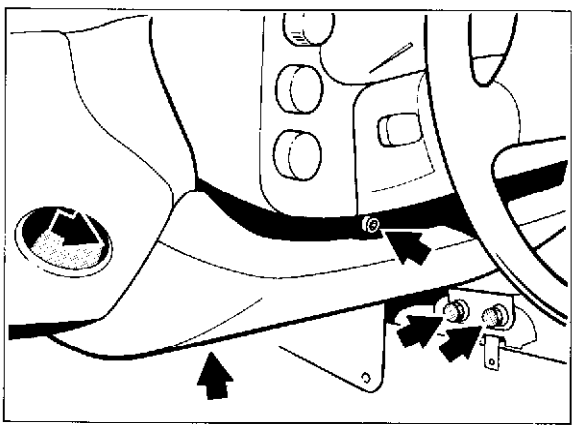
Adjusting mechanism of steering wheel height adjuster open.



978-48

Dismantling

1. Remove knee protector strip. The fastening screws and nuts (arrows) are accessible after removal of the center console cover and of the air outlet nozzle.



979-48

Note

If the steering wheel height adjuster is modified to the new version, assembly may be started from item 2 immediately after removal of the knee protector strip (e.g. if the adjuster lever/through bolt union is disconnected). This means that adjuster mechanism items No. 10 to 18 (page 48 - 34) do not have to be dismantled any further.

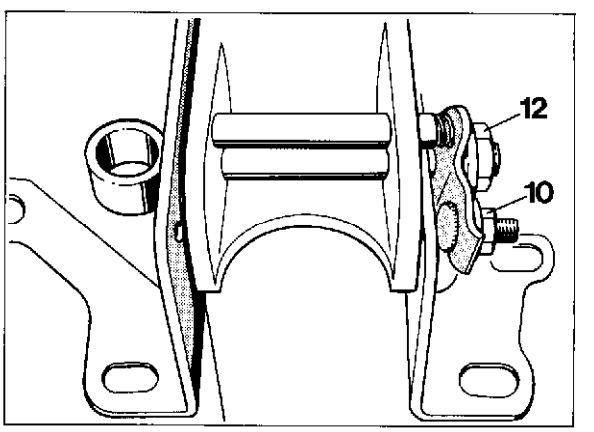
2. Turn adjuster lever of height adjuster to the open position. For dismantling sequence, refer to explosion drawing on page 48 - 34.

Assembly

1. If required, fit parts No. 10 to No. 18 (p. 48 - 34).

2. For further assembly or fitting, use only the parts applicable as of MY '92 (modified version with spring clip).
   For identification of the relevant parts, refer to page 48 - 40.

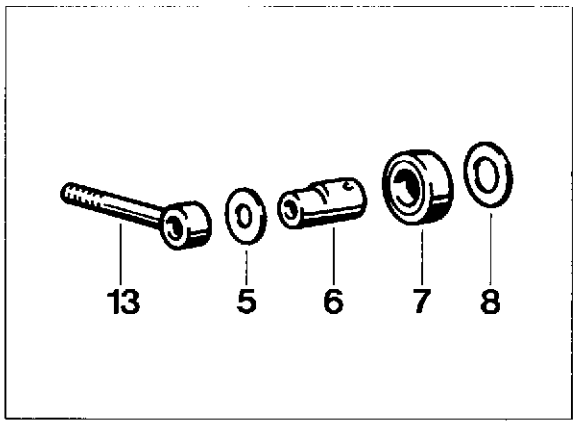
3. Undo lock nut (No. 10). Open setting nut (No. 12) by a minimum amount. If parts – No. 10 to No. 18 – had not been removed, mark previous position of the setting nut (No. 12).



980-48

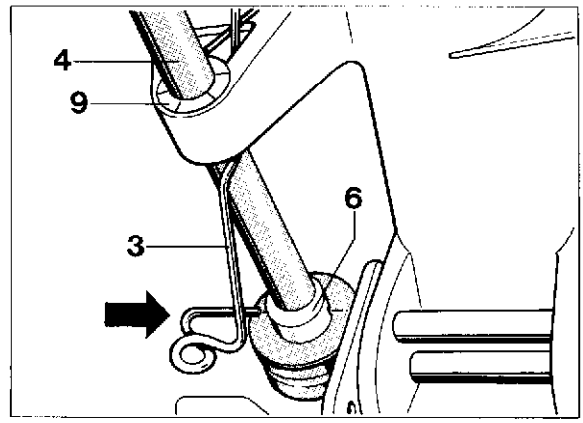
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4. Insert eccentric (No. 6) with small washer (No. 5) and large washer (No. 8) as well as needle-roller bearing (No. 7) into through bolt (No. 13). Use multi-purpose grease.



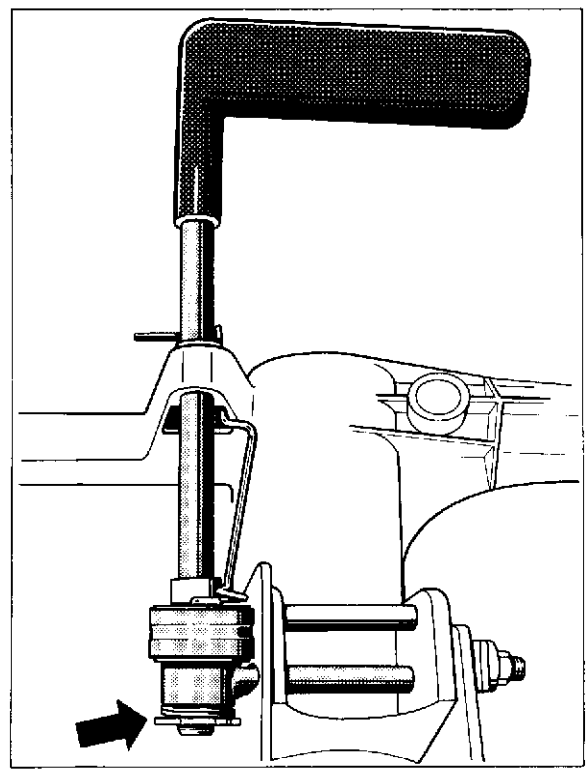
983-48

5. Place pilot bushing (No. 9) into the column tube.
Insert adjuster lever (No. 4) in open position (lever points straight down) into pilot bushing (Nr. 9) and into eccentric (No. 6). **The wider side of the eccentric must face down.**
If required, turn eccentric accordingly.
Place a new spring (No. 3) into the described position (holes in eccentric and adjuster lever mate up with each other).



981-48

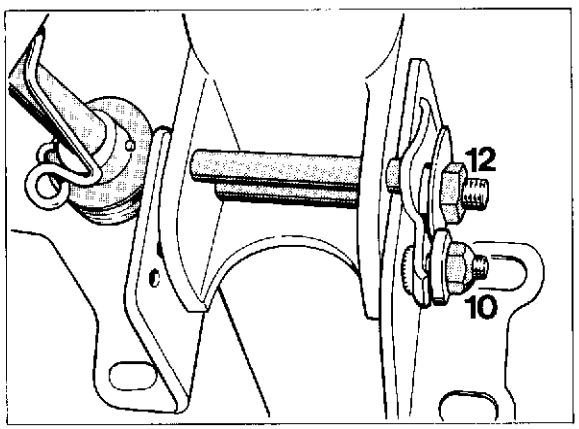
6. Install spring washers (2 pc.) and spring clip.



986-48

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7. Adjust setting nut (No. 12) of the through bolt carefully.
   Proceed as follows: Tighten setting nut until both the steering wheel height adjuster operates perfectly in the open position and the clamping action at the adjuster mechanism is fully operative in the closed position.
   Following careful adjustment, tighten the lock nut (No. 10). This causes the setting nut (No. 12) to be locked.



982-48

8. Check operation of the steering wheel height adjuster repeatedly and fit the corresponding parts (knee protector strip etc.).

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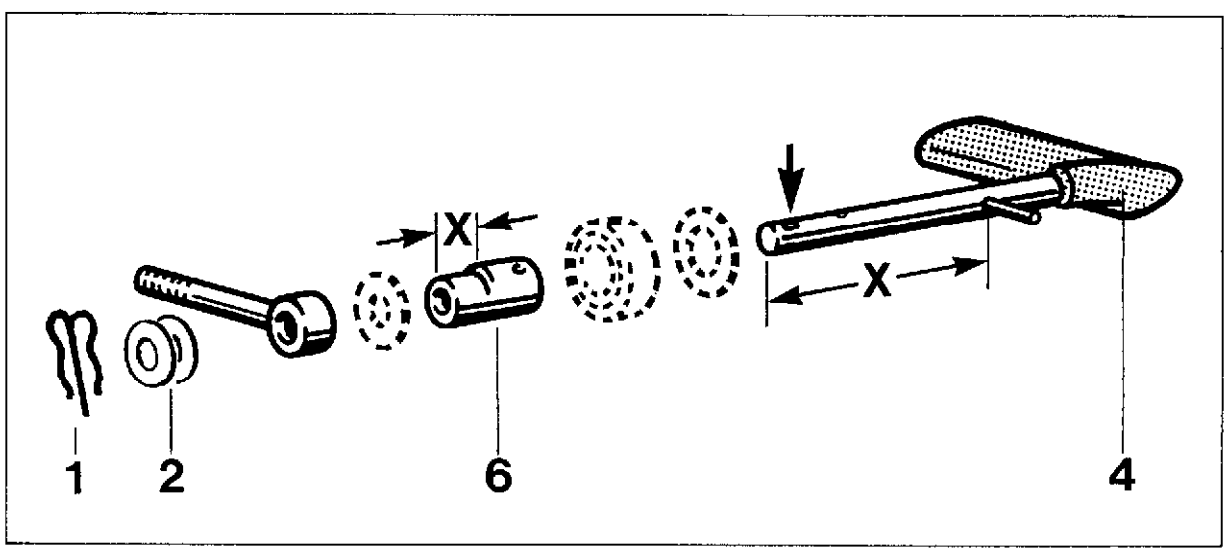
Modifications to the steering wheel height adjuster

As of MY '92, axial locking of the operating level (No. 4) was improved by a spring clip (No. 1).
This has entailed modification of the operating lever (No. 4) and of the eccentric (No. 6).
The spring clip (No. 1) and two spring washers (No. 2) were newly introduced.

In case of repairs, the modified design should also be adopted for vehicles prior to MY '92 equipped with airbag.
Required parts: New lever, new eccentric, two spring washers and one spring clip.

Parts identification

No.	Designation	Original version	Modified version
4	**Adjuster lever**	without hole at end	with hole at end (arrow)
	dimension x ≈	106 mm	111 mm
6	**Eccentric**		
	Total length	36.0 + 1.0 mm	34.5 + 1.0 mm
	Dimension x =	14.5 + 0.2 mm	13.0 + 0.2 mm



488-48

Adjustment specification for Keylock cable

General

Vehicles with automatic transmissions for the USA and Canada have been equipped with the Keylock safety system as of the 1993 model year.

Keylock has been installed in vehicles with automatic transmission world-wide as of the 1994 model year. With this system, the ignition key can be pulled out **only** if the selector lever was moved to position P beforehand. This ensures that the vehicle does not move off unintentionally.

The selector lever remains locked until the ignition key is inserted again and the ignition lock is turned to position **1** (terminal X).

The blocking function is activated and deactivated via a cable between the ignition lock and the selector lever lock.

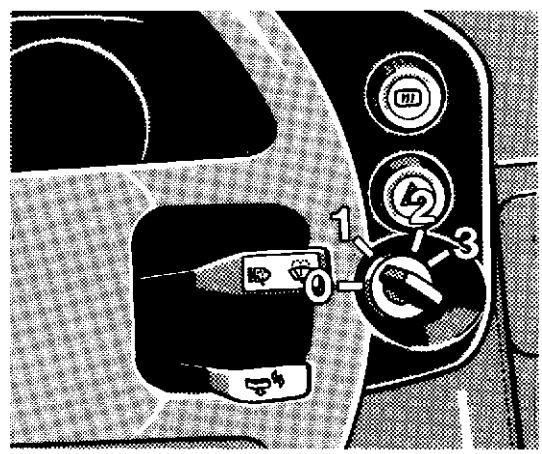
The vehicle cannot be moved without the ignition key, as the engaged parking lock prevents the drive wheels from turning.

Fit the Keylock cable on the steering lock

Screw in the Keylock cable No. 37 (see Page 48-42) **only** with the steering lock in position "2" (ignition on). **Then move the selector lever to position "P" and subsequently turn the steering lock to position "0".**

Note

The cable adjustment has to be corrected (see Page 48-42) if the ignition lock cannot be turned to position "0".



BA-928/30

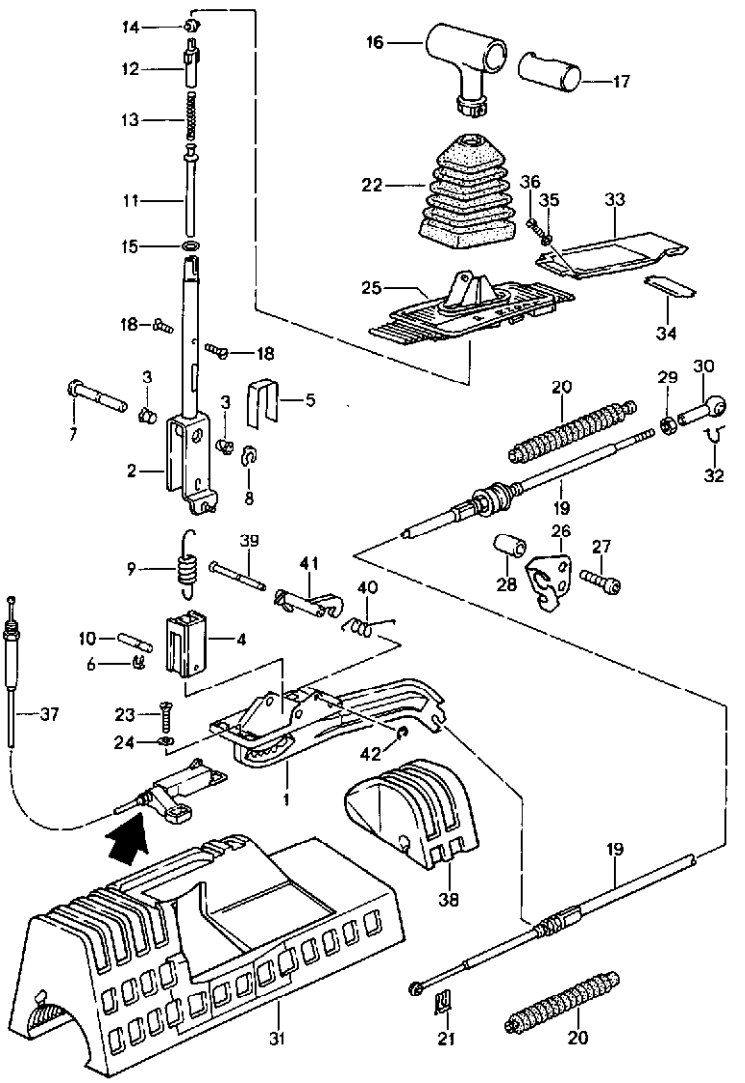
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Adjustment and testing specification for Keylock cable

Move the selector lever to position "P". Turn the ignition key to position 2 (ignition on).

Unscrew the adjusting screw (arrow) until the ignition key can no longer be turned to position 0 (stop).

Carefully **screw in** the adjusting screw until the ignition lock can be locked again (using greater force).
Then screw in the adjusting screw by **an additional** approx. 1/2 turn = 0.5 mm. After this step, it must be possible to turn the ignition key to position 0 (stop) and pull it out only if the selector lever is in position "P".



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Refer to Repair Group 87 for removal and installation of heater, blower and air distribution housing, as well as disassembly and assembly of heater.

Several points will not apply to cars without an air conditioner.

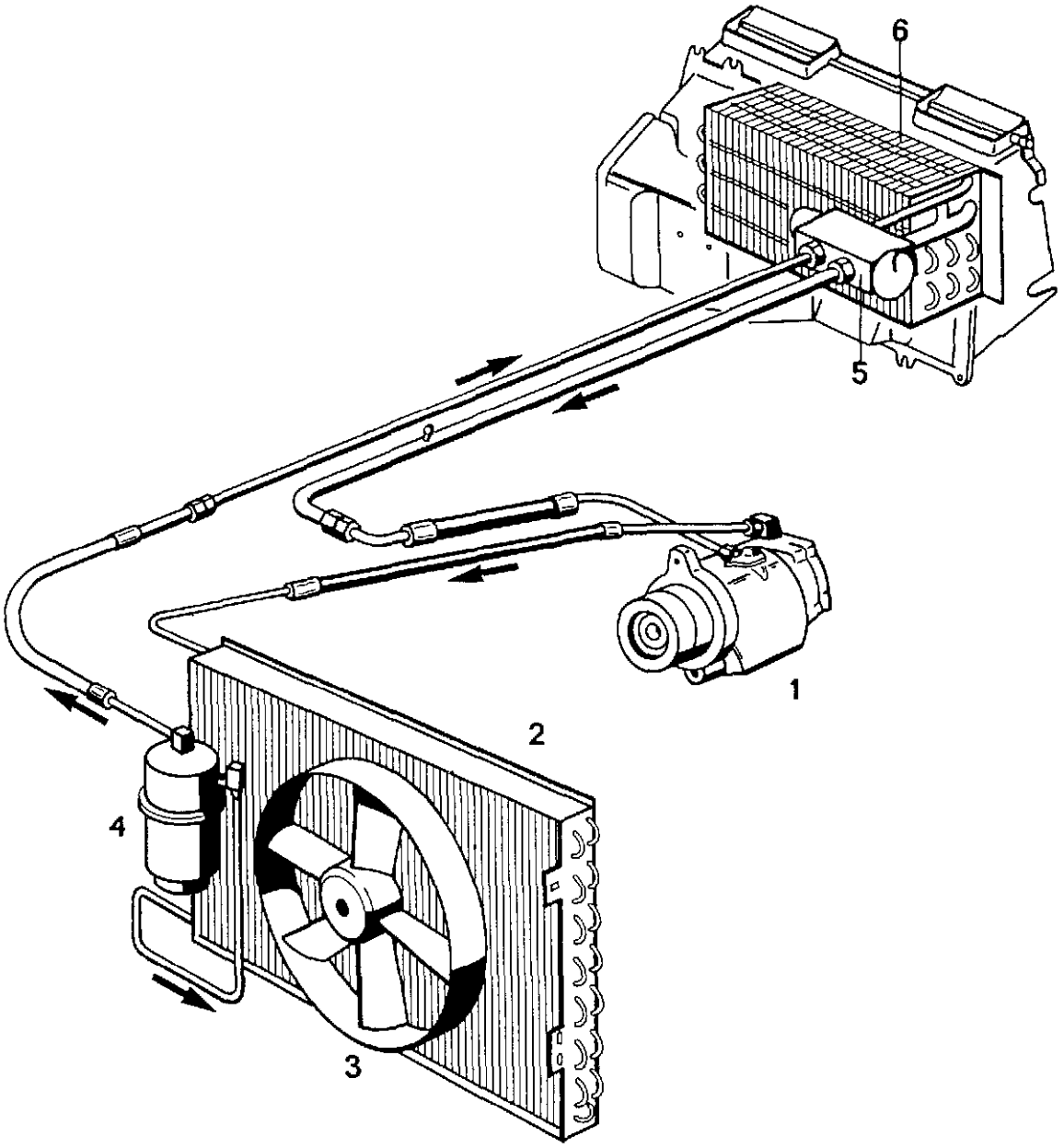
SPECIFICATIONS FOR AIR CONDITIONER

Refrigerant capacity	950 grams/33,5 ounces of R 12
Refrigerant oil in compressor	350 cm^3/12 ounces of Suniso No. 5 GS or Texaco Cappela "E" or similar
Power requirement of compressor clutch	approx. 50 watts
Seal on receiver-drier	Seal ruptures at 117 ± 3° C/242 ± 5° F = a pressure of approx. 45 bar/640 psi
Relief valve on compressor	Valve opens at pressure of 31 to 35 bar/ 440 to 500 psi = temperature of 95 to 105° C/ 203 to 221° F

TIGHTENING TORQUES - AIR CONDITIONER

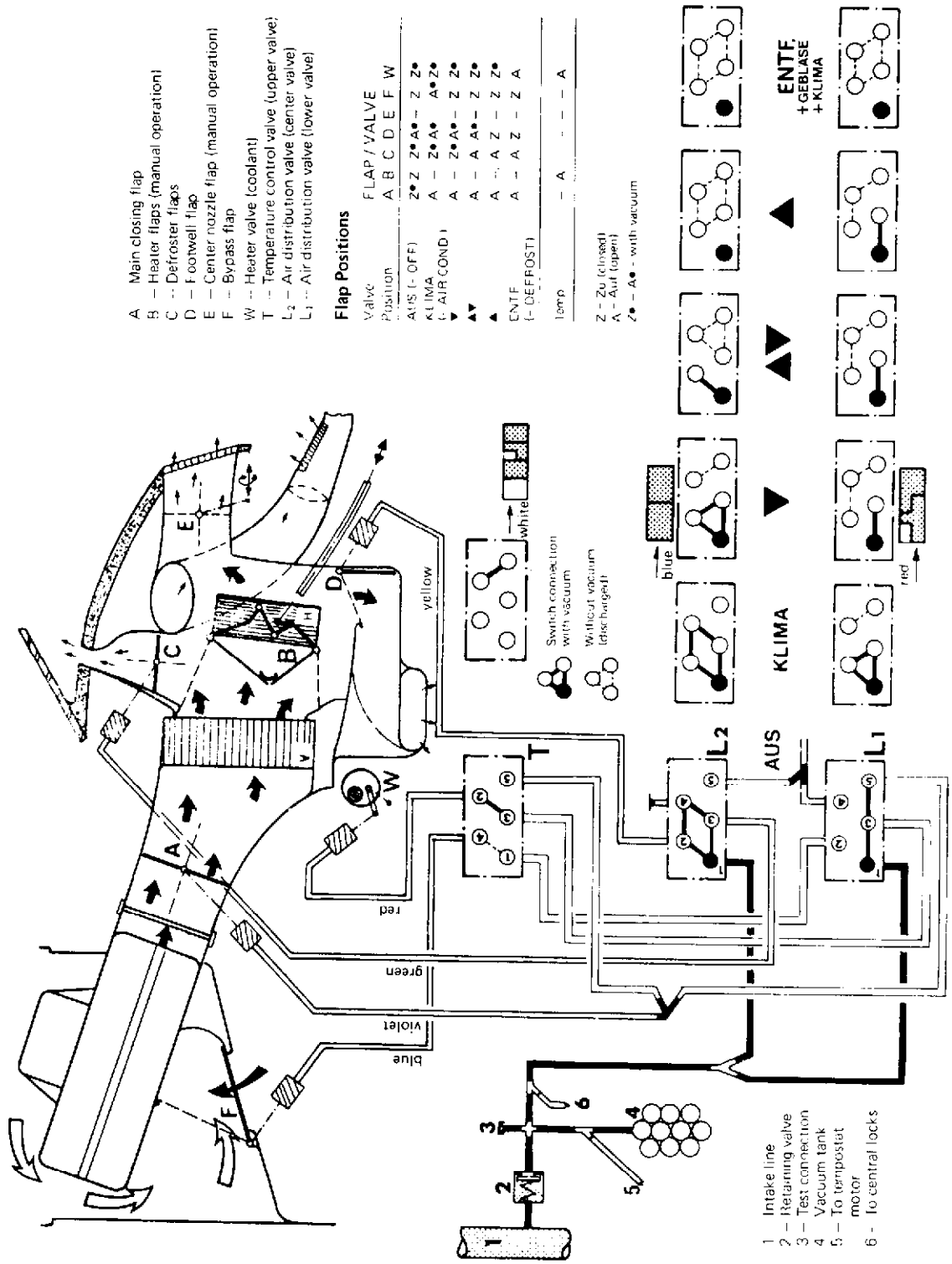
Location	Description	Threads	Material	Torque Nm (ft lb)
Pressure line to expansion valve	Coupling	5/8"x 18 UNF	28 K	14 - 20 (10 - 14)
Pressure line to receiver-drier	Coupling	5/8"x 18 UNF	28 K	14 - 20 (10 - 14)
Hose to compressor/ condenser	Coupling	3/4"x 16 UNF	28 K	33 - 39 (24 - 28)
Hose to suction line/ compressor	Coupling	7/8"x 14	28 K	36 - 42 (26 - 30)
Suction line to expansion valve	Coupling	7/8"x 18	28 K	36 - 42 (26 - 30)

REFRIGERANT SYSTEM LAYOUT



1 - Compressor
2 - Condenser
3 - Fan
4 - Receiver-drier
5 - Expansion valve
6 - Evaporator

VACUUM SYSTEM LAYOUT



Safety regulations for handling the refrigerant R12

The used refrigerante R12 is known as a safety refrigerant. In other words, this refrigerant is non-combustible, non-explosive, non-toxic, non-irritating, odorless and tasteless. Nevertheless, you should observe the following points:

1. Any contact with fluid or gaseous refrigerants must be avoided. Affected skin areas must be treated like frost injuries; wash off immediately with cold water and then consult a physician. Protective goggles must be worn to protect the eyes. If refrigerant should nevertheless enter the eye, consult a physician immediately. Rubber gloves must be worn to protect hands.

2. When performing repairs on the air-conditioning system, the refrigerant must be syphoned off from the system and the refrigerant cleaned. Refrigerant must not be allowed to enter the environment, because it attacks the earth's ozone layer.

3. Welding must not be performed on parts of the closed air-conditioning system or close to it under any circumstances. Irrespective of whether the system is filled with refrigerant or not, a very high pressure is produced by heating which can lead to damage to the system or even to an explosion. R 12 is completely non-toxic at normal temperatures, but decomposes into hydrogen chloride and fluorocarbon. These decomposition products contain, among other things, chlorine and phosgene. Corresponding care must be taken because these products are damaging to health.

4. Refrigerant bottles must not be thrown and must not be exposed to the sun or other heat sources for a long period in filled condition. The maximum permissible temperature of a filled refrigerant bottle must not exceed 45 °C.

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Characteristics of the refrigerant R 12

Trade designation: Frigen R 12, Freon R 12

Chemical designation: CCl_2F_2 (Dichlorfluormethane) or CF_2Cl_2 (Difluordichlormethane)

R 12 is colorless, odorless, non-toxic, non-combustible and heavier than air.

Boiling point: - 30° C at atmospheric pressure. At higher pressure, R 12 is also still fluid at higher temperatures (e.g. in the pressure bottle).

Chemical behavior with respect to other substances

1. R 12 does not attack most metals, particularly iron, copper, brass and aluminum, but lead may react with R 12 under certain circumstances. For this reason, lead is not used in refrigeration engineering.

2. Many plastics are decomposed by R12. Seals and closures etc. made of plastic must be used only if they have been specially recommended by the refrigerant companies.

3. R 12 dissolves oil. The special refrigerating oil required for lubricating the compressor circulates in the refrigerant circuit. Additives or contaminations in the oil enter into chemical reactions with R 12: consequently, only oils suitable for the refrigerant R 12 must be used.

4. Moisture in the refrigerant leads to decomposition of the refrigerant oil and to icing of the expansion valve. For this reason, dismantled lines and assemblies and test instruments must be sealed immediately after use in order to keep out air humidity and dirt particles.

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Flushing the air-conditioning system with refrigerant R 12

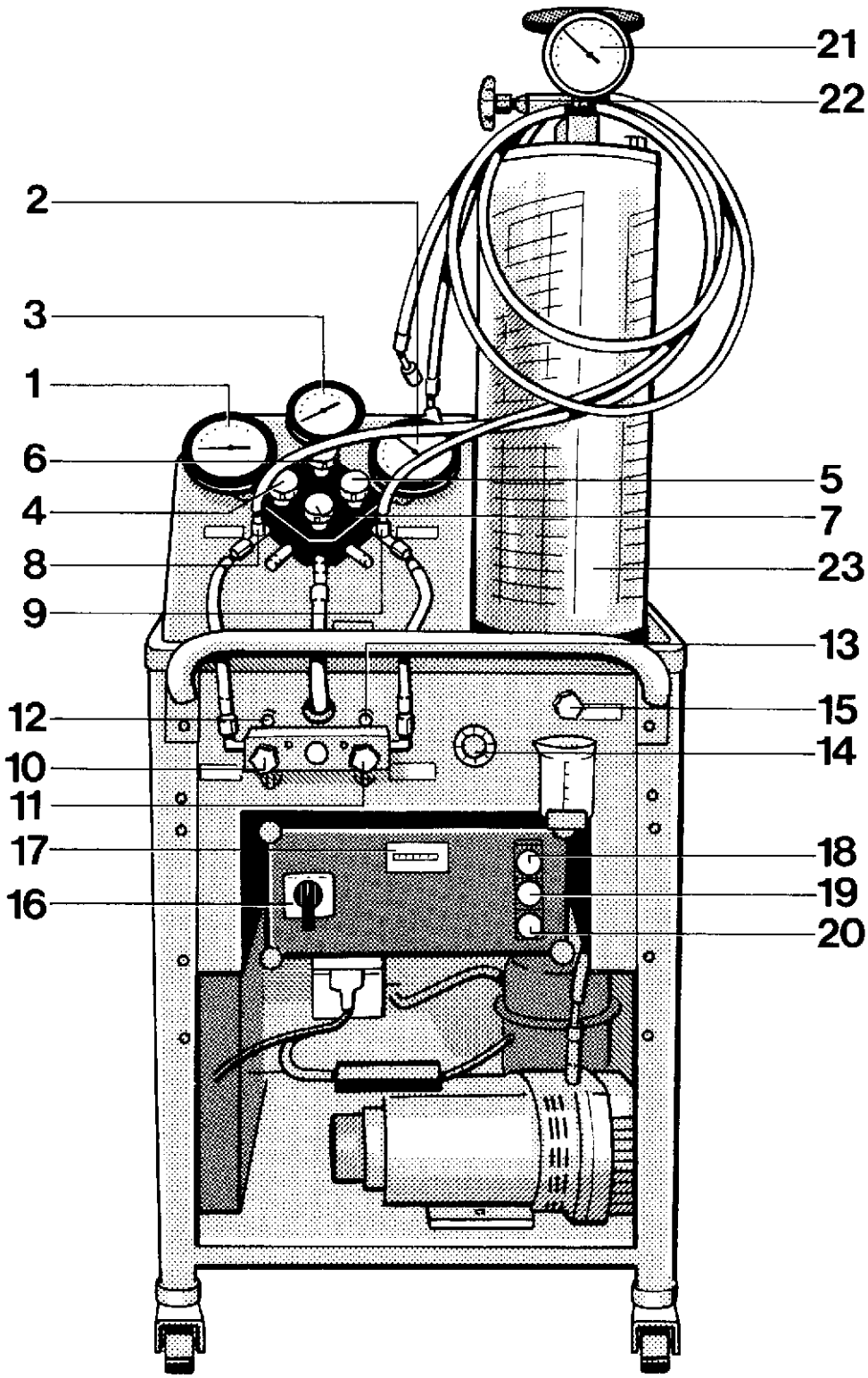
If humidity has entered the system during assembly of the air-conditioning system or as result of replacement of individual parts, the following procedure must be followed when refilling the system:

1. Connect the service unit.
2. Evacuate.
3. Fill approx. 500 g refrigerant.
4. Switch on the air-conditioning system and allow the compressor to run for approx. 1 min. Ensure that valves 6 and 7 are closed on the service unit.
5. Syphon off the refrigerant.
6. Fit new fluid reservoir.
7. Evacuate.
8. Fill

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Installation work on the air-conditioning system

Service unit SECU



303-87

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1 - Pressure gauge, low-pressure

2 - Pressure gauge, high-pressure

3 - Torrmeter

4 - Shut-off valve, low pressure (blue)

5 - Shut-off valve, high-pressure (red)

6 - Shut-off valve, torrmeter (black)

7 - Shut-off valve, vacuum pump (yellow)

8 - Connection piece, low-pressure

9 - Connection piece, high-pressure

10 - Shut-off valve, refrigerant inlet

11 - Shut-off valve; refrigerant outlet

12 - Connectiong piece, refrigerant inlet (from refrigerant botttle)

13 - Connectlon piece, refrigerant outlet (to refrigerant bottle)

14 - Moisture indicator

15 - Drain valve, refrigerating oil

16 - Main switch

17 - Operating hours counter

18 - Pilot lamp, yellow

19 - Pilot lamp, red

20 - Pilot lamp, green

21 - Pressure gauge, filling cylinder

22 - Shut-off valve, filling cylinder

23 - Filling cylinder with weight scale

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Installation work with intervention in the refrigerant system

The contents of the air-conditioning system must be disposed of in accordance with the relevant regulations before all work on the air-conditioning system which necessitates opening of the refrigerant system. The safety regulations must also be observed.

Dirt and moisture must be kept out of the piping system of the air-conditioning system. Extreme cleanliness must therefore be observed for all work. No parts of the system must be cleaned inside with hot steam under any circumstances. Only nitrogen must be used for cleaning.

When replacing a component, all openings must be sealed with a suitable stopper.

General work sequence

1. Syphon off refrigerant.
2. Remove faulty parts.
3. Evacuate.
4. Check system for leaks.
5. Flush with refrigerant.
6. Syphon off system again.
7. Evacuate.
8. Fill.

Note

Pay attention to sealing rings when disconnecting or connecting the hose connections.

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Syphoning off refrigerant

1. Connect the service unit to the system.

Note

Check on the fluid reservoir whether the sight glass is still transparent. If the sight glass is discolored brown on the inside, the refrigerant should be pre-filtered by a cleaning drier installed inbetween in the extraction hose. In this case, syphon off via the high-pressure side only.

2. Open the low-pressure shut-off valve (4), high pressure shut-off valve (5) and refrigerant inlet shut-off valve (8).

3. Turn the main switch (16) fully to the right. The green pilot lamp lights up.

Note

The syphoning-off operation takes place automatically. The unit is switched off when all refrigerant has been syphoned out of the circuit. The red pilot lamp then lights up.

4. Close shut-off valves 4, 5 and 8.

5. Open the refrigerating oil drain cock (15) and drain off syphoned-off refrigerating oil.

6. Determine the volume of the refrigerating oil.

Note

Do not use syphoned-off refrigerating oil again.

7. Fill in new refrigerating oil (syphoned-off volume + 10 cm^3)

Filling with refrigerating oil

1. Unscrew the red hose on the service unit at connection piece 9 and hold in the container with new refrigerating oil.

2. Switch on the vacuum pump.

3. Open the shut-off valves for low pressure (4) and vacuum pump (7).

Note

Refrigerating oil is now sucked into the system via the high-pressure side.

4. After filling the system with the refrigerating oil, close the shut-off valves and switch off the vacuum pump.

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Evacuating the air-conditioning system

1. Syphon off any existing pressure.

2. Switch on the vacuum pump (turn the main switch to the left).

3. Open the shut-off valves for low pressure (4), high pressure (5), torrmeter (6) and vacuum pump (7).

4. Leave the vacuum pump switched on for at least 15 min.

5. Close shut-off valves 6 and 7 at a pressure of approx. 0.1 bar (absolute)

6. Switch off the vacuum pump.

Note

If the vacuum cannot be reached or can be reached only after a very long time or if the pressure increases to over 0.2 bar (absolute) approx. 10 minutes after switching off the pump, the circuit possesses a leak and must be sealed.

Flushing the air-conditioning system

Note

Flushing the air-conditioning system serves the purpose of drying the circuit.

1. Evacuate.

2. Open the shut-off valves for high pressure (5) and the refrigerant outlet (11).

3. Allow refrigerant to flow in until a pressure of approx. 2 bar (absolute) is indicated.

4. Close shut-off valves 5 and 11.

5. Shut-off refrigerant again.

6. Evacuate.

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Filling the air-conditioning system

Note

The air-conditioning system must be evacuated and filled. There must be sufficient refrigerant in the filling cylinder. Top up if necessary.

1. All valves on the service unit must be closed.

2. A pressure of approx. 7 bar is required to fill the system. If the pressure is lower, the pressure can be increased by cleaning the refrigerant (refer to Page 87 - 16g). If the pressure is higher than 10 bar (end of the weight scale), the pressure in the filling cylinder can be lowered by opening the shut-off valve 22.

Note

The pressure increases by approx. 1.5 bar in 10 minutes.

3. In accordance with the value read off on pressure gauge 21, adjust the rotary scale of the filling cylinder so that the value specified on the top edge of the scale stops over the sight glass.

Note

It must be noted that the rotary scale is designed for use of different refrigerants. The refrigerant designations are specified at the bottom scale edge.
Only the scales for R12 are applicable for vehicle air-conditioning systems.

4. Set the required refrigerant quantity on the filling cylinder with the rubber ring (difference with respect to the refrigerant level in the filling cylinder).

5. Open the shut-off valves for high pressure (5) and the refrigerant outlet (11).

6. Observe the fluid level in the sight glass of the filling cylinder. Close shut-off valves 11 and 5 when the fluid level has reached the setting ring.

7. Check the refrigerating output (refer to Page 87-116).

8. Disconnect filling hoses at compressor.

9. Screw protective caps onto the valves.

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Topping up the air-conditioning system

Note

There is not sufficient refrigerant in the system if gas bubbles are visible in the sight glass of the fluid reservoir when the air-conditioning system is switched on.

1. Syphon off the fluid from the air-conditioning system.
2. Determine the volume of the refrigerating oil which is syphoned off as well.
3. Fill system with new refrigerating oil.
4. Evacuate.
5. Check system for leaks.
6. Fill with prescribed filling quantity.

Filling the service unit with refrigerant

1. Connect the refrigerant bottle with the refrigerant inlet connection piece (12).
2. Open the valve on the refrigerant bottle and shut-off valve 10.
3. Switch on the service unit with the main switch (16). The green pilot lamp lights up.
4. If there is sufficient refrigerant in the service unit, close the bottle valve. The system switches off automatically when the refrigerant has been syphoned off up to the bottle valve.
5. Close the refrigerant inlet shut-off valve (10).

Empty the service unit

Note

If the filling cylinder is full of refrigerant and it is necessary to syphon off more refrigerant, the clean refrigerant can be filled into a refrigerant bottle. Pay attention to the maximum filling weight. **The refrigerant bottle must not be overfilled.**

1. Connect the refrigerant bottle with the refrigerant outlet connection piece (13).
2. Increase the pressure in the filling cylinder to approx. 8 bar by cleaning the refrigerant.
3. Open the bottle valve and refrigerant outlet shut-off valve (11).
4. After completing emptying, close the bottle valve and shut-off valve.

Note

Do not empty the filling cylinder completely, otherwise moisture may enter the service unit.

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Cleaning the refrigerant

Note

If the syphoned-off refrigerant is heavily contaminated, it must be pumped through the filter systems several times.

The cleaning condition can be seen at the moisture indicator (14).

1. Open the filling cylinder shut-off valve (22).

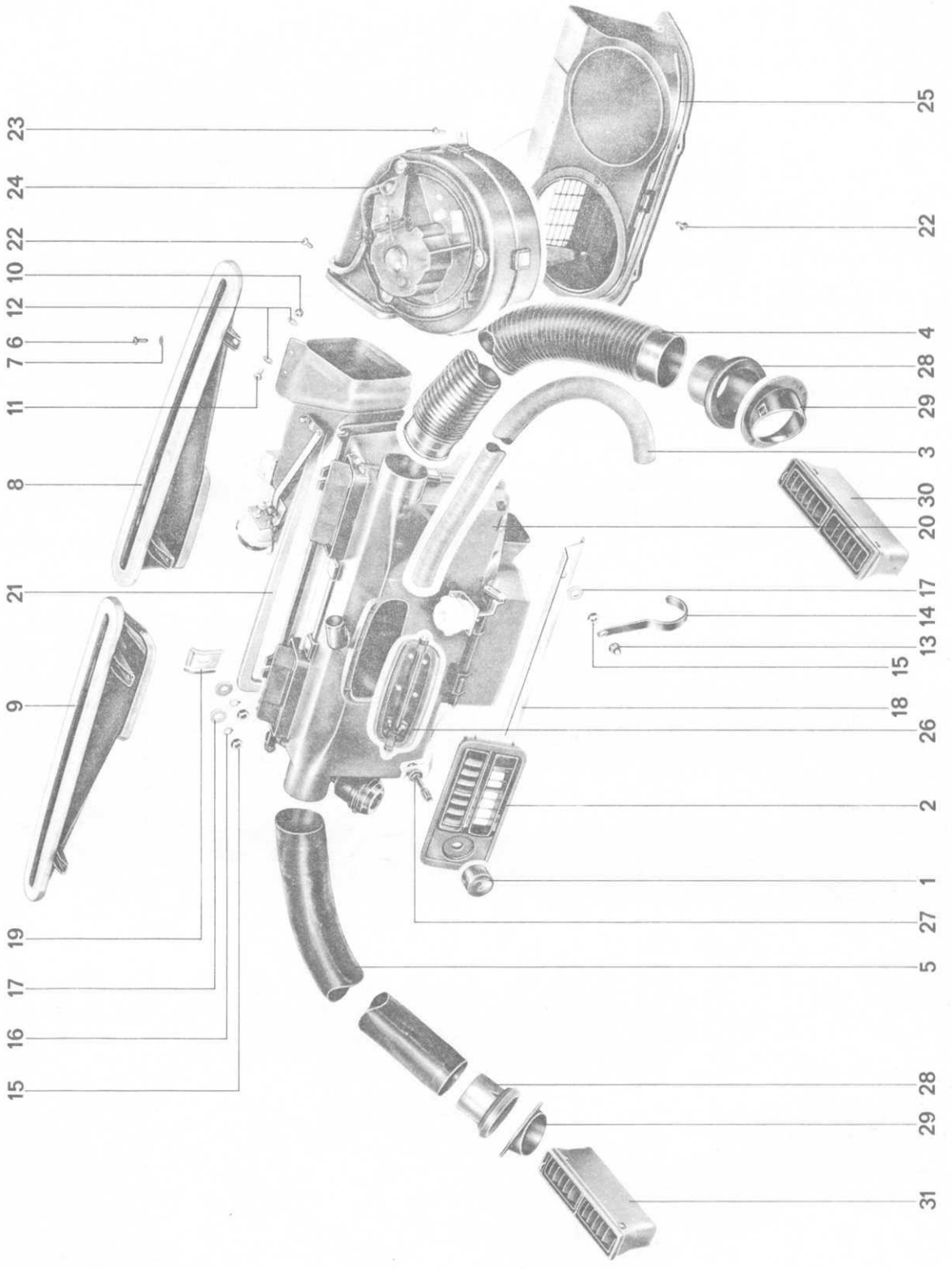
2. Switch on the service unit. The green pilot lamp lights up.

3. After cleaning the refrigerant (condition shown by the moisture indicator), close the shut-off valve).

Note

The unit switches off automatically when all refrigerant has been pumped into the filling cylinder (red pilot lamp lights up). The pressure in the filling cylinder increases.

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Knob	1			
2	Center vent	1	Don' t break off mounting pins		
3	Connecting hose to glove box	1		Replace, if necessary	
4	Connecting hose between instrument panel/side vent and heater/air cond.	1		Replace, if necessary	
5	Connecting hose between instrument panel/side vent and heater/air cond.	1		Replace, if necessary	
6	Screw 4.2 x 9.5	4			
7	Washer	4			
8	Defroster vent, right	1			
9	Defroster vent, left	1			
10	Self-locking nut	2		Replace, if necessary	
11	Screw 5 x 20	2			
12	Washer	4			
13	Cap nut	2			
14	Cable holder	1			
15	Nut	6			
16	Lockwasher	4			
17	Washer	6			
18	Reinforcement	1			
19	Retaining plate	2			
20	Heater/air cond.	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
21	Seal	1		Paste on body	
22	Screw	2			
23	Screw	1			
24	Blower	1			
25	Air distribution housing	1		In addition to seal, also use non-hardening sealant	
26	Shut-off flap	1			
27	Blower switch shaft	1			
28	Adapter for air duct	2			
29	Escutcheon	2			
30	Side vent, right	1			
31	Side vent, left	1			

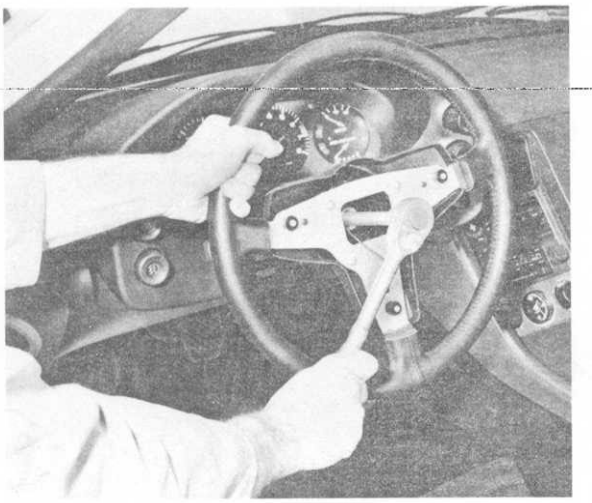
REMOVING AND INSTALLING HEATER/AIR CONDITIONER

Removing

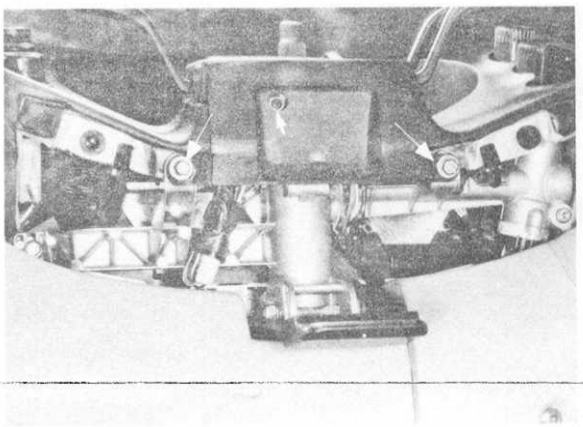
1. Discharge air conditioner.

2. Disconnect battery ground strap from body. If car has electric seats, run back seats all the way to facilitate work.

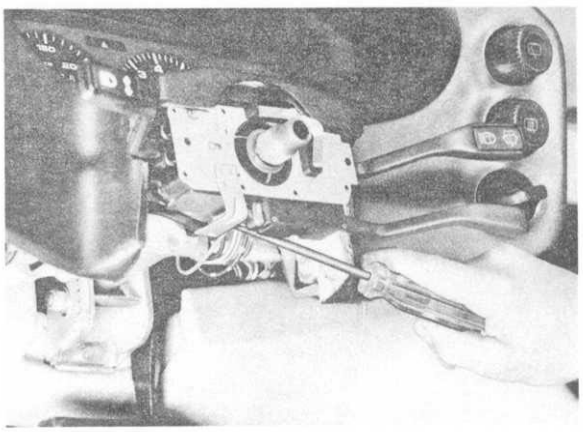
3. Pull off impact pad from steering wheel and remove horn wires. Mark position of steering wheel to steering shaft. Unscrew nut and take off steering wheel with washer.



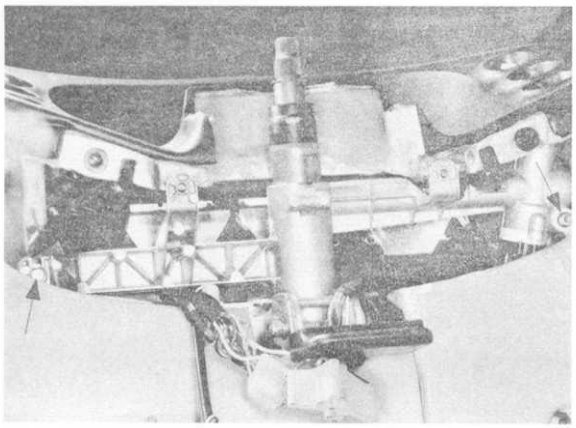
4. Remove cover underneath instrument cowl (only on new models) and cover underneath steering column switch.



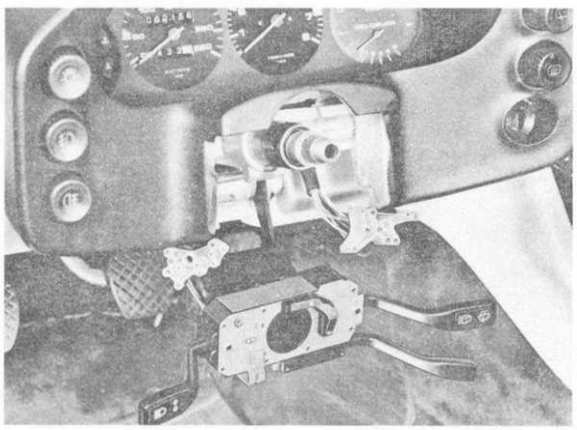
5. Loosen mounting screw for steering column switch.



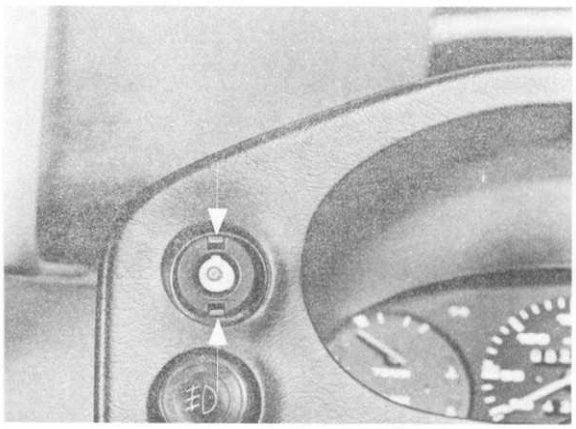
6. Remove instrument cowl mounting screws.



7. Lift instrument cowl, pull off plugs and remove steering column switch.

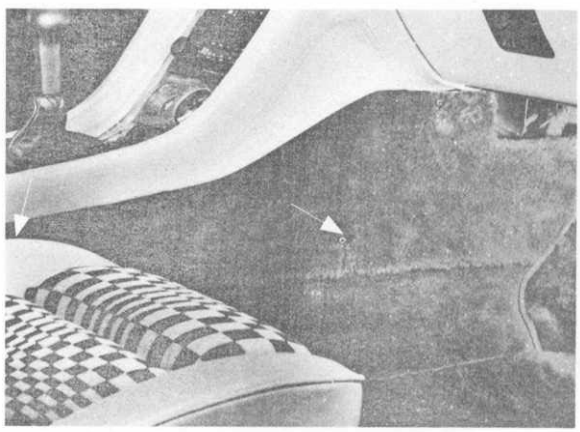


8. Remove 5 switches from instrument cowl by pulling off switch knobs, compressing spring clips, pulling out switches and pulling off plugs.



9. Pull out plugs from receptacles on back of instrument cowl (printed circuit) and lift off instrument cowl. Mark plugs for reinstallation.

10. Remove kick plate at accelerator pedal. Detach side trim panels from center console. Remove carpet sections and insulation sheets.

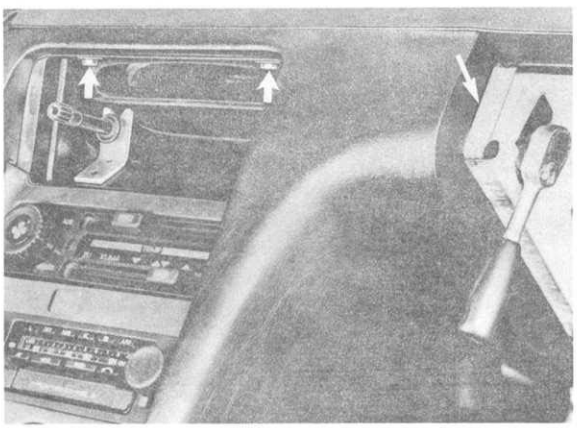


11. Take off tray and glove box. Remove shift lever knob and dust cover.

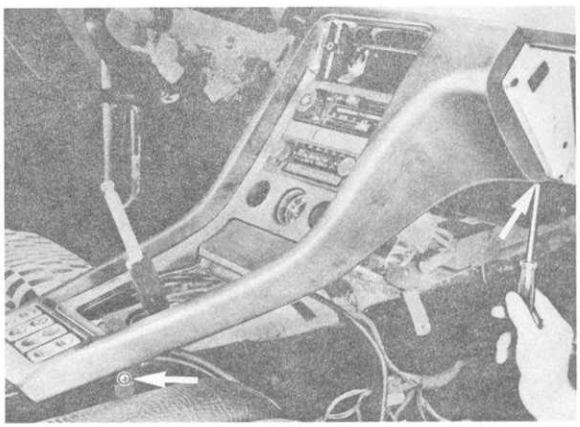
12. Pull off rotary knob for center vent. Pull out center vent withoug twisting or turning (danger of breaking off mounting pins).



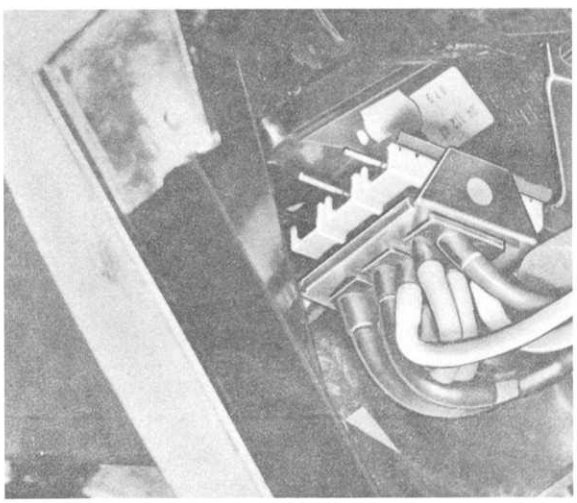
13. Remove center console mounting screws in recess of center nozzle and right mounting screw in glove box opening.



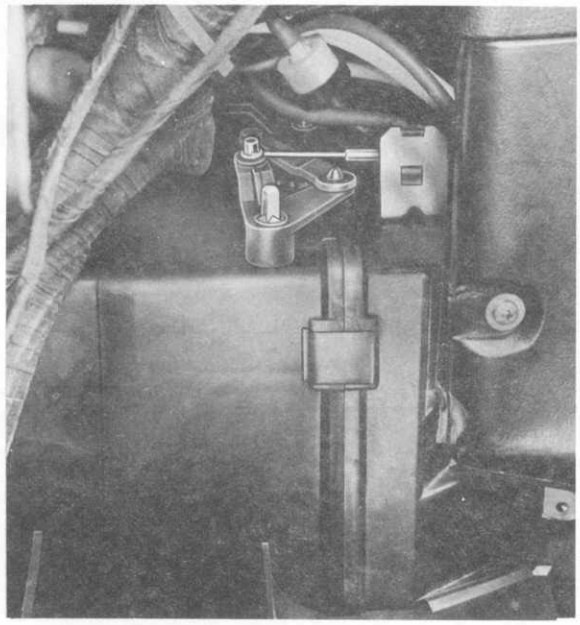
14. Remove remaining center console mounting screws on frame tunnel at left and right sides as well as on instrument panel. Remove radio mounting nut on holder (not applicable to plug-in version).
Disconnect or pull off following plug connectors or plugs.
Emergency flasher light switch, ashtray, radio, clock, seat belt light (double indicator lamp), heater/fresh air control switch, central warning panel (check buttons on new models), blower switch, power windows, electric sun roof.



15. Disconnect vacuum lines from control switch by disengaging spring clips and pulling off adapter.



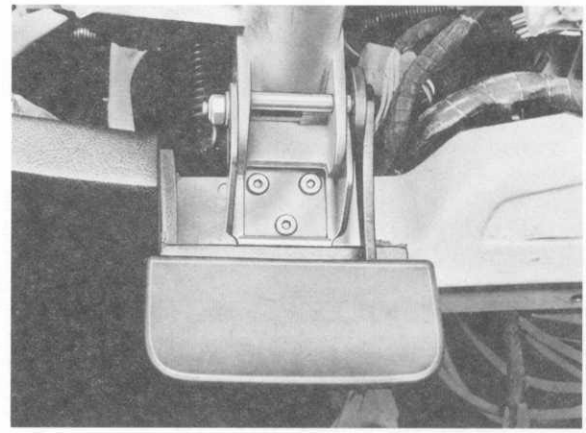
16. Disconnect cable from heater flaps on heater/ air conditioner unit.



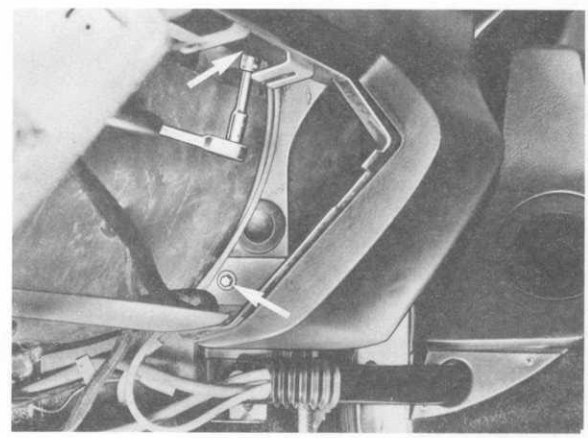
17. Pull out cable for heater flaps, which is routed between instrument panel and heater/air conditioner, and lift off center console.

18. Unscrew holder from control unit for tempostat cruise control and receiver of radio, and tilt off to the right side.

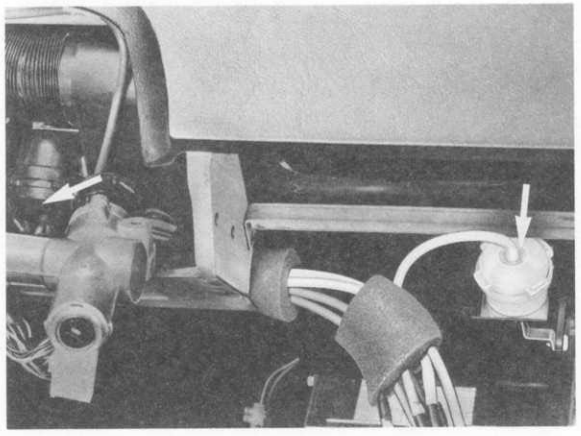
19. Disconnect steering protection tube from instrument panel (3 fillister head screws).



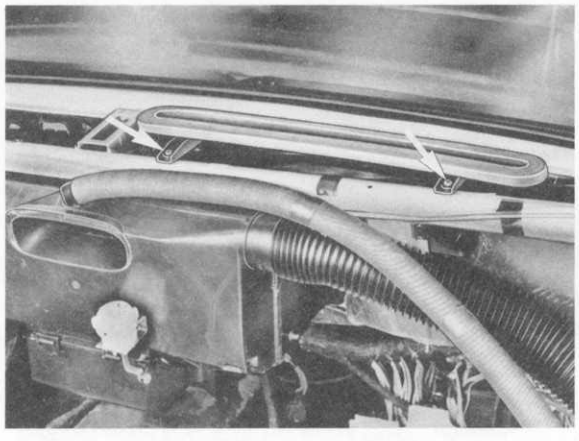
20. Unscrew mounting screws of instrument panel (2 each on left and right sides). Pull off hoses for side ventilation. Remove hose clips (holding vacuum hoses).



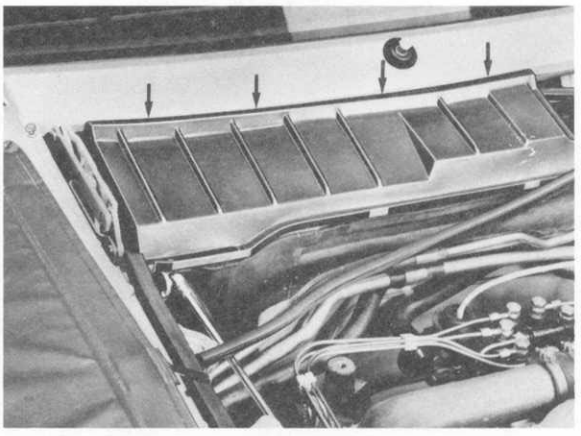
21. Pull off yellow and green vacuum hoses from vacuum boxes of footwell flap and defroster flaps. Remove instrument panel.



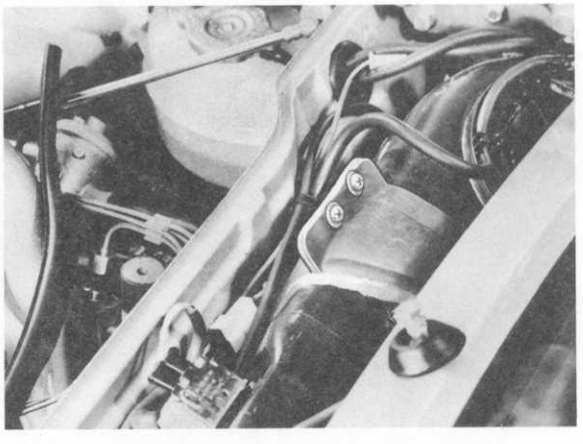
22. Remove connecting hoses between side nozzles/glove box nozzle and heater/air conditioner. Remove defroster nozzles.



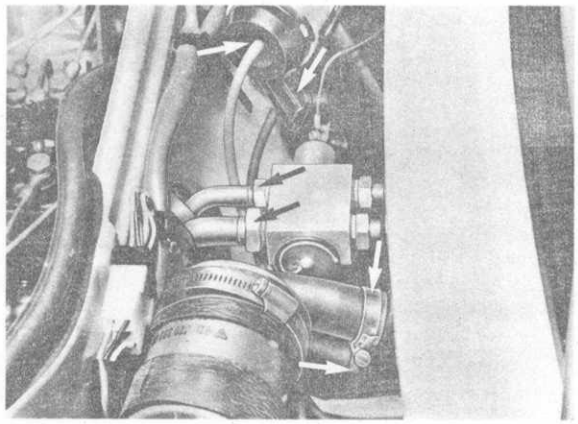
23. Remove cover over blower.



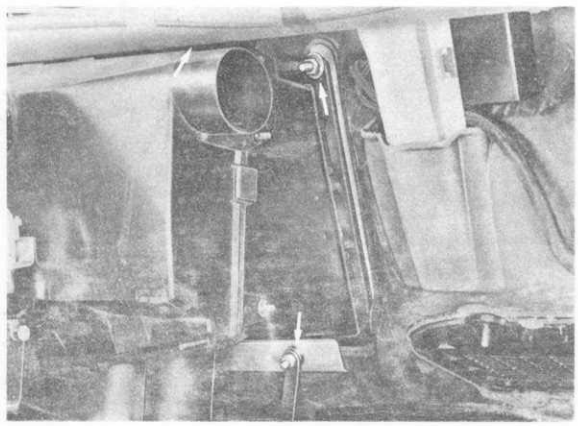
24. Remove two screws on rubber connector between blower and heater/air conditioner. Pull off wires from temperature switch.



25. Pry off wiper linkage from wiper motor (facilitates assembly). Pull off plugs from resistor block/safety switch and vacuum hose (violet) from vacuum unit of main shut-off flap. Unscrew and plug low pressure and high pressure lines on expansion valve for air conditioner. Detach coolant hoses from heat exchanger.



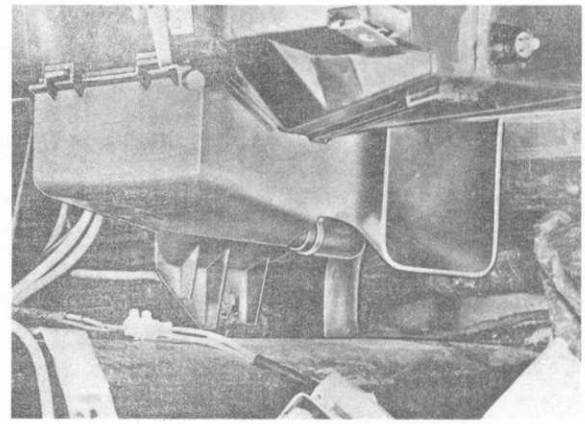
26. Remove mounting nuts from heater/air conditioner. Pull off water drain hose. Lift out heater/air conditioner.



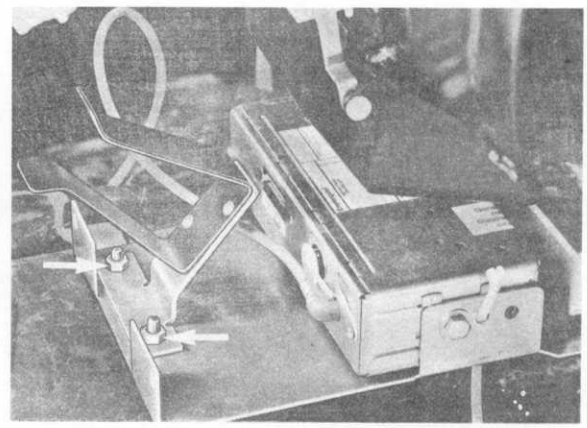
Installing

1. Replace O-rings on air conditioner. Install air conditioner, center and tighten screws.

2. Install water drain hose on footwell housing. Tighten hose clamp.

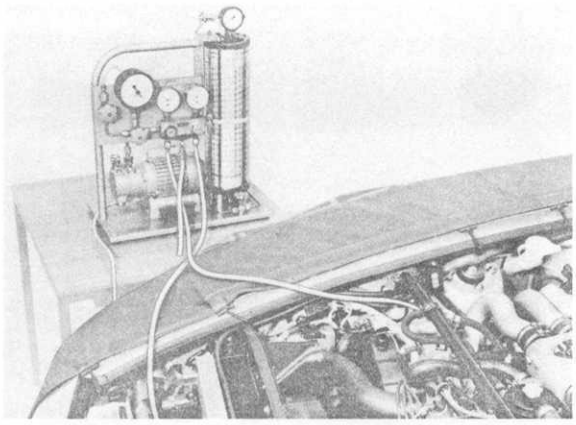


3. Install holder for control unit, automatic speed control and radio receiver.

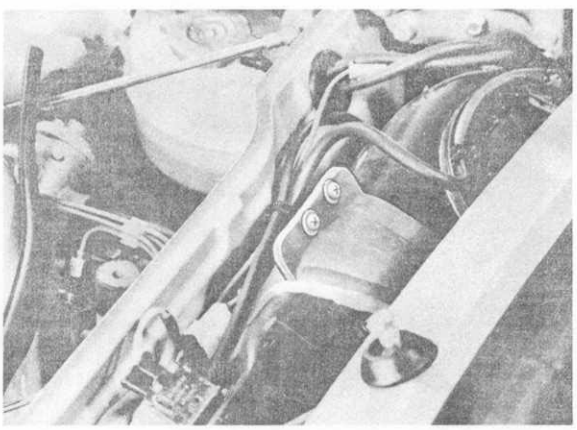


4. Connect lines on expansion valve, coolant hoses, vacuum hose of main shut-off flap, plugs on resistor block/safety switch and wires on temperature switch. Connect wiper linkage.

5. Connect service unit. Quick flush air conditioner.



6. Install rubber connector between blower and heater/air conditioner with a suitable adhesive, e.g. Loctite Super Bonder 414.



7. Install cover over blower.

8. Attach connecting hoses for side and glove box ventilation on heater/air conditioner. Install defroster vents.

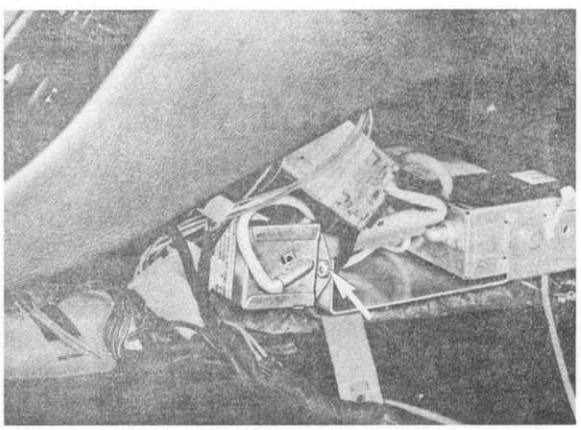
9. Install instrument panel. Attach connecting hoses for side ventilation.

10. Install steering protective tube on instrument panel. Do not yet tighten the three socket head screws.

11. Connect yellow hose for vacuum unit of footwell flap, green hose for vacuum unit of defroster flap and fasten vacuum hoses on instrument panel with clips.

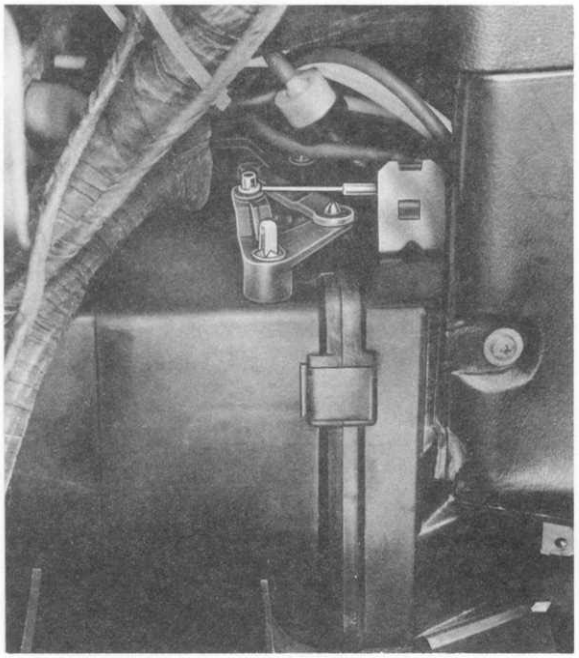
12. Install center console on frame tunnel. Push in cable for heater flaps between instrument panel and heater/air conditioner. Mount vacuum hoses on control switch.

13. Connect power seats and radio, or install.



14. Tighten center console screws, starting at center nozzle/instrument panel.

15. Attach cables for heater flaps.



16. Install shift lever knob with dust cover. For new version (large opening in shift lever area) first mount dust cover with shift lever knob on frame. Push shift lever knob on to shift lever. Engage frame on center console.

17. Install center nozzle and rotary knob. Charge air conditioner.

18. Install instrument cowl (incl. steering column switch and covers). When installing switches, be careful not to mix up plugs for front fog light and tail fog light switches! Plug with black/violet wire belongs to front fog light switch. Align instrument cowl with instrument panel and tighten mounting screws (3 fillister head screws) of steering protective tube.

19. Mount electric wires on holder of tempostat control with clips.

20. Connect battery. If applicable, insulate glove box light wires. Check function of heater, fresh air supply, air conditioner and electric system. Add coolant for engine cooling system.

21. Install side trim panels on center console and tread protection plate at height of accelerator pedal. Install floor carpets and insulation sheets. Install steering wheel.

22. Install glove box. Fit and adjust lid. Install tray.

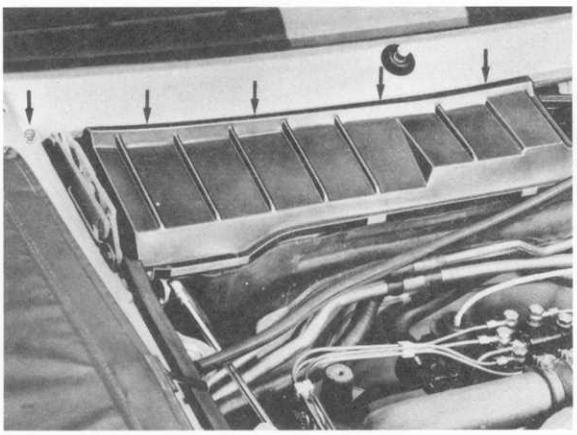
REMOVING AND INSTALLING BLOWER

Removing

1. Pull off ignition key. Mark position of engine hood and remove engine hood.

2. Take off right windshield wiper arm.

3. Remove cover above blower. Unscrew mounting screws from apron outer section on fenders of left and right sides.

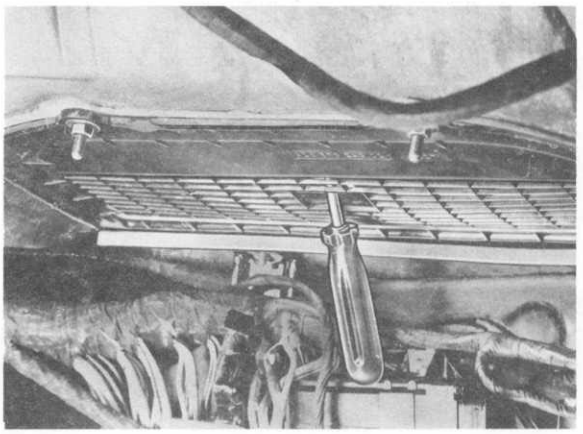


4. Open rubber connector between blower and heater/air conditioner. Don' t pull off rubber connector from heater/air conditioner (sealed).

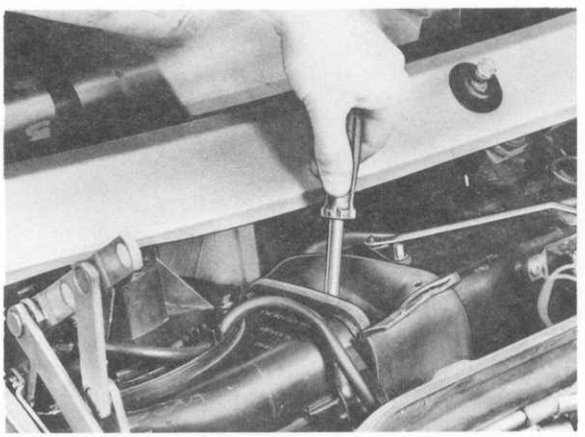
5. Disconnect blower wire harness at plug connector.

6. Remove three mounting screws from blower.

   a) To accomplish this, open flap of intake housing (move control switch lever to "AIR COND. "). Unscrew mounting screw with a screwdriver inserted through open flap. Cars without an air conditioner have a hole in the intake housing, which is sealed with a plug.



   b) Unscrew screw on inside of blower housing and screw on outside of blower housing.



4. Switch on the air-conditioning system, motor speed approx. 2000 rpm. Open the filling valve 2 and low-pressure valve 7.

5. Observe the sight glass in the fluid reservoir. The filling operation is complete if no gas bubbles are formed.

Note

Valves 6 and 7 must never be opened simultaneously when the compressor is running.

Flushing the air-conditioning system with refrigerant R 12

If humidity has entered the system during assembly of the air-conditioning system or as result of replacement of individual parts, the following procedure must be followed when refilling the system:

1. Connect the service unit.

2. Evacuate.

3. Fill approx. 500 g refrigerant.

4. Switch on the air-conditioning system and allow the compressor to run for approx. 1 min. Ensure that valves 6 and 7 are closed on the service unit.

5. Syphon off the refrigerant.

6. Fit new fluid reservoir.

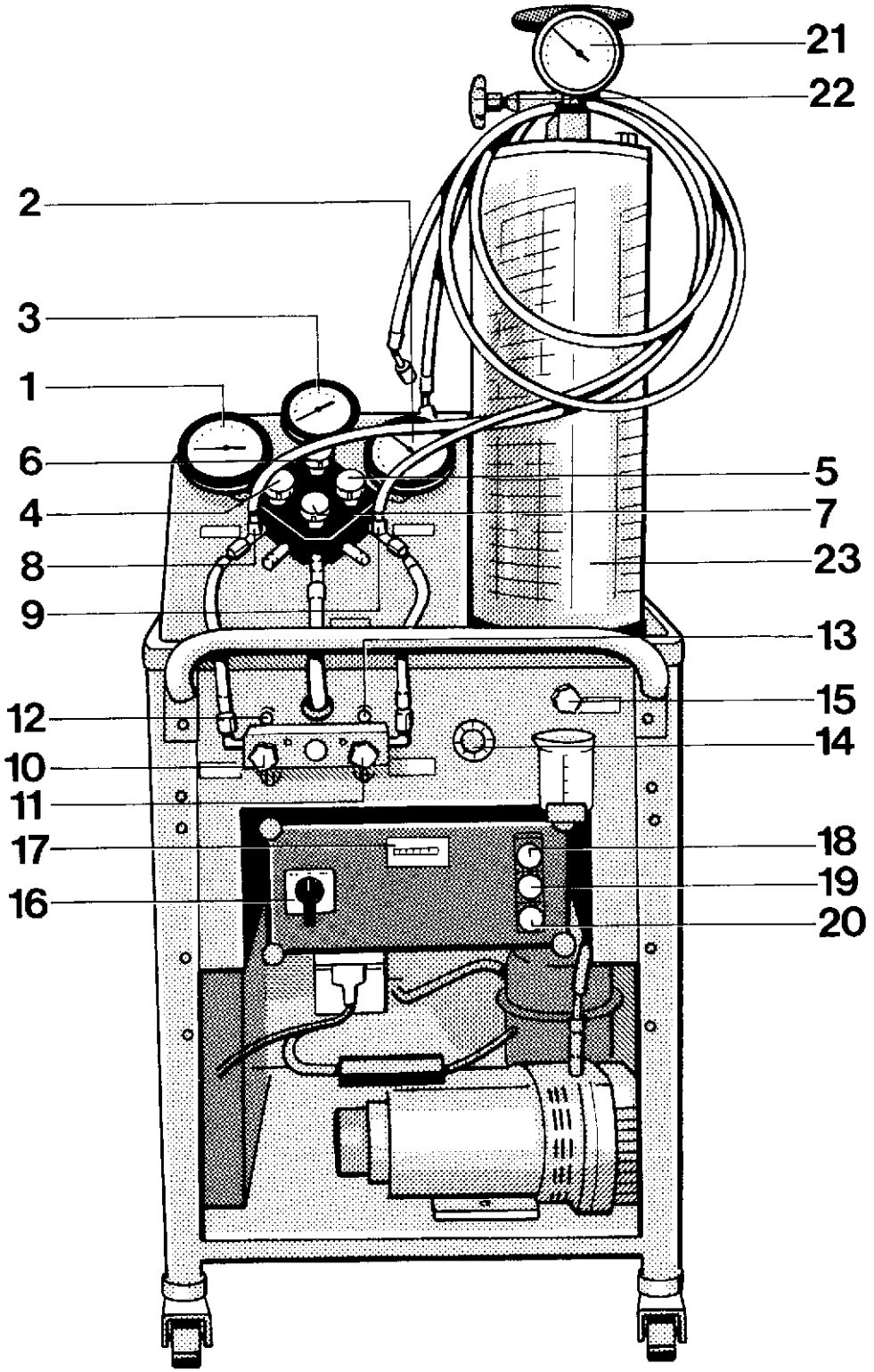
7. Evacuate.

8. Fill

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Installation work on the air-conditioning system

Service unit SECU



303-87

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1 - Pressure gauge, low-pressure

2 - Pressure gauge, high-pressure

3 - Torrmeter

4 - Shut-off valve, low pressure (blue)

5 - Shut-off valve, high-pressure (red)

6 - Shut-off valve, torrmeter (black)

7 - Shut-off valve, vacuum pump (yellow)

8 - Connection piece, low-pressure

9 - Connection piece, high-pressure

10 - Shut-off valve, refrigerant inlet

11 - Shut-off valve; refrigerant outlet

12 - Connectiong piece, refrigerant inlet (from refrigerant botttle)

13 - Connection piece, refrigerant outlet (to refrigerant bottle)

14 - Moisture indicator

15 - Drain valve, refrigerating oil

16 - Main switch

17 - Operating hours counter

18 - Pilot lamp, yellow

19 - Pilot lamp, red

20 - Pilot lamp, green

21 - Pressure gauge, filling cylinder

22 - Shut-off valve, filling cylinder

23 - Filling cylinder with weight scale

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Installation work with intervention in the refrigerant system

The contents of the air-conditioning system must be disposed of in accordance with the relevant regulations before all work on the air-conditioning system which necessitates opening of the refrigerant system. The safety regulations must also be observed.

Dirt and moisture must be kept out of the piping system of the air-conditioning system. Extreme cleanliness must therefore be observed for all work. No parts of the system must be cleaned inside with hot steam under any circumstances. Only nitrogen must be used for cleaning.

When replacing a component, all openings must be sealed with a suitable stopper.

General work sequence

1. Syphon off refrigerant.
2. Remove faulty parts.
3. Evacuate.
4. Check system for leaks.
5. Flush with refrigerant.
6. Syphon off system again.
7. Evacuate.
8. Fill.

Note

Pay attention to sealing rings when disconnecting or connecting the hose connections.

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Syphoning off refrigerant

1. Connect the service unit to the system.

Note

Check on the fluid reservoir whether the sight glass is still transparent. If the sight glass is discolored brown on the inside, the refrigerant should be pre-filtered by a cleaning drier installed inbetween in the extraction hose. In this case, syphon off via the high-pressure side only.

2. Open the low-pressure shut-off valve (4), high pressure shut-off valve (5) and refrigerant inlet shut-off valve (8).

3. Turn the main switch (16) fully to the right. The green pilot lamp lights up.

Note

The syphoning-off operation takes place automatically. The unit is switched off when all refrigerant has been syphoned out of the circuit. The red pilot lamp then lights up.

4. Close shut-off valves 4, 5 and 8.

5. Open the refrigerating oil drain cock (15) and drain off syphoned-off refrigerating oil.

6. Determine the volume of the refrigerating oil.

Note

Do not use syphoned-off refrigerating oil again.

7. Fill in new refrigerating oil (syphoned-off volume + 10 cm^3)

Filling with refrigerating oil

1. Unscrew the red hose on the service unit at connection piece 9 and hold in the container with new refrigerating oil.

2. Switch on the vacuum pump.

3. Open the shut-off valves for low pressure (4) and vacuum pump (7).

Note

Refrigerating oil is now sucked into the system via the high-pressure side.

4. After filling the system with the refrigerating oil, close the shut-off valves and switch off the vacuum pump.

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Evacuating the air-conditioning system

1. Syphon off any existing pressure.

2. Switch on the vacuum pump (turn the main switch to the left).

3. Open the shut-off valves for low pressure (4), high pressure (5), torrmeter (6) and vacuum pump (7).

4. Leave the vacuum pump switched on for at least 15 min.

5. Close shut-off valves 6 and 7 at a pressure of approx. 0.1 bar (absolute)

6. Switch off the vacuum pump.

Note

If the vacuum cannot be reached or can be reached only after a very long time or if the pressure increases to over 0.2 bar (absolute) approx. 10 minutes after switching off the pump, the circuit possesses a leak and must be sealed.

Flushing the air-conditioning system

Note

Flushing the air-conditioning system serves the purpose of drying the circuit.

1. Evacuate.

2. Open the shut-off valves for high pressure (5) and the refrigerant outlet (11).

3. Allow refrigerant to flow in until a pressure of approx. 2 bar (absolute) is indicated.

4. Close shut-off valves 5 and 11.

5. Shut-off refrigerant again.

6. Evacuate.

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Filling the air-conditioning system

Note

The air-conditioning system must be evacuated and filled. There must be sufficient refrigerant in the filling cylinder. Top up if necessary.

1. All valves on the service unit must be closed.

2. A pressure of approx. 7 bar is required to fill the system. If the pressure is lower, the pressure can be increased by cleaning the refrigerant (refer to Page 87 - 16g). If the pressure is higher than 10 bar (end of the weight scale), the pressure in the filling cylinder can be lowered by opening the shut-off valve 22.

Note

The pressure increases by approx. 1.5 bar in 10 minutes.

3. In accordance with the value read off on pressure gauge 21, adjust the rotary scale of the filling cylinder so that the value specified on the top edge of the scale stops over the sight glass.

Note

It must be noted that the rotary scale is designed for use of different refrigerants. The refrigerant designations are specified at the bottom scale edge.
Only the scales for R12 are applicable for vehicle air-conditioning systems.

4. Set the required refrigerant quantity on the filling cylinder with the rubber ring (difference with respect to the refrigerant level in the filling cylinder).

5. Open the shut-off valves for high pressure (5) and the refrigerant outlet (11).

6. Observe the fluid level in the sight glass of the filling cylinder. Close shut-off valves 11 and 5 when the fluid level has reached the setting ring.

7. Check the refrigerating output (refer to Page 87-116).

8. Disconnect filling hoses at compressor.

9. Screw protective caps onto the valves.

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Topping up the air-conditioning system

Note

There is not sufficient refrigerant in the system if gas bubbles are visible in the sight glass of the fluid reservoir when the air-conditioning system is switched on.

1. Syphon off the fluid from the air-conditioning system.
2. Determine the volume of the refrigerating oil which is syphoned off as well.
3. Fill system with new refrigerating oil.
4. Evacuate.
5. Check system for leaks.
6. Fill with prescribed filling quantity.

Filling the service unit with refrigerant

1. Connect the refrigerant bottle with the refrigerant inlet connection piece (12).
2. Open the valve on the refrigerant bottle and shut-off valve 10.
3. Switch on the service unit with the main switch (16). The green pilot lamp lights up.
4. If there is sufficient refrigerant in the service unit, close the bottle valve. The system switches off automatically when the refrigerant has been syphoned off up to the bottle valve.
5. Close the refrigerant inlet shut-off valve (10).

Empty the service unit

Note

If the filling cylinder is full of refrigerant and it is necessary to syphon off more refrigerant, the clean refrigerant can be filled into a refrigerant bottle. Pay attention to the maximum filling weight. **The refrigerant bottle must not be overfilled.**

1. Connect the refrigerant bottle with the refrigerant outlet connection piece (13).
2. Increase the pressure in the filling cylinder to approx. 8 bar by cleaning the refrigerant.
3. Open the bottle valve and refrigerant outlet shut-off valve (11).
4. After completing emptying, close the bottle valve and shut-off valve.

Note

Do not empty the filling cylinder completely, otherwise moisture may enter the service unit.

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Cleaning the refrigerant

Note

If the syphoned-off refrigerant is heavily contaminated, it must be pumped through the filter systems several times.

The cleaning condition can be seen at the moisture indicator (14).

1. Open the filling cylinder shut-off valve (22).
2. Switch on the service unit. The green pilot lamp lights up.
3. After cleaning the refrigerant (condition shown by the moisture indicator), close the shut-off valve).

Note

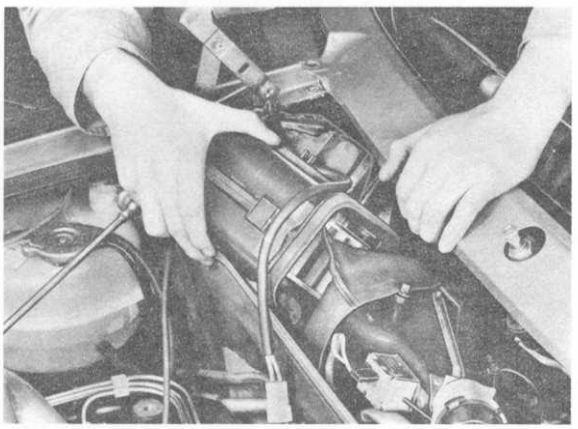
The unit switches off automatically when all refrigerant has been pumped into the filling cylinder (red pilot lamp lights up). The pressure in the filling cylinder increases.

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7. Close main shut-off flap. Lift apron outer section. Lift out blower.

Note

Be careful not to damage apron outer section.



Installing

Seal rubber connector between blower and heater/air conditioner with a suitable adhesive, e.g. Loctite Super Bonder 414.

REMOVING AND INSTALLING AIR DISTRIBUTION HOUSING

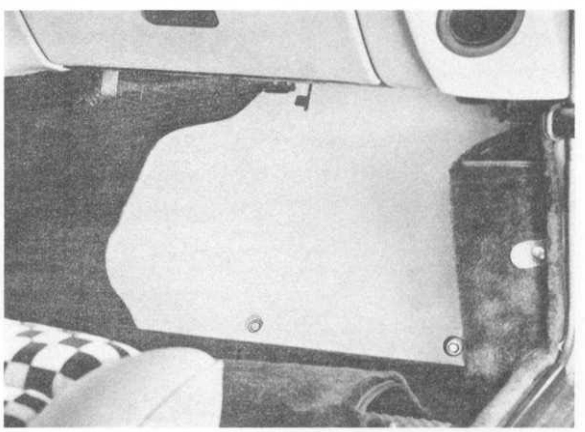
Removing

1. Disconnect battery ground.

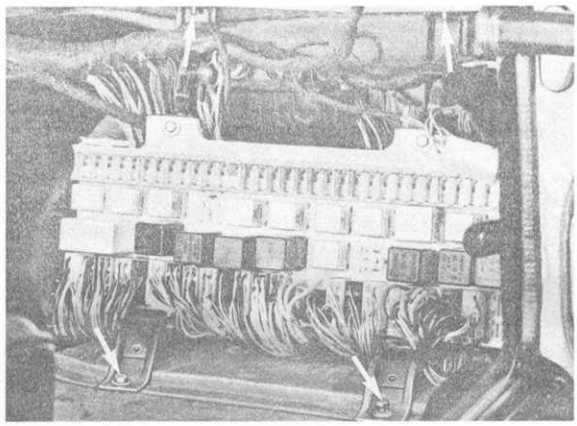
2. Remove blower.

3. Disconnect vacuum hose from vacuum unit of control flap (only air conditioner) at connector of hoses.

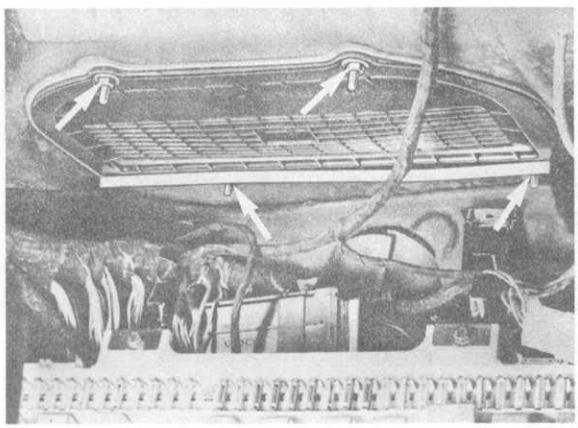
4. Remove cover from central fuse/relay plate in footwell of passenger's side and tray.



5. Remove mounting nuts and screws from central fuse/relay plate. Lower central fuse/relay plate.

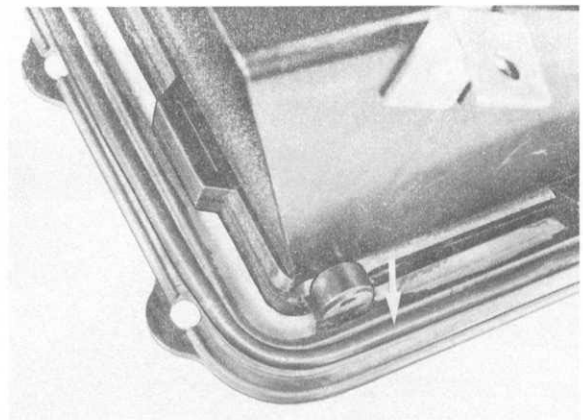


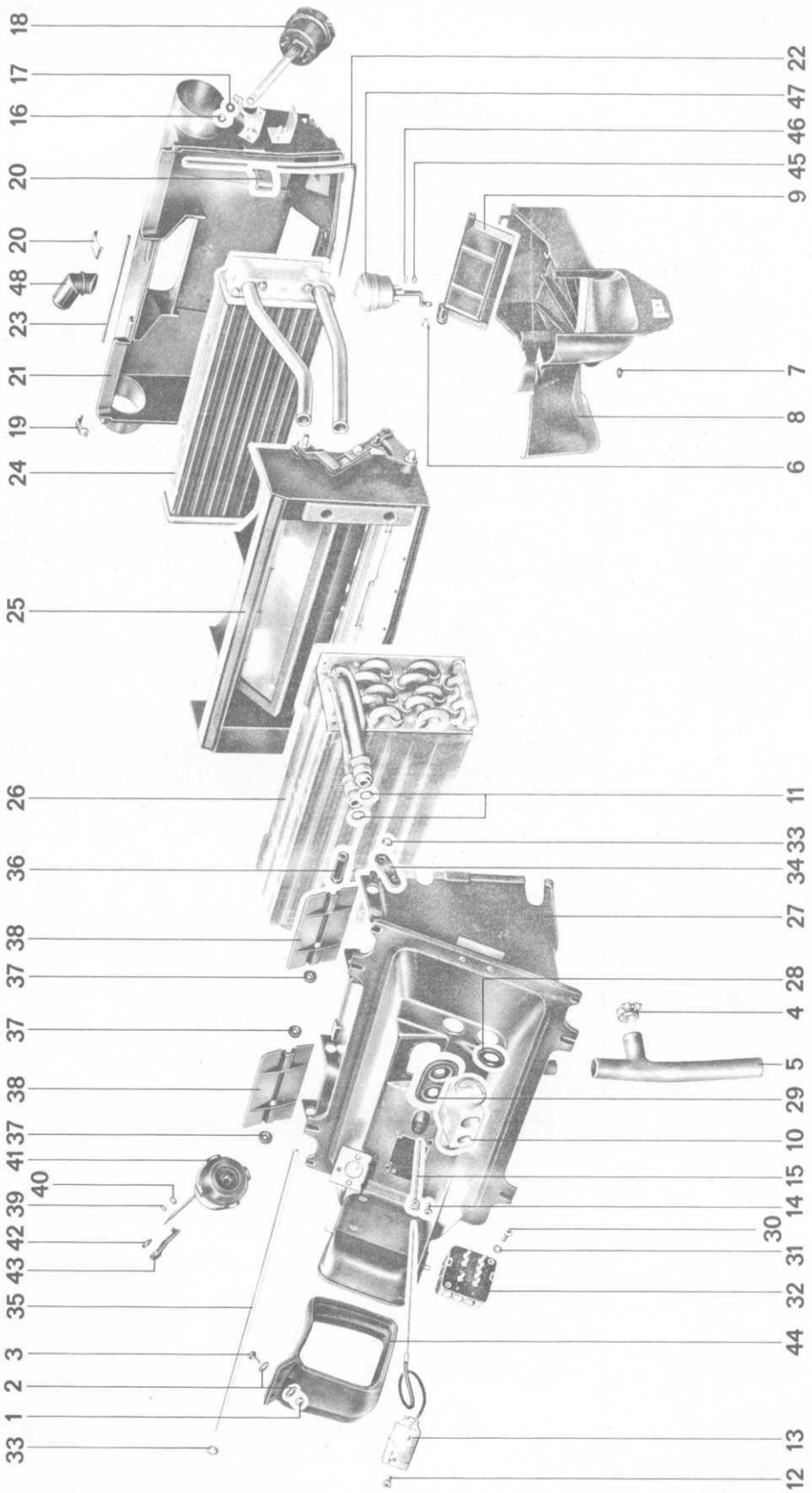
6. Lift out air distributor housing after removal of mounting nuts.



Installing

To seal the air distributor housing, use a non-hardening caulking compound in addition to the gasket.




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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Self-locking nut	2		Replace, if necessary	
2	Washer	4			
3	Screw 5 x 20	2			
4	Hose clamp	1		Replace, if necessary	
5	Water drain hose	1		Check for damage and position correctly	
6	Pin	1			
7	Push nut	1		Replace	
8	Footwell housing	1			
9	Footwell flap	1			
10	Expansion valve	1		Replace all 4 O-rings	
11	O-ring	2		Replace	
12	Screw	2			
13	Temperature switch	1			
14	Screw	1			
15	Capillary guide tube	1			
16	Push nut	3		Replace (same as no. 39)	
17	Rubber washer	3			
18	Vacuum unit for de-froster vents	1		Check operation	
19	Clamp	2		Replace, if necessary	

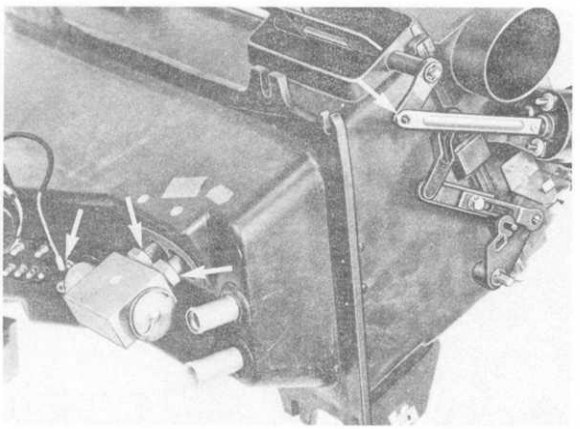
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
20	Clip	8		Replace, if necessary	
21	Housing, rear	1			
22	Cord seal	1		Replace	
23	Cord seal	1		Replace	
24	Heater core	1			
25	Flap housing	1			
26	Evaporator core	1			
27	Housing, front	1			
28	Grommet (heater core)	2		Position correctly	
29	Grommet (evaporator core)	1		Position correctly	
30	Screw	2			
31	Washer	2			
32	Resistor block/safety switch	1			
33	Push nut	2		Replace (same as no. 42)	
34	Defroster flap lever	1		Same as no. 43	
35	Flap shaft	1			
36	Sleeve	1			
37	Bushing	3			
38	Defroster flap	2		Position correctly	
39	Push nut	2		Replace (same as no. 16)	

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
40	Rubber washer	3			
41	Vacuum unit for shut-off flap	1		Check operation	
42	Push nut	1		Replace (same as no. 33)	
43	Shut-off flap lever	1		Same as no. 34	
44	Rubber connector	1			
45	Push nut	3		Replace	
46	Rubber washer	3			
47	Vacuum unit for footwell flap	1			
48	Outlet neck	1			

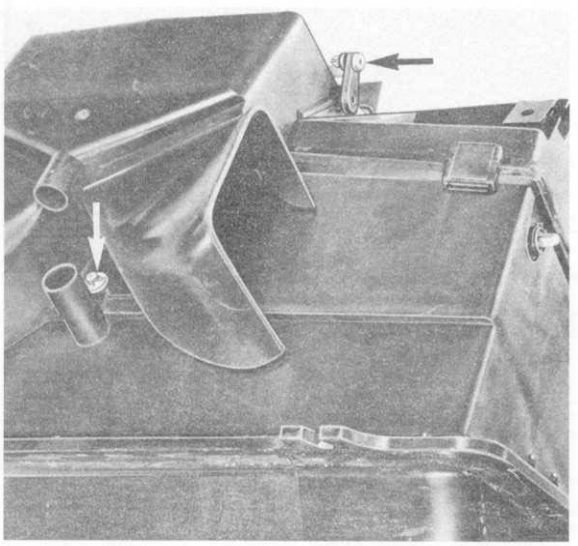
DISASSEMBLING AND ASSEMBLING HEATER/EVAPORATOR

Disassembling

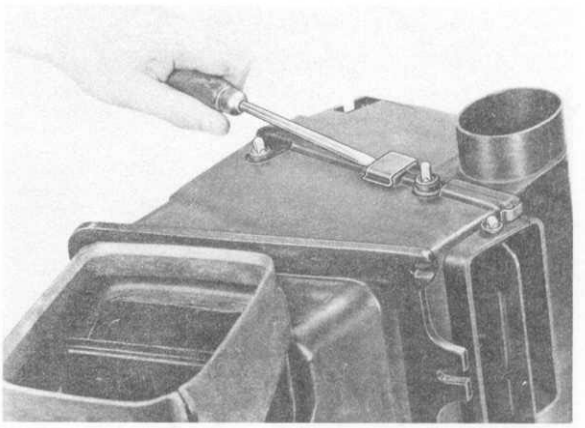
1. Take off expansion valve. Remove temperature switch and pull out capillary tube from guide tube carefully. Remove capillary tube. Disconnect vacuum unit from defroster flaps.



2. Remove pins on vacuum unit of footwell flap. Pry off push nut uniformly and remove footwell housing with footwell flap.



3. Pry off retaining clips and remove sealant from joint. Take apart heater/evaporator and remove interior parts.



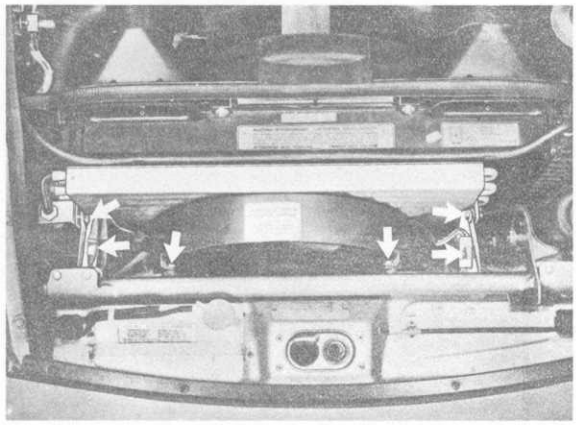
Assembling

Seal joint between front housing and rear housing sections.

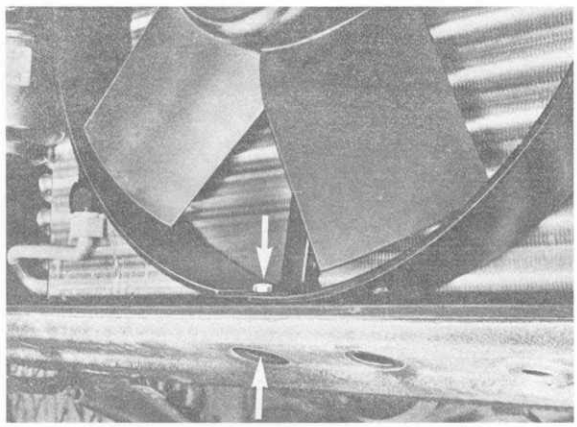
REMOVING AND INSTALLING CONDENSER FAN

1. Remove air inlet grill.

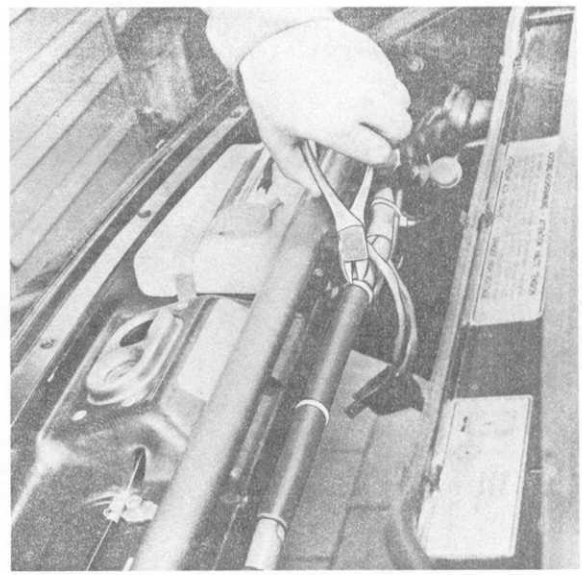
2. Pull off hose clamps on radiator. Disconnect wire plugs. Unscrew left and right brackets on condenser. Unscrew upper fan mountings.



3. Unscrew lower mounting.



4. Loosen wire harness on lock cross member and remove cover.



5. Pull out fan from top. Be careful not to damage fins of condenser.

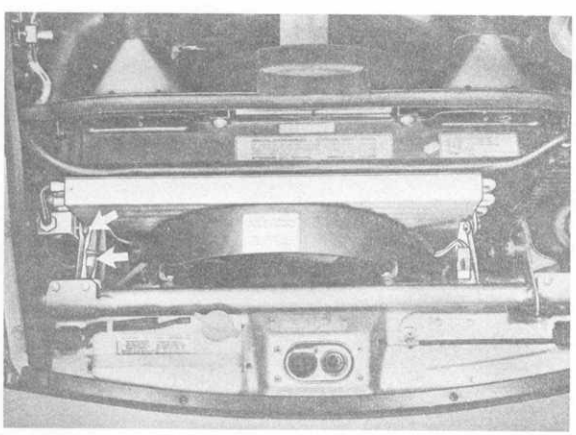
REMOVING AND INSTALLING RECEIVER-DRIER

1. Discharge air conditioner.

2. Remove air inlet grill.

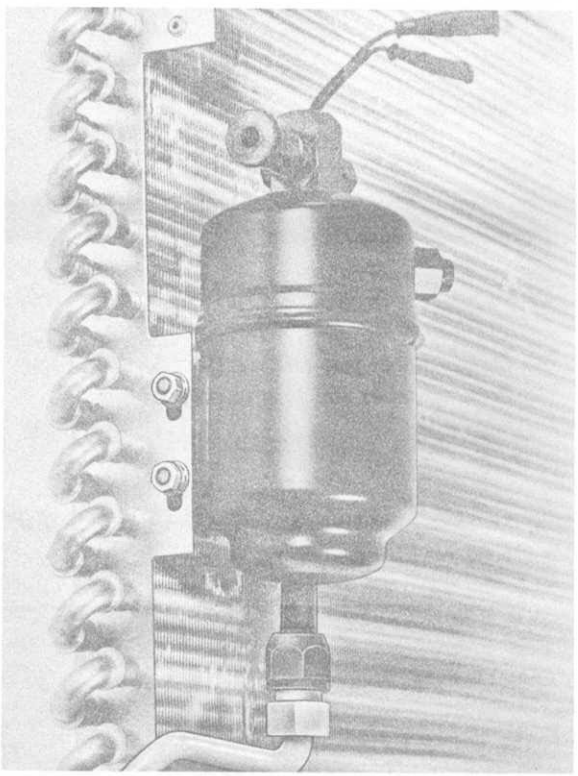
3. Remove upper and lower condenser fan mountings and push fan to one side.

4. Pull off wire plugs for temperature and low pressure switches. Unscrew right bracket for condenser.



5. Remove hose at top of receiver-drier.

6. Remove receiver-drier.



Install new receiver-drier and charge air conditioner.

REMOVING AND INSTALLING CONDENSER

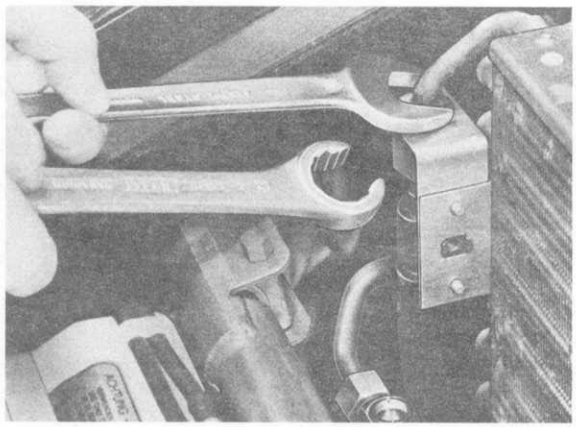
1. Discharge air conditioner.

2. Remove air inlet grill.

3. Remove condenser fan.

4. Loosen upper left and right brackets on lock cross member and turn to on e side.

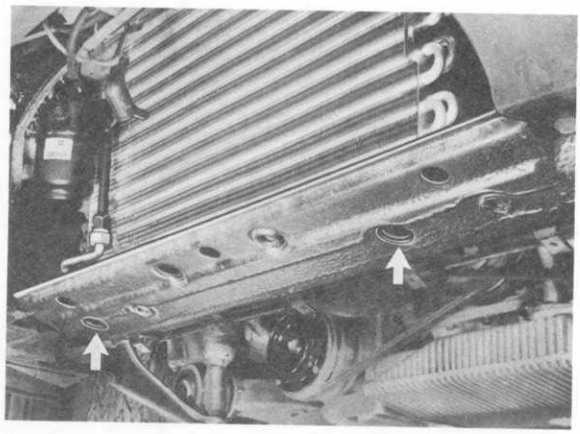
5. Remove hose lines at top of condenser and on receiver-drier.



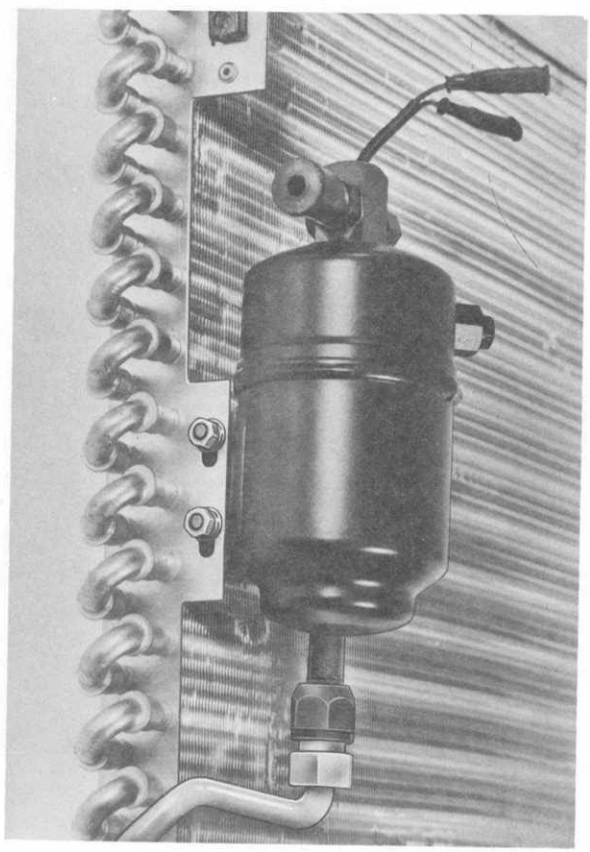
6. Remove low pressure switch on receiver-drier.



7. Remove lower mounting screws on condenser. Pull out condenser with receiver-drier from above.



8. Take off receiver-drier.



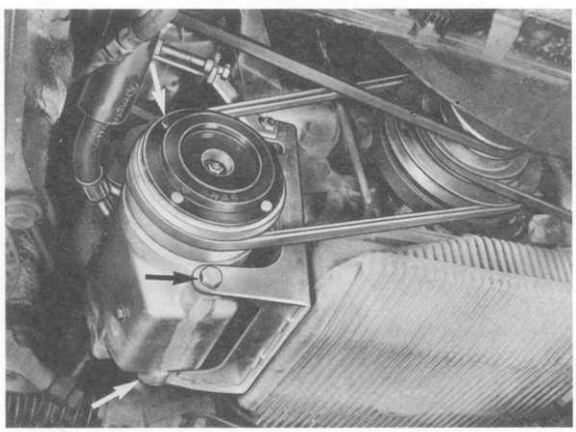
REMOVING AND INSTALLING COMPRESSOR

Removing

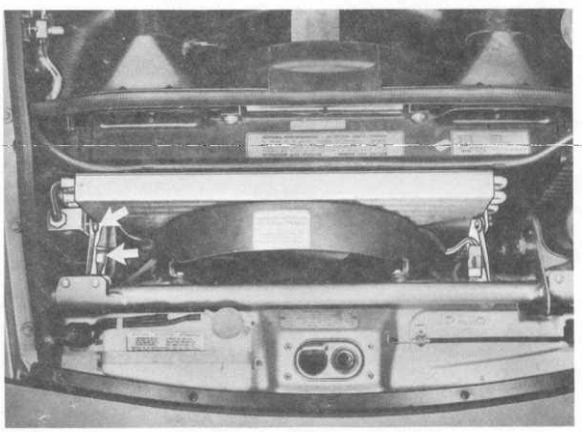
1. Discharge air conditioner.

2. Remove spash shield underneath radiator.

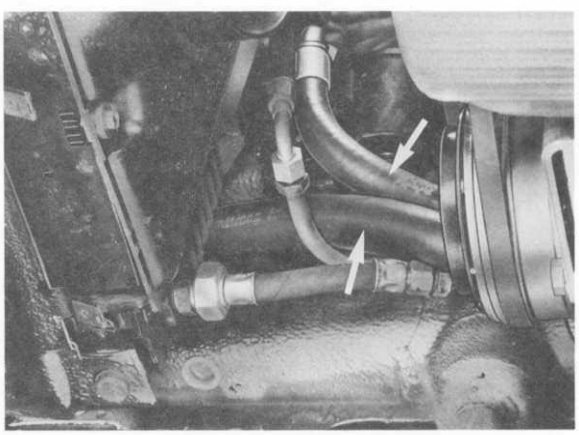
3. Loosen compressor and take off belt.

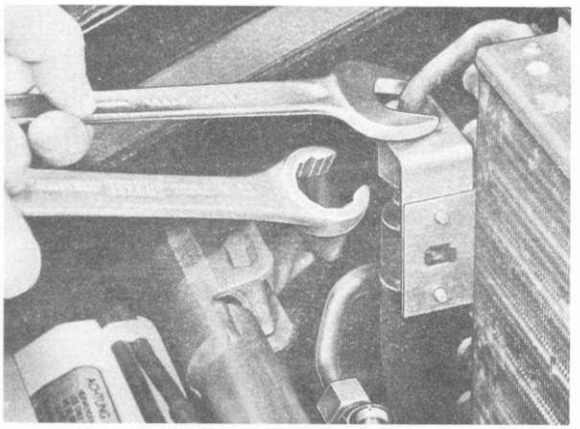


4. Remove holder from condenser at top right.



5. Disconnect hoses.





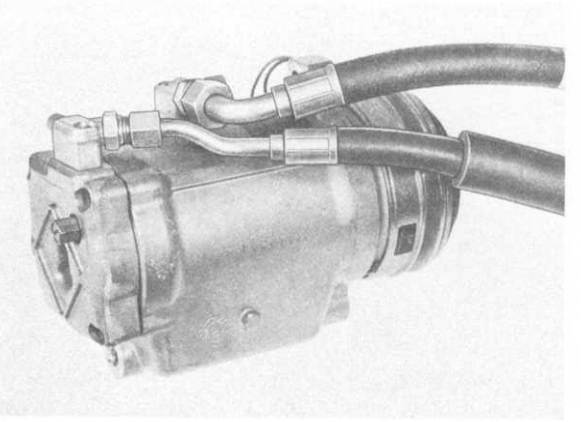
6. Pull off wire plugs of magnetic clutch. Remove compressor mounting bolts and remove compressor with hoses.

7. Remove hoses and insert plugs in connections and lines.

Installing

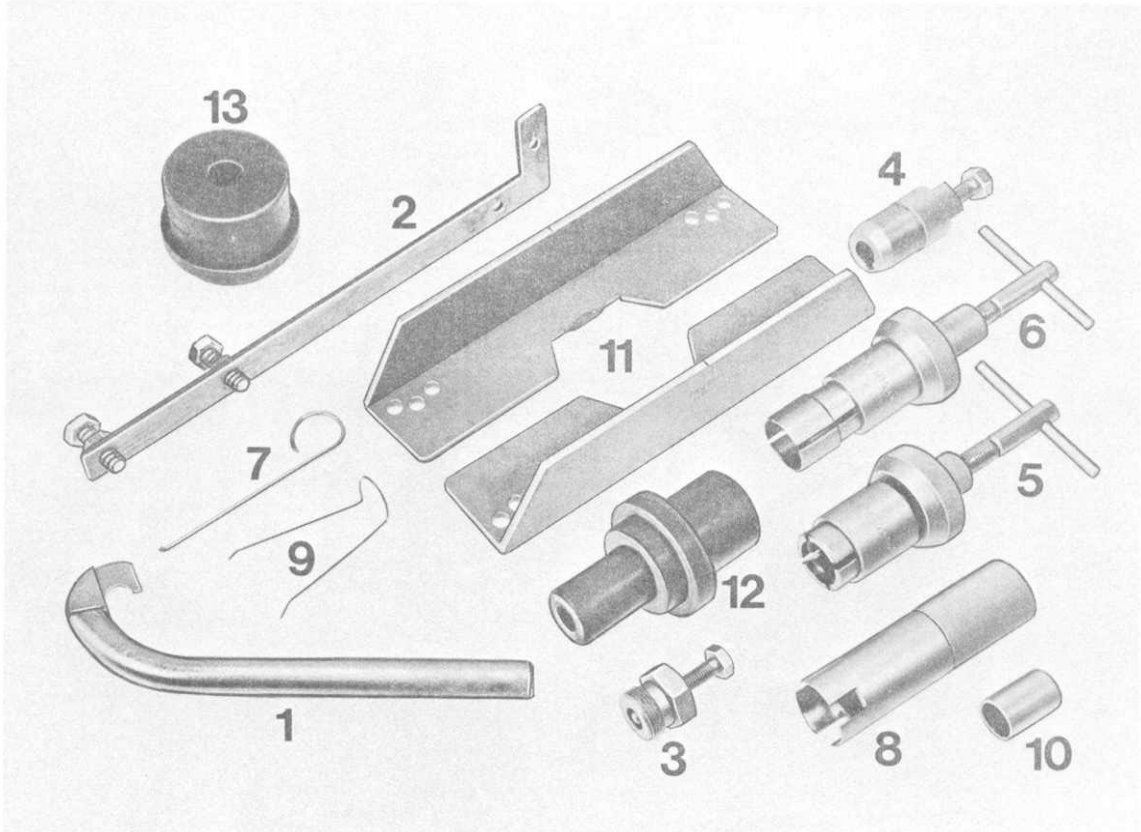
New compressors are under pressure. Consequently unscrew plugs slowly until refrigerant is heard to have escaped. Remove plugs only after releasing pressure.

Install and tighten hoses prior to installation.

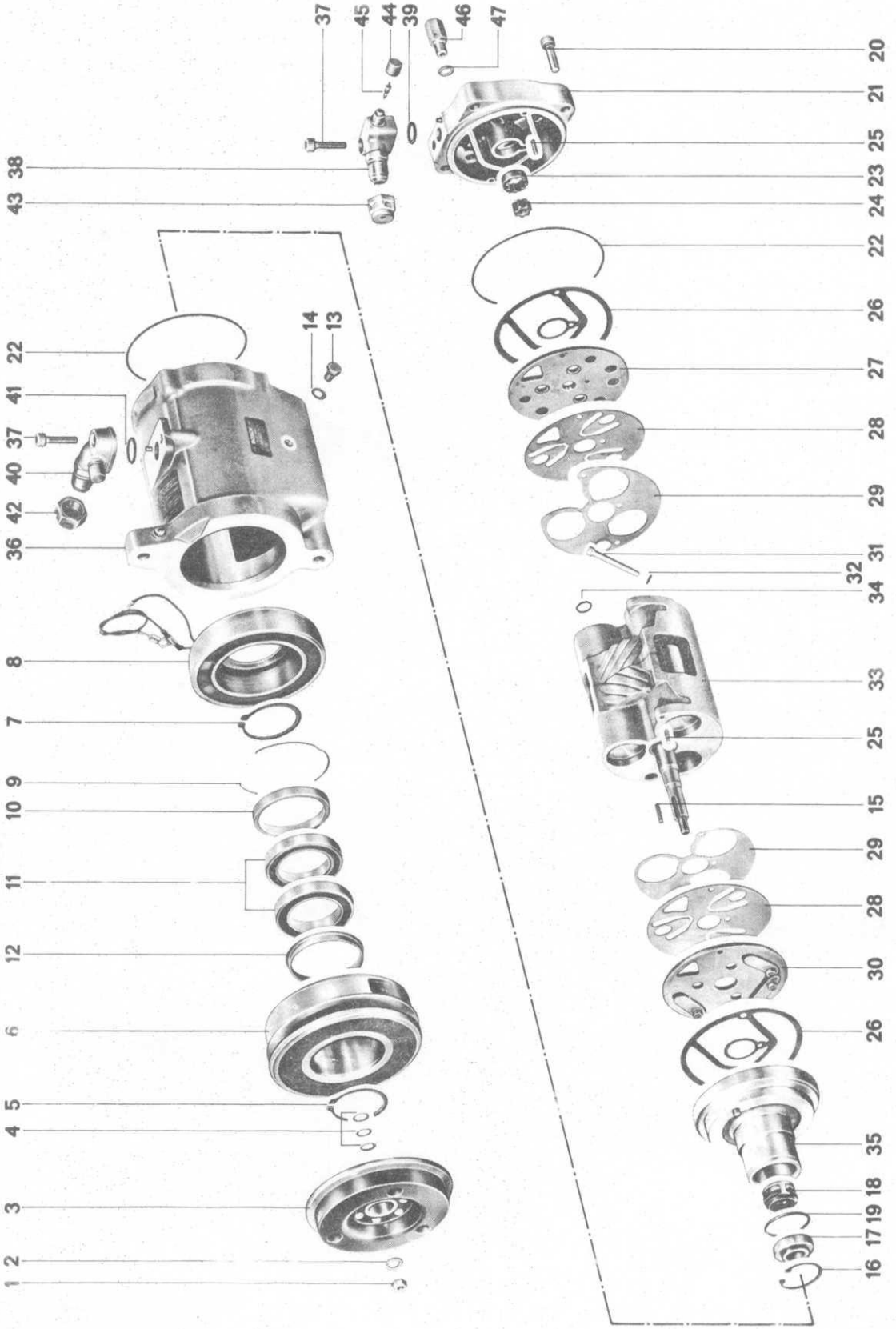


Charge air conditioner.

TOOLS



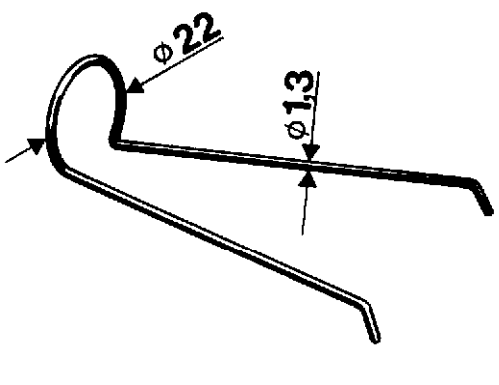
No.	Description	Special Tool	Remarks
1	Holding wrench	95458-02070	
2	Holding wrench		Local manufacture from 924 Sankyo compressor
3	Puller	95456-03064	
4	Woodruff key puller	95456-21060	
5	Thrust washer puller	95456-03060	
6	Seal puller	95456-02060	
7	Oil pipe pulling hook		Local manufacture
8	Seal installer	95456-08010	
9	Thrust washer installer		Local manufacture
10	Thrust washer pad	95456-09010	
11	Holding rails	VW 457/1	For removing and installing bearing
12	Thrust pad	VW 195	To remove bearing
13	Thrust pad	VW 472/1	To remove bearing

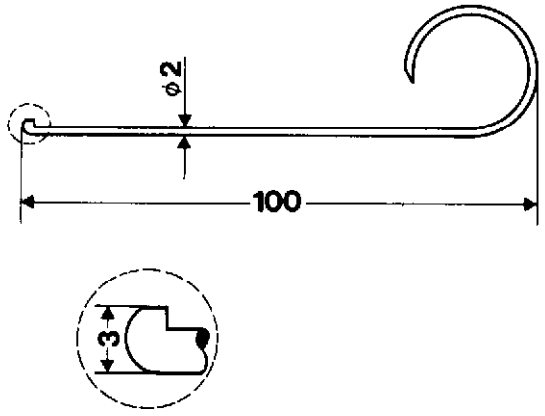

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Nut	1		Tighten to 17 Nm (12 ft lb)	
2	Lockwasher	1			
3	Clutch plate	1		Check for damage	
4	Set of shims	1		Adjust play between pulley and coupling to 0.4 - 1.0 mm (0.016 - 0.040 in.)	
5	Circlip	1		Bevel faces shaft end	
6	Pulley	1		Replace pulley assembly with ball bearing, if friction surface is worn or oil splattered	
7	Circlip	1		Bevel faces shaft end	
8	Coil unit	1		3.7 ohm resistance	
9	Circlip	1			
10	Spacer	1			
11	Ball bearing	2			
12	Dust ring	1			
13	Oil filler plug	1		Tighten to 15 Nm (11 ft lb)	
14	Seal	1			
15	Woodruff key	1			
16	Circlip	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
17	Thrust washer	1		Don't damage sealing surfaces. Check for scratches, replacing both parts if necessary. Lubricate with refrigerant oil	
18	Seal	1			
19	O-ring	1			
20	Screw	4		Tighten to 26 Nm (19 ft lb)	
21	Housing cover, rear	1			
22	O-ring	2			
23	Oil pump outer race	1			
24	Oil pump inner race	1			
25	Dowel pin	4			
26	Valve plate gasket	2			
27	Valve plate, rear	1			
28	Suction valve	2			
29	Cylinder gasket	2			
30	Valve plate, front	1			
31	Oil suction tube	1			
32	O-ring	1			
33	Cylinder block	1			Must not be disassembled
34	O-ring	1			
35	Housing cover, front	1			
36	Housing	1			
37	Screw	2		Tighten to 19 Nm (14 ft lb)	
38	Discharge service valve	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
39	O-ring	1			
40	Suction service valve	1			
41	O-ring	1			
42	Cap, suction valve	1			
43	Cap, discharge valve	1			
44	Cap	2			
45	Valve core	2			
46	Safety valve	1			
47	Seal	1			

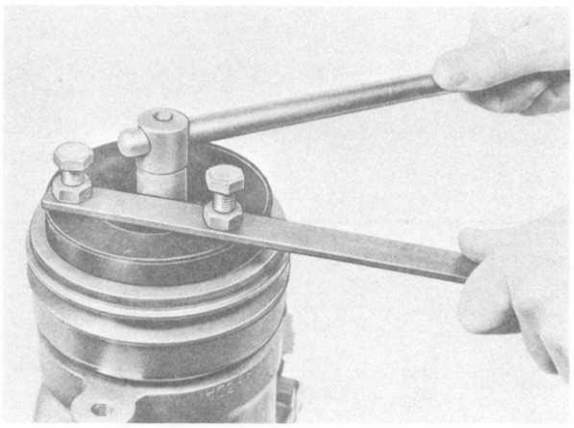




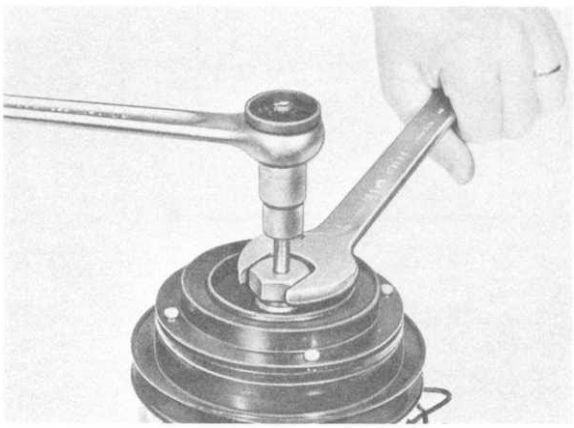
DISASSEMBLING AND ASSEMBLING COMPRESSOR

Removing and Installing Magnetic Clutch

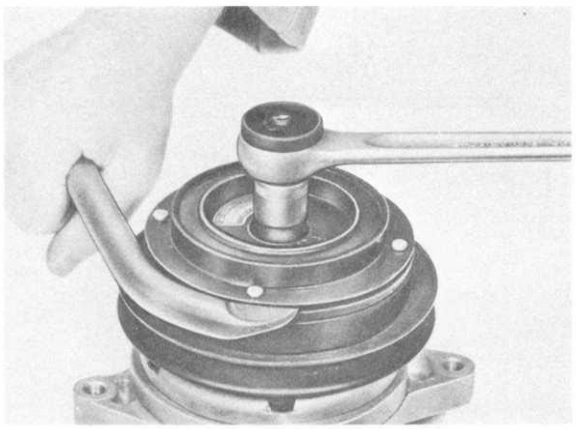
1. Counterhold with correct wrench depending on version to loosen or tighten mounting nut.

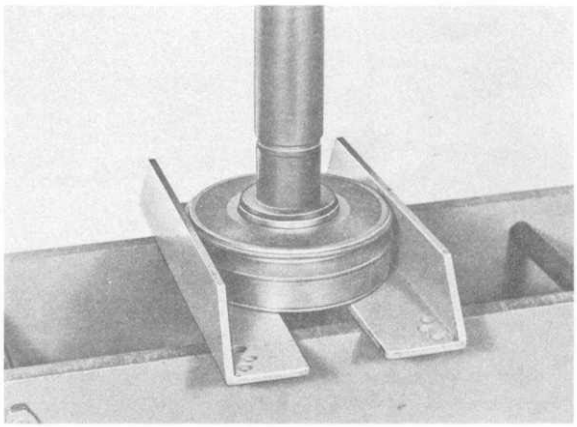


2. Remove clutch plate with puller.

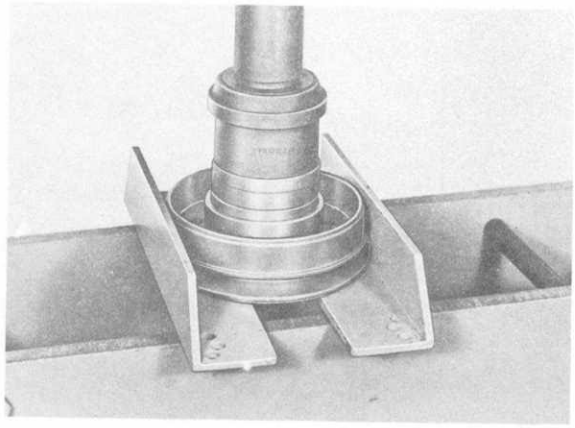


3. Remove ball bearing.

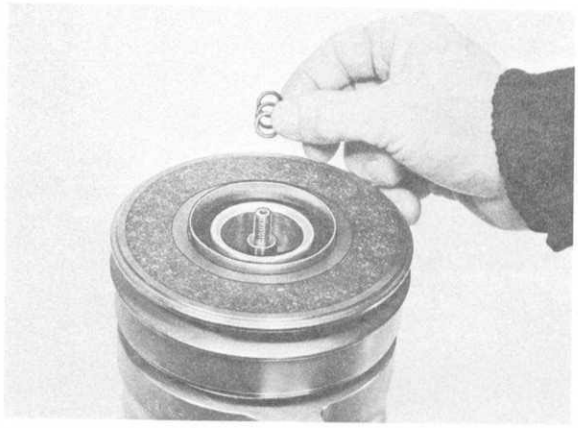




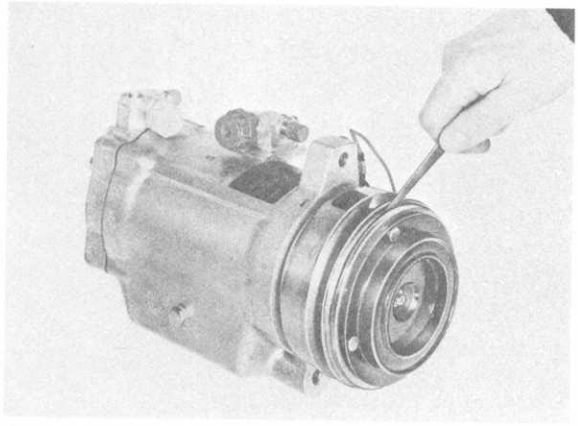
4. Install ball bearing.



If necessary, adjust play with set of shims.



5. Play between clutch plate and pulley is 0.4 to 1.0 mm (0.016 to 0.040 in.).



Disassembling Compressor

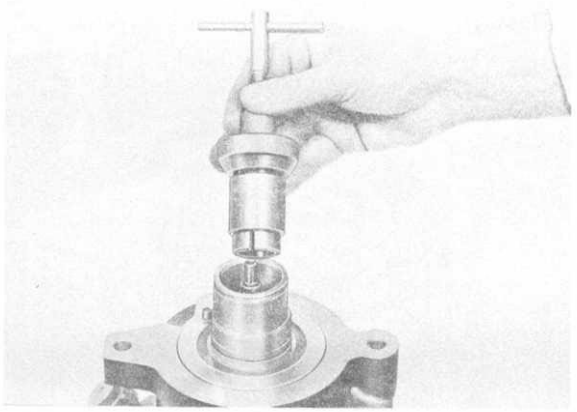
Note

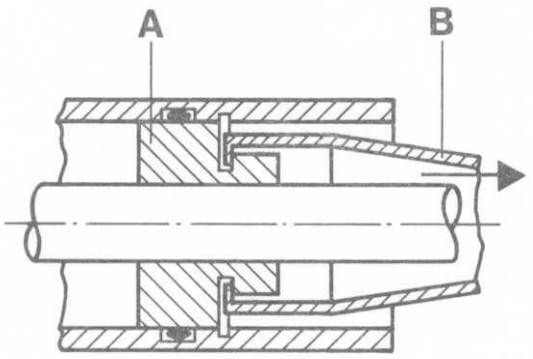
Remove any plugs from line connections to let residual gas escape.

1. Drain refrigerating oil (never reuse).

2. Remove woodruff key with woodruff key puller.

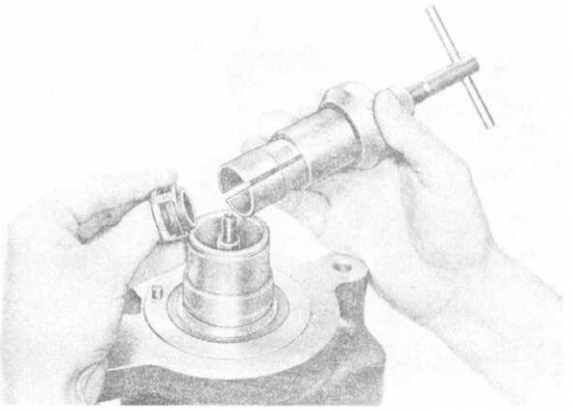
3. Pull out thrust washer with puller.



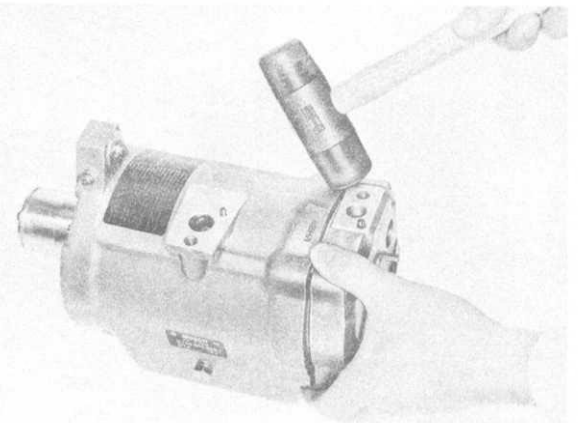


A - Thrust washer
B - Puller

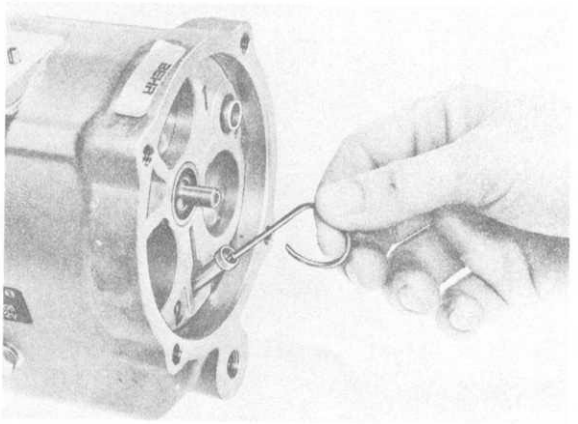
4. Remove seal with puller.



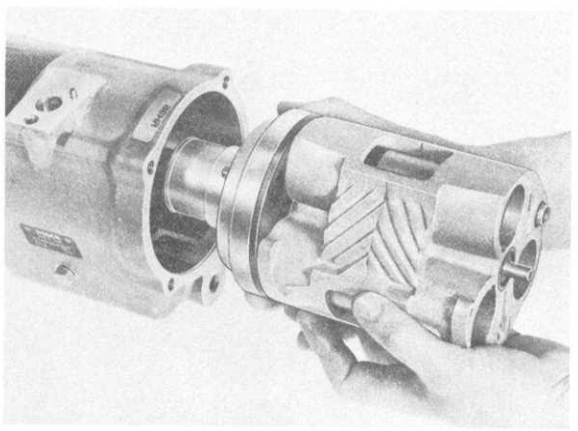
5. Remove mounting bolts from rear housing cover. Take off housing cover, applying light taps with a plastic hammer when necessary.



6. Pull out oil suction tube with pulling hook.



7. Remove cylinder block from housing.



Note

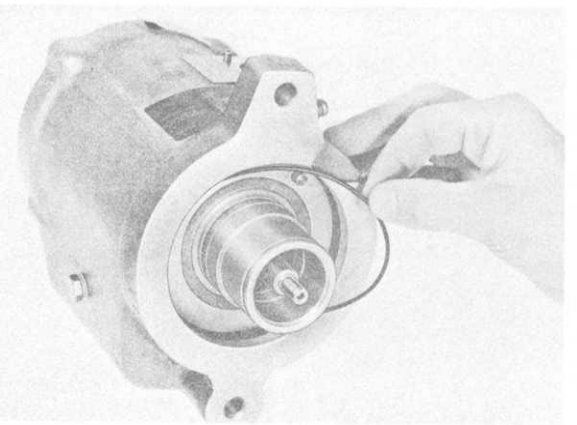
Never disassemble cylinder block!

Assembling Compressor

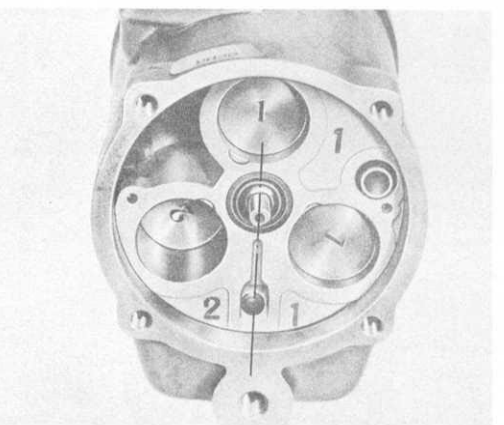
Note

Coat all gaskets and seals with clean refrigerating oil prior to installation.
(See page 87 - 01 for types of oil.)

1. Place O-ring in front of housing and push in cylinder block.

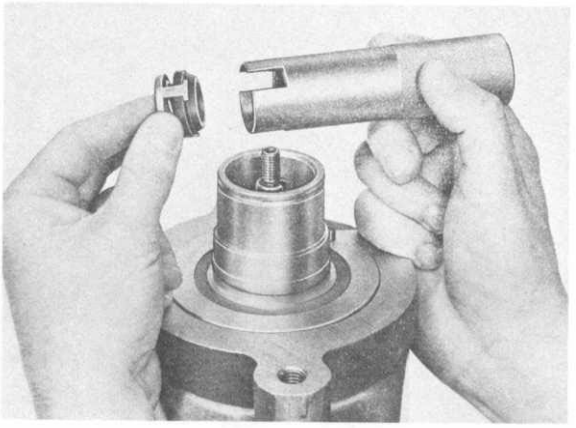


2. Align cylinder block so that bore of oil suction tube faces down.

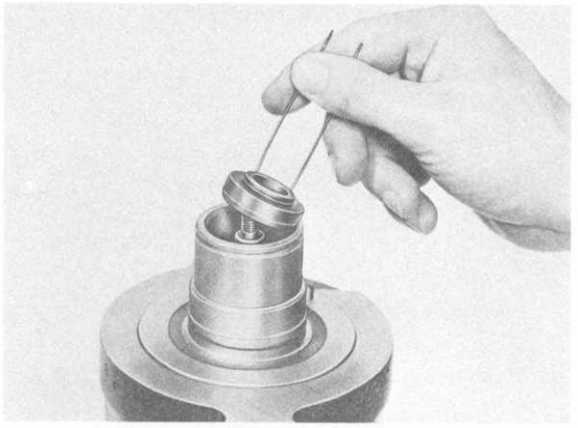


3. Place seal in assembly tool and push on to input shaft.

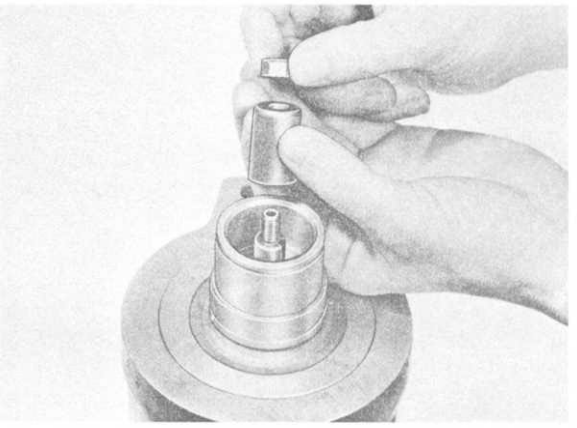
   Turn seal on shaft with tool until seal engages.



4. Guide in thrust washer with assembly tool carefully.

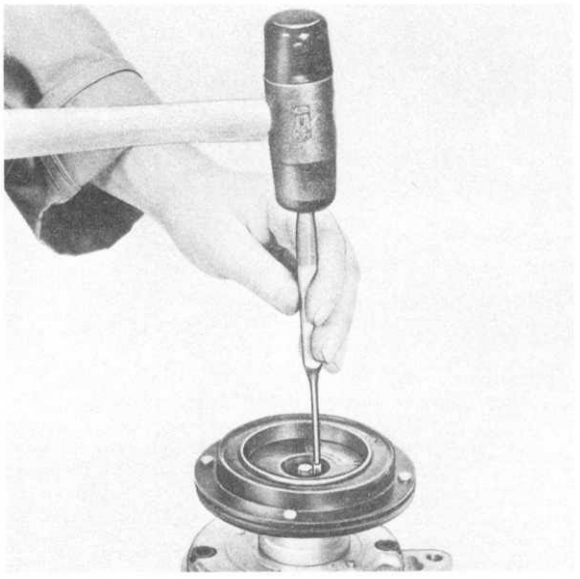


5. Press in thrust washer with thrust pad and nut until groove for circlip is visible.



   Insert circlip and take off thrust pad.

6. Install woodruff key by mounting clutch plate and driving in key.



7. Add refrigerant oil.

8. Turn assembled compressor with a torque wrench.

   Torque must not exceed 17,5 Nm (12,5 ft lb).

Note

After installation of compressor and charging the system, run compressor 15 minutes at idle speed with magnetic clutch applied.

Checking Volume of Oil in System

There is no way of checking the oil level in the air conditioner compressor. The compressor of a newly installed air conditioner has a total oil volume of about 350 cc prior to initial operation. The refrigerant oil will be distributed throughout the system when operated for a while. The different parts will then have the following oil quantities:

Condenser	approx. 30 cc/1 ounce
Evaporator	approx. 60 cc/2 ounces
Receiver-drier and lines	approx. 10 cc/0,34 ounce
Remainder in compressor	approx. 250 cc/8 ounces

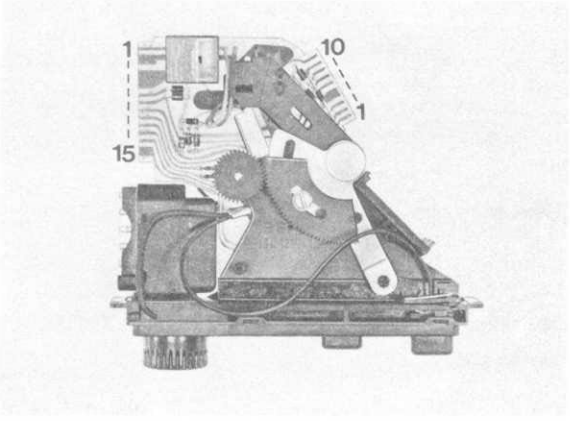
1. When replacing a condenser, evaporator, receiver-drier or lines, the amount of oil for the part concerned must be added to the system. To do this, remove compressor, unscrew oil drain plug and add refrigerant oil.

2. Prior to installation of a new compressor in an already used air conditioner, remove enough oil from the compressor so that the total oil volume will again be about 350 cc/2 ounces.

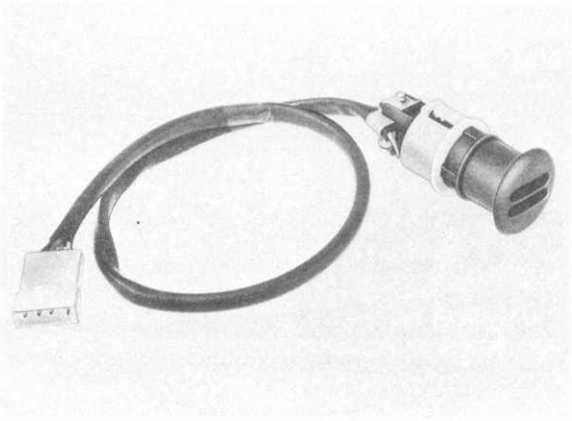
   For example, if no other part is replaced besides the compressor, drain approx. 100 cc/3,4 ounces of oil from the new compressor.

REGULATORS AND CONTROL UNIT OF AUTOMATIC AIR CONDITIONER

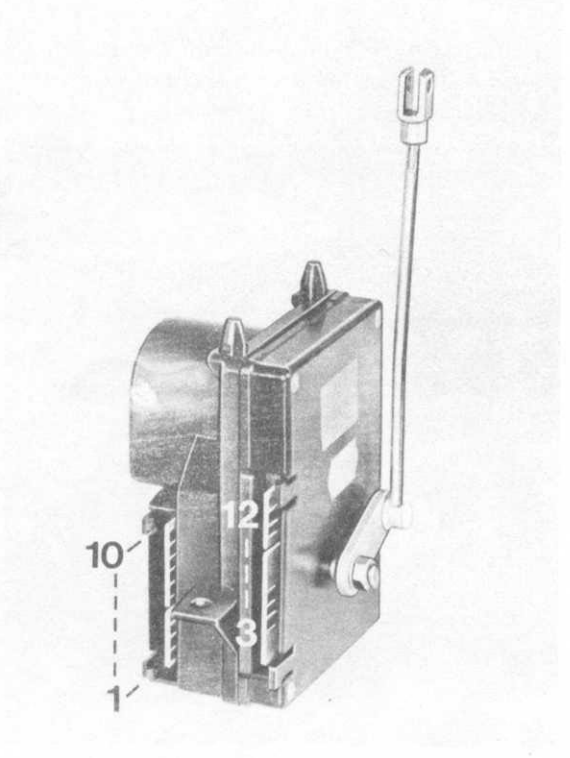
Control Switch (opened)



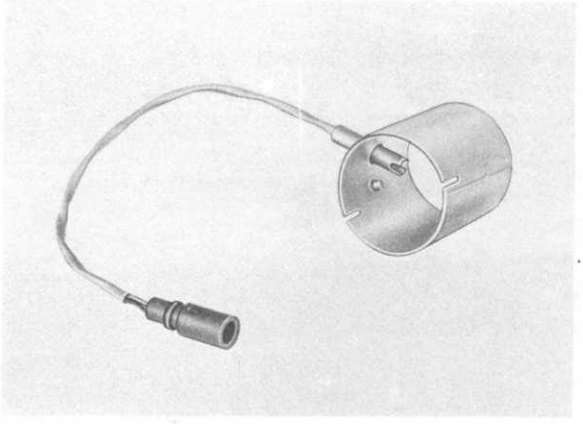
Inside Sensor



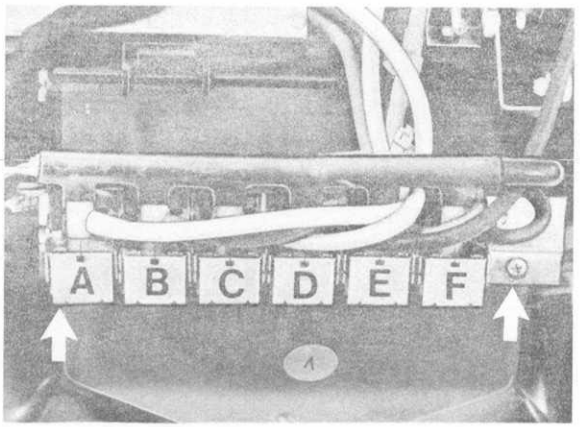
Control Unit



Outside Sensor



Solenoid Valves



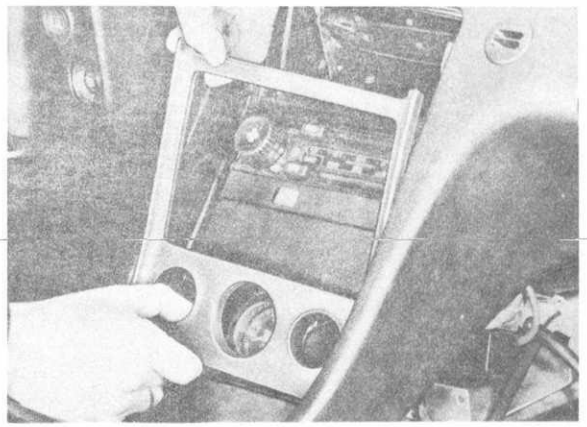
A - Footwell flap (yellow)
B - Defroster flap (green)
C - Center nozzle stage I (orange)
D - Center nozzle stage II (brown)
E - Mixing flap and heating valve (red)
F - Fresh air bypass flap (blue)

Removing and Installing Control Switch

1. Pry out center vent with a putty knife.



2. Pull off cover frame starting at top.



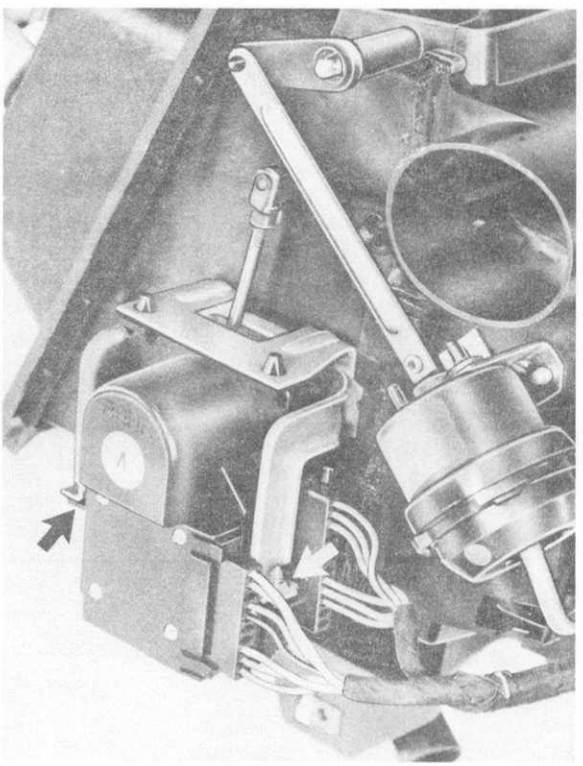
3. Loosen and remove control board (wires can remain connected).

4. Loosen and pull out control switch. Pull off plugs.

Removing and Installing Control Unit

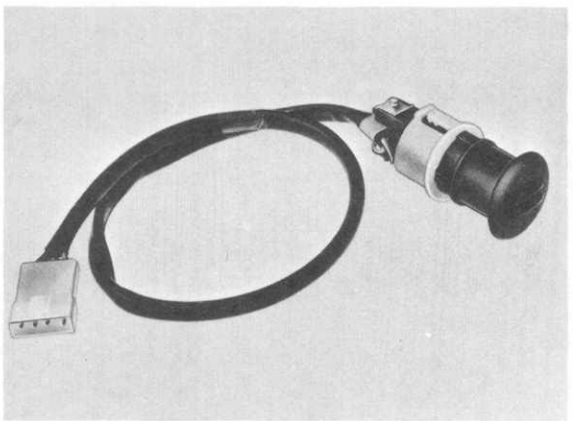
1. Pull off both plugs.

2. Unscrew front and rear mounting bolts. Pull out control unit downward and disconnect operating rod at bottom.

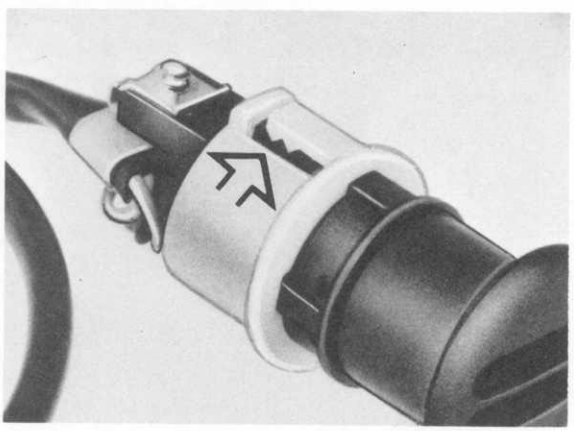


Removing and Installing Inside Sensor

1. Remove control switch.
2. Remove tray and glove box.
3. Unscrew trim panels on left and right sides of center console.
4. Unscrew center console mounting screws on instrument panel and frame tunnel. Wires remain connected.
5. Lift center console far enough and pull back toward rear so that inside sensor is accessible.
6. Press out inside sensor from inside.

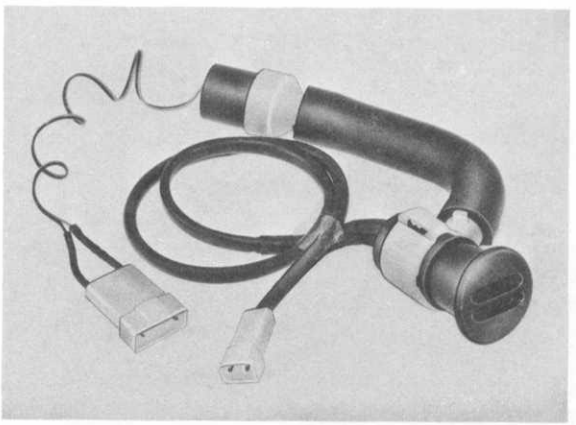


The mounting ring is pressed on and held in position by retaining tabs.



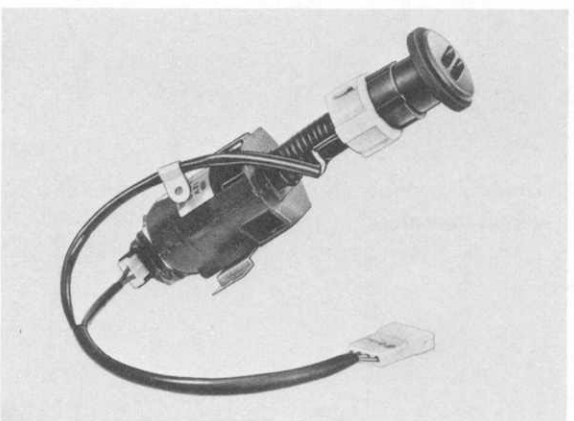
Note

Some cars since standard production of 1980 models have an inside sensor with a separate blower.



This inside sensor is not available as a spare part. When installing a new inside sensor in these cars, the wires must be transferred in the multiple pin plug. Note colors of wires.

Inside Sensor with Blower Beginning With February, 1981

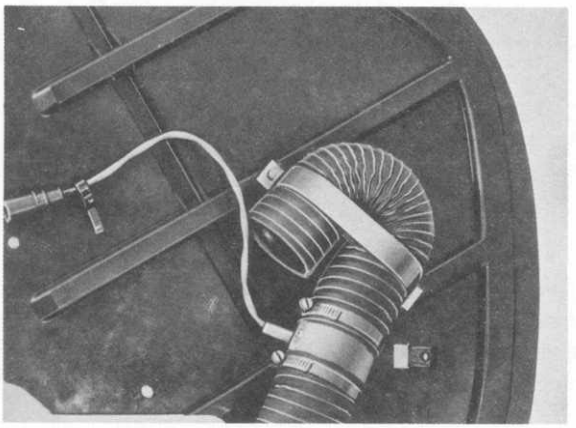


Removing and Installing Outside Sensor

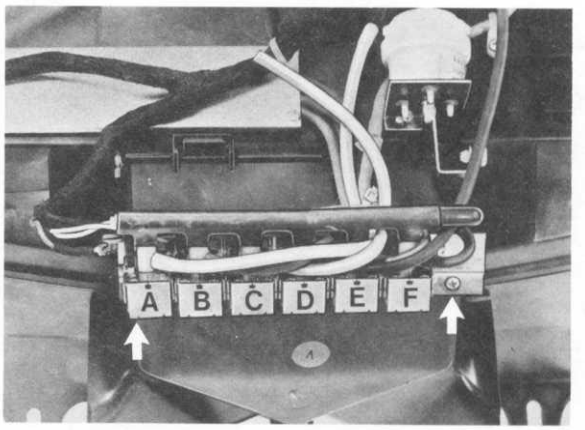
Outside sensor is located in fresh air hose of alternator.

1. Unscrew cover in front left wheel house.

2. Loosen hose straps on fresh air hoses and pull off of outside sensor housing. Disconnect plugs.



3. Unscrew valve carrier (2 screws).

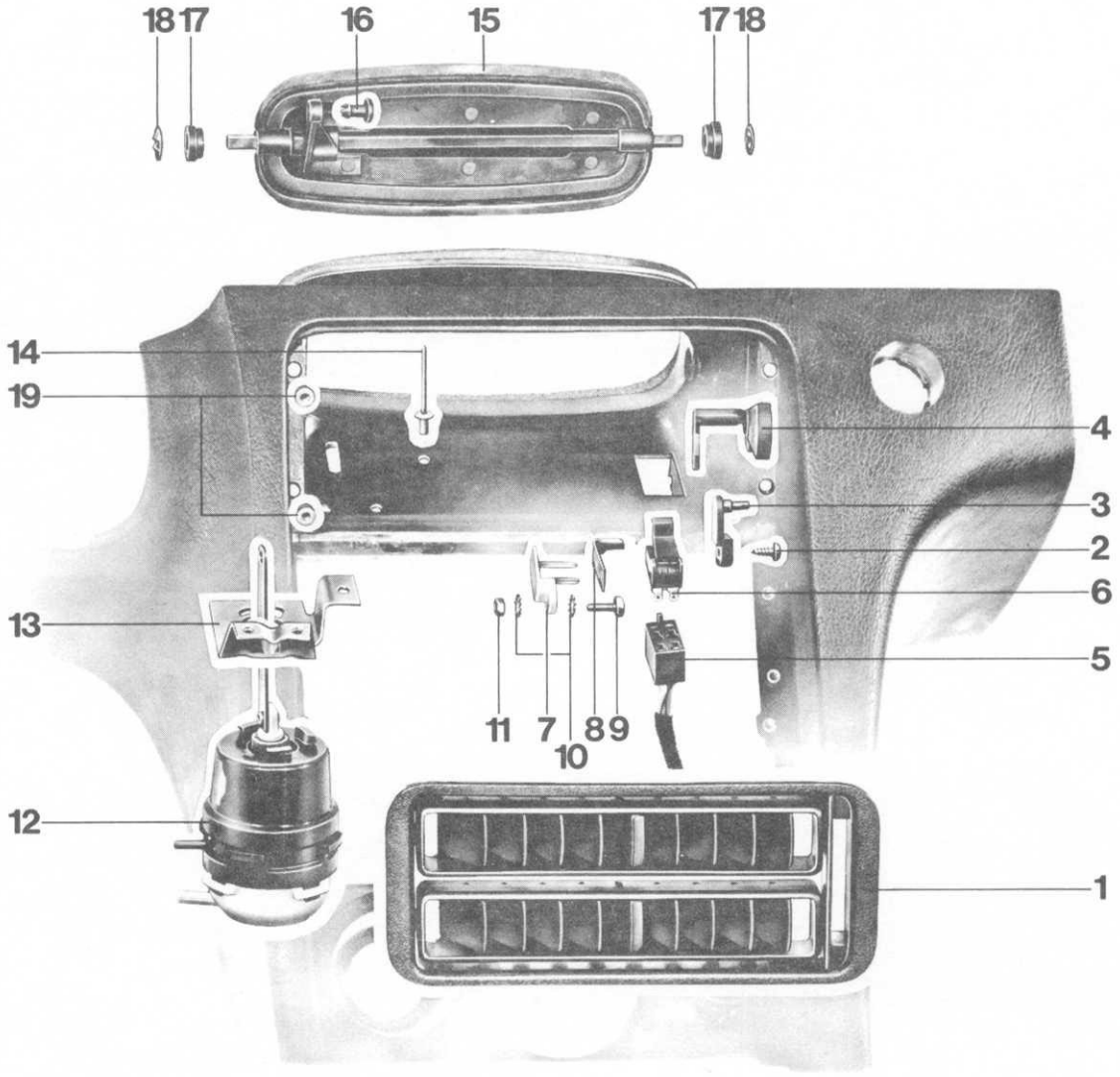


4. Unscrew mounting bolt of valve being replaced and disconnect by moving up.
Pull off vacuum line and electric wire.

Removing and Installing Vacuum Servo Solenoid Valves

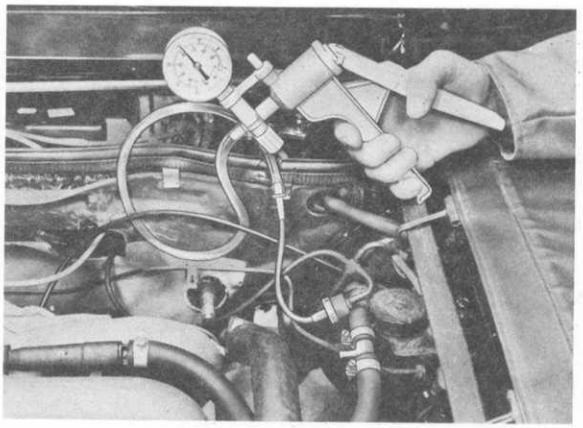
1. Remove tray.

2. Unscrew trim panels on left and right sides of center console.


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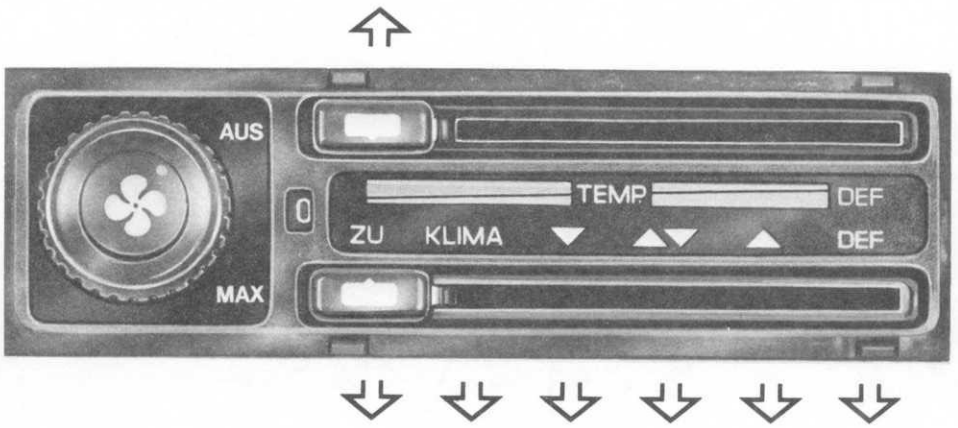
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Center vent	1			
2	Metal screw	1			
3	Mounting part	1			
4	Operating lever	1			
5	Plug	1			
6	Microswitch	1			
7	Microswitch holder	1			
8	Holder	1			
9	Bolt	1			
10	Lockwasher	2			
11	Nut	1			
12	Vacuum unit for center vent	1			
13	Holder	1			
14	Rivet	3			
15	Flap, center vent	1			
16	Pin	1			
17	Bushing	2			
18	Clip	2			
19	Grommet	4			

Check all functions of vacuum controlled flaps prior to installation of center console. For this purpose connect a vacuum hand pump in the suction line ahead of the check valve and build up a vacuum of about 400 mbar.

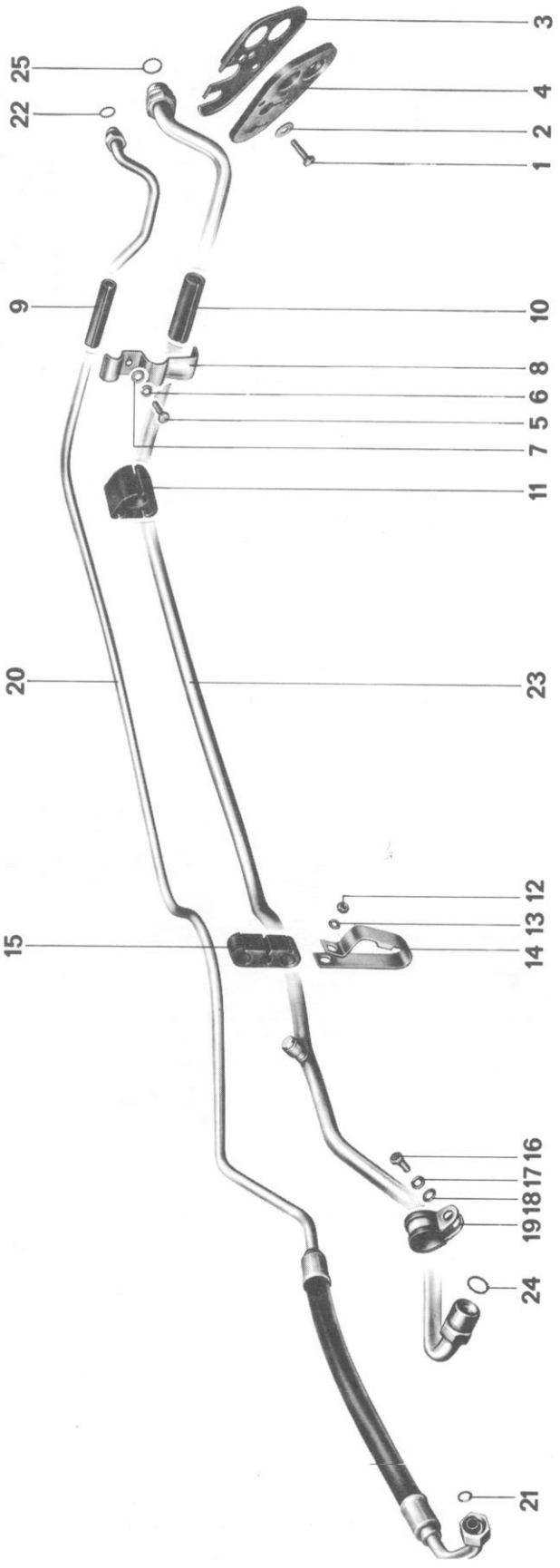


The relation of the slide position of the control switch to the positions of the flaps is shown in the table below.

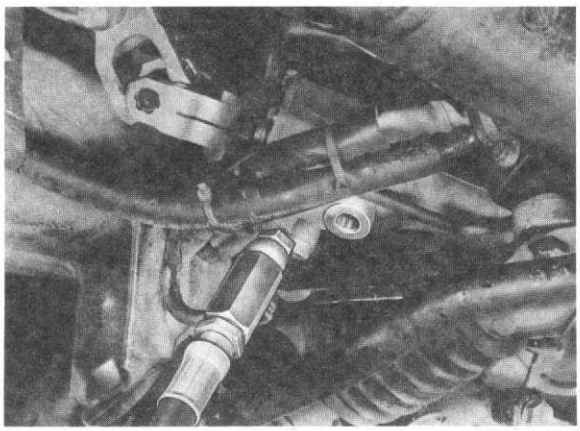
Heater remains switches off



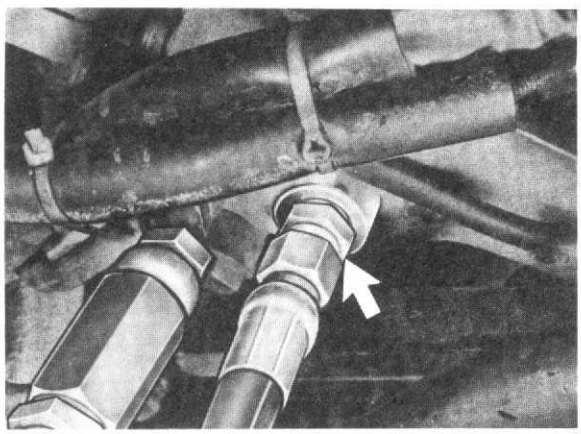
Blower switch in off position	off	on	→		max.
Main shut-off flap	off	on	→		
Defroster flap	off	→	on	→	
Footwell flap	off	→		off	→
Bypass flap	off	on	off	→	
Heater valve	off	→			on


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3. Pull down pressure line, which does not require loosening mounting clamp of lines. Connect 1.5 meter long high pressure hose no. 2 to pressure line using the hollow bolt and adapter no. 1 (seals required: 2 x 14 x 18 and 1 x 18 x 22 or 1 x 16 x 20).



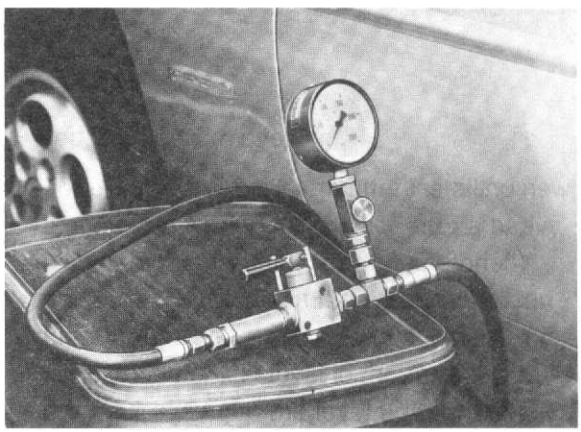
4. Screw connector with high pressure hose no. 5 on steering gear (seal required: 14 x 18).



5. Mount pressure gauge between high pressre hoses and place on a base (e.g. toolbox) next to driver's door.

Note

Use adapter no. 4 for old version pressure gauge and connect high pressure hose no. 5 on connection V of pressure gauge.



6. **Open shut-off value of pressure gauge (lever position I)**, fill supply tank and bleed steering system (see page 48 - 8j).

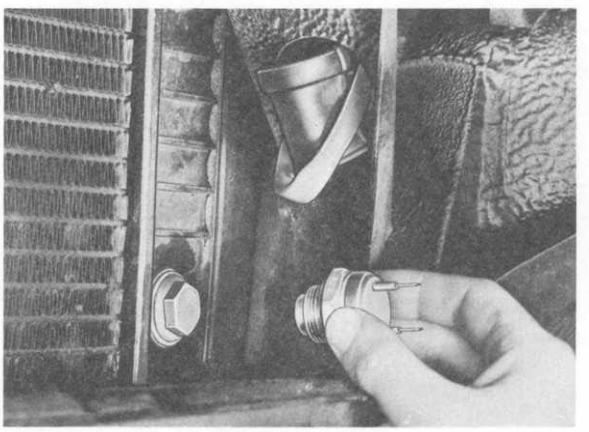
7. Check delivery pressure of power steering pump and system pressure (page 48 - 13).

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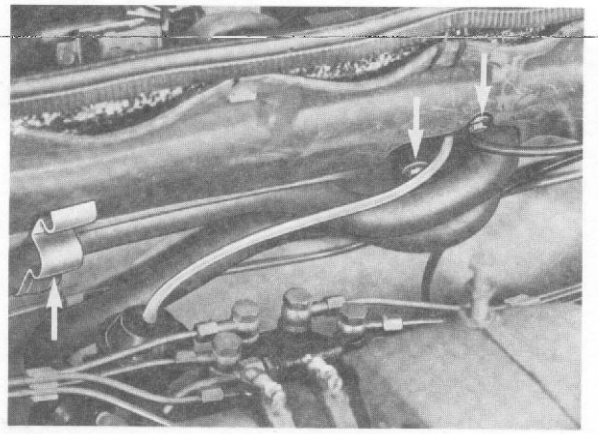
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
21	O-ring 7.5 x 1.8	1			
22	O-ring 7.5 x 1.8	1			
23	Suction line NW 13	1			
24	O-ring 14 x 1.8	1			
25	O-ring 14 x 1.8	1			

Installing Pressure and Suction Lines

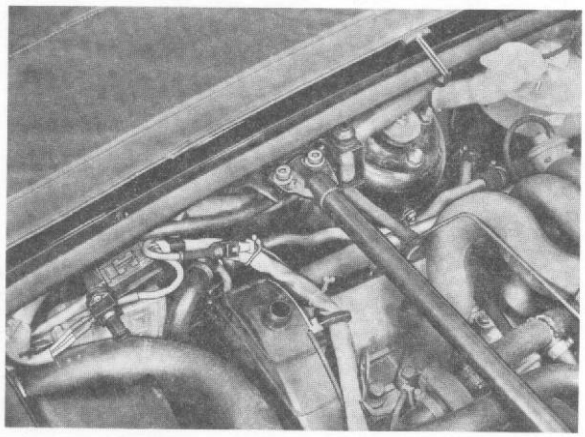
1. Take off engine cover.
2. Remove air cleaner.
3. Unscrew guard underneath radiator.
4. Drain coolant from radiator.
5. Unscrew air inlet grill.
6. Remove plug on radiator and screw in temperature switch (torque: 39 Nm or 3.9 kpm). Connect provided plug with protective sleeve.



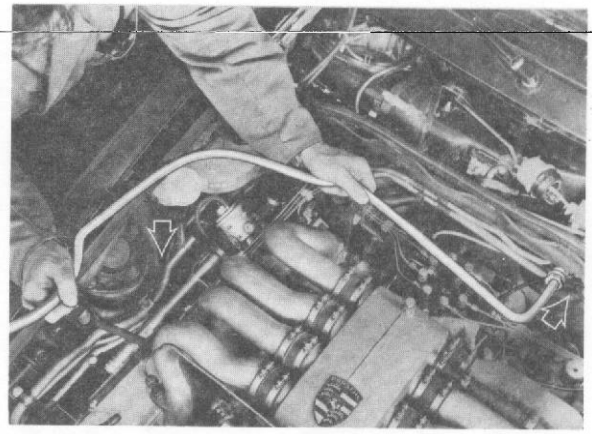
7. Unscrew cover for tread plate in firewall. Pull out vacuum hoses and heater hoses from tread plate. Unscrew holder for heater hose.



8. Unscrew front right radiator hose. Disconnect plug and plus terminal. Unscrew TCI control unit. Detach coolant hose at t-adapter underneath cross member. Remove heater pipe with heater hose at firewall.



9. Guide large diameter suction line through opening in firewall with connection end facing expansion valve and then position between engine and right wheel housing.



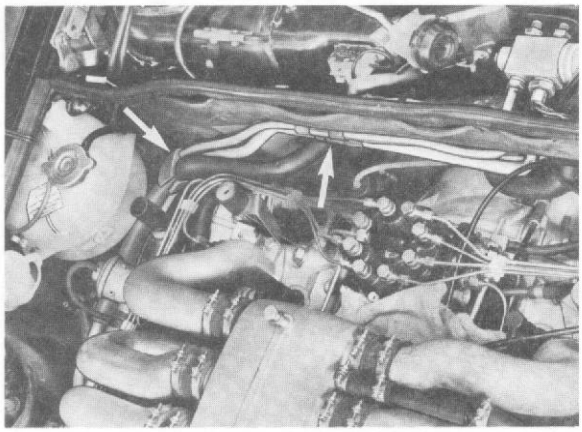
10. Route pressure line in the same manner, whereby pressure line is mounted above suction line.

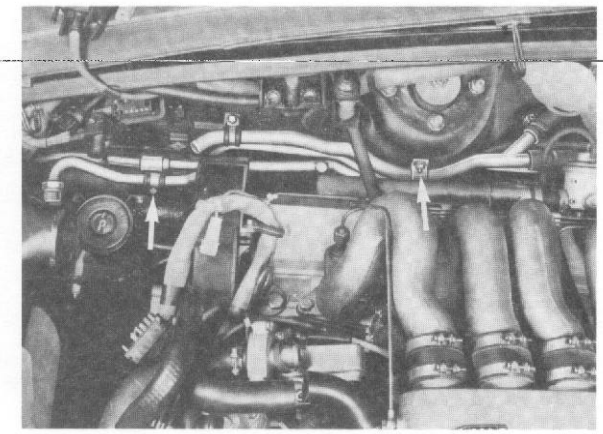
11. Insert tread plate behind firewall above both lines.

12. Connect lines on expansion valve. Hold expansion valve when tightening lines.

13. Position heater pipe line with hose above lines on wheel housing.

14. Place new mounting parts on lines and install nuts and screws. Align pipes and hoses, and tighten screws or nuts.

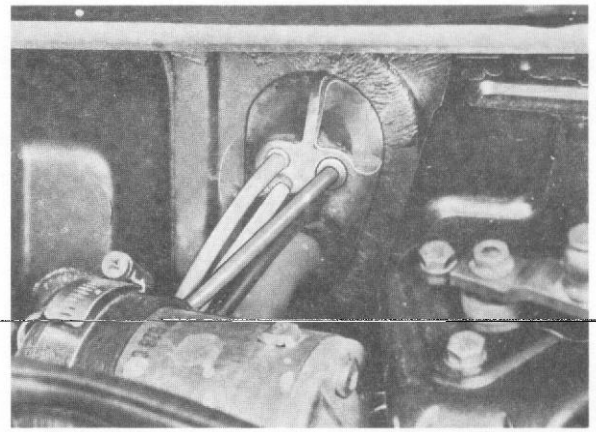




15. Connect cover behind firewall on tread plate. Insert and connect heater and vacuum hoses.

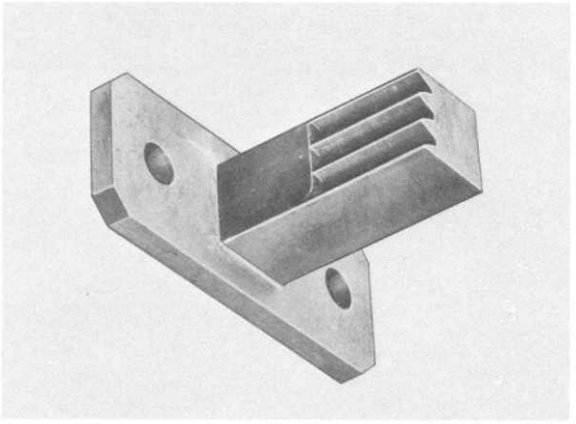
16. Screw on cover of tread plate.

Insert new vacuum line for bypass flap in intake housing through grommet provided in partition and connect.

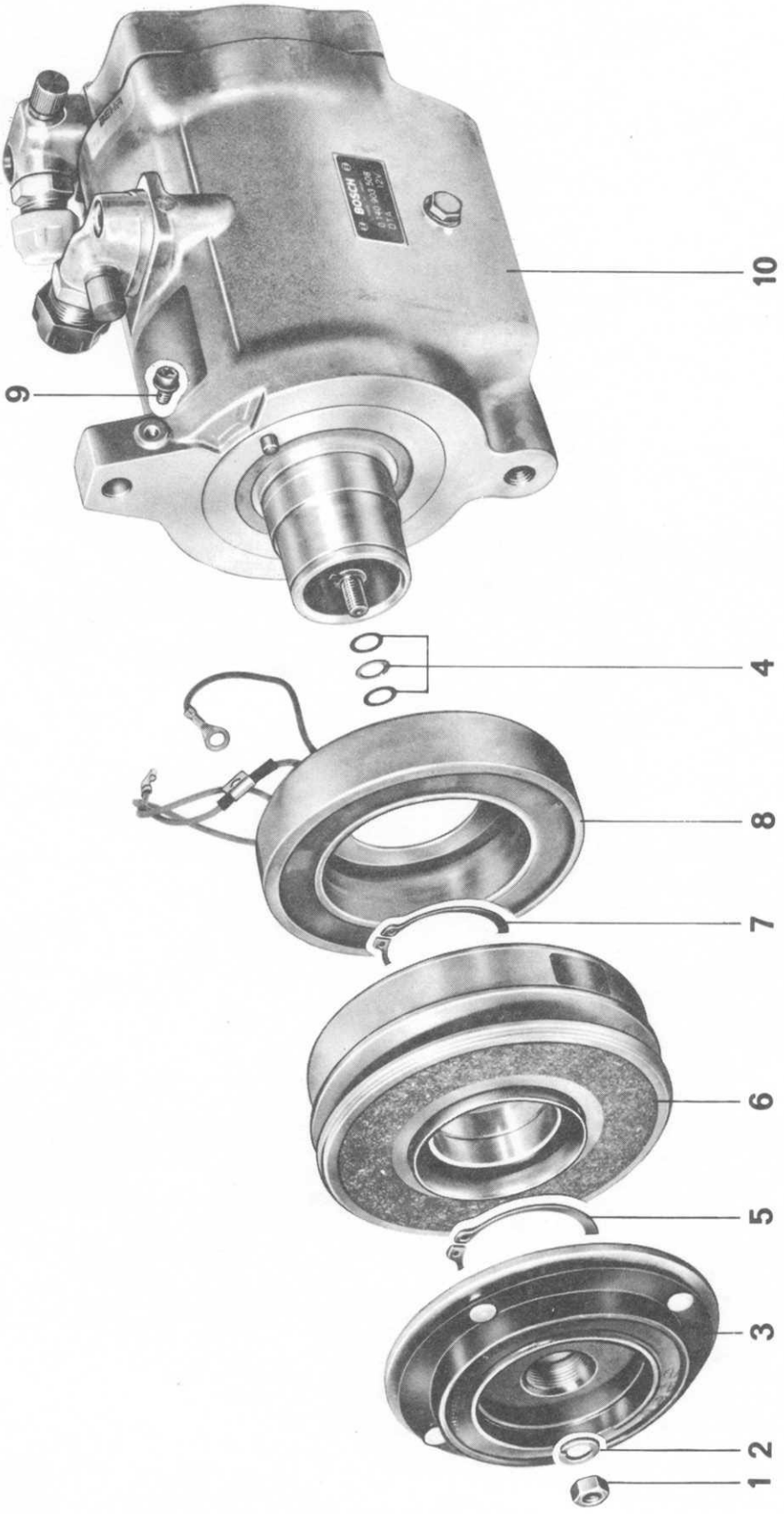


Installing Pulley for Compressor

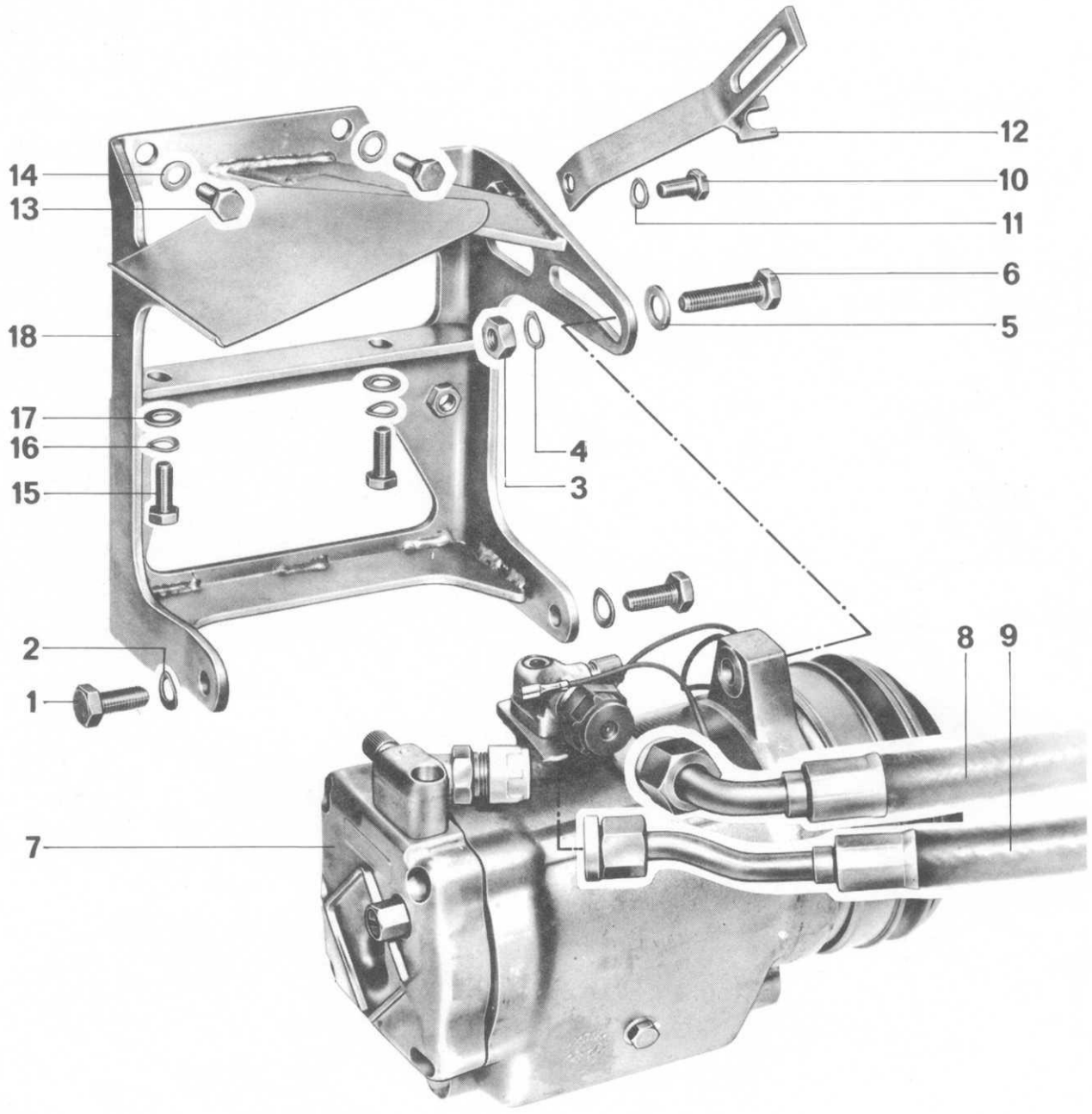
1. Remove belts from power steering pump, air pump and alternator.
2. Unscrew clutch operating cylinder (or cover for cars with automatic transmission) and install tool for holding flywheel with same screws.



3. Remove pulley. Install compressor pulley in place of spacer and tighten screws.
4. Reinstall operating cylinder or cover.


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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Nut M 8	1		Tighten to 17 Nm (1.7 kpm)	
2	Lockwasher	1			
3	Coupling	1			
4	Set of shims	1		Adjust play between pulley and coupling to 0.4 - 1.0 mm	
5	Circlip	1			
6	Pulley	1			
7	Circlip	1			
8	Coil unit	1			
9	Phillips screw	1			
10	Compressor	1			

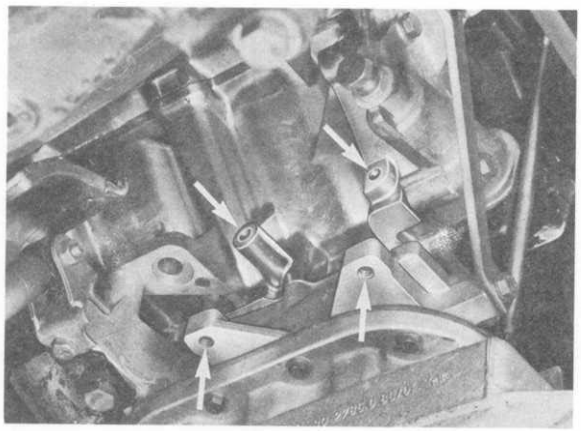

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Bolt M 10 x 25	2			
2	Washer	2			
3	Nut M 10	1			
4	Washer	1			
5	Washer	1			
6	Bolt M 10 x 40	1			
7	Compressor	1			
8	Hose NW 13	1			
9	Hose NW 10	1			
10	Bolt M 8 x 22	1			
11	Washer	1			
12	Strut	1			
13	Bolt M 8 x 20	2			
14	Washer	2			
15	Bolt M 8 x 22	2			
16	Washer	2			
17	Washer	2			
18	Compressor console	1			

Installing Compressor Console and Compressor

1. Remove air pump without air cleaner.

2. Bolt console at tapped holes provided for this purpose.

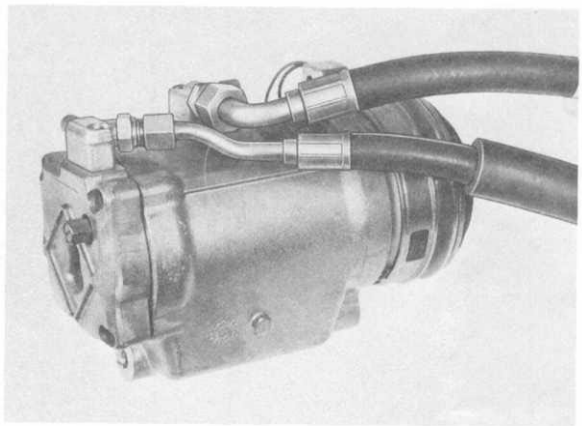


3. Replace air pump strut by shorter version.

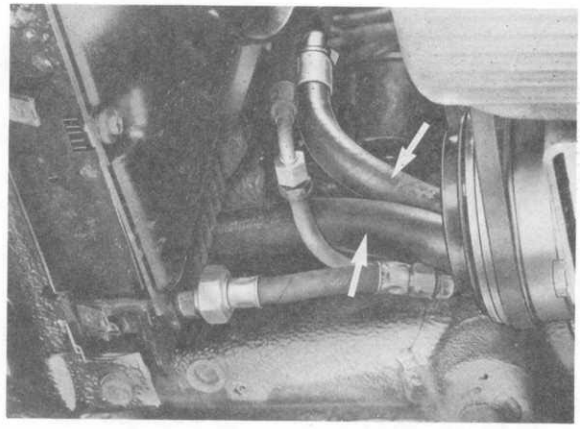
4. Install air pump.

5. New compressor is under pressure!
   Unscrew plugs on compressor slowly and listen for escaping refrigerant. Remove plugs only after releasing pressure.

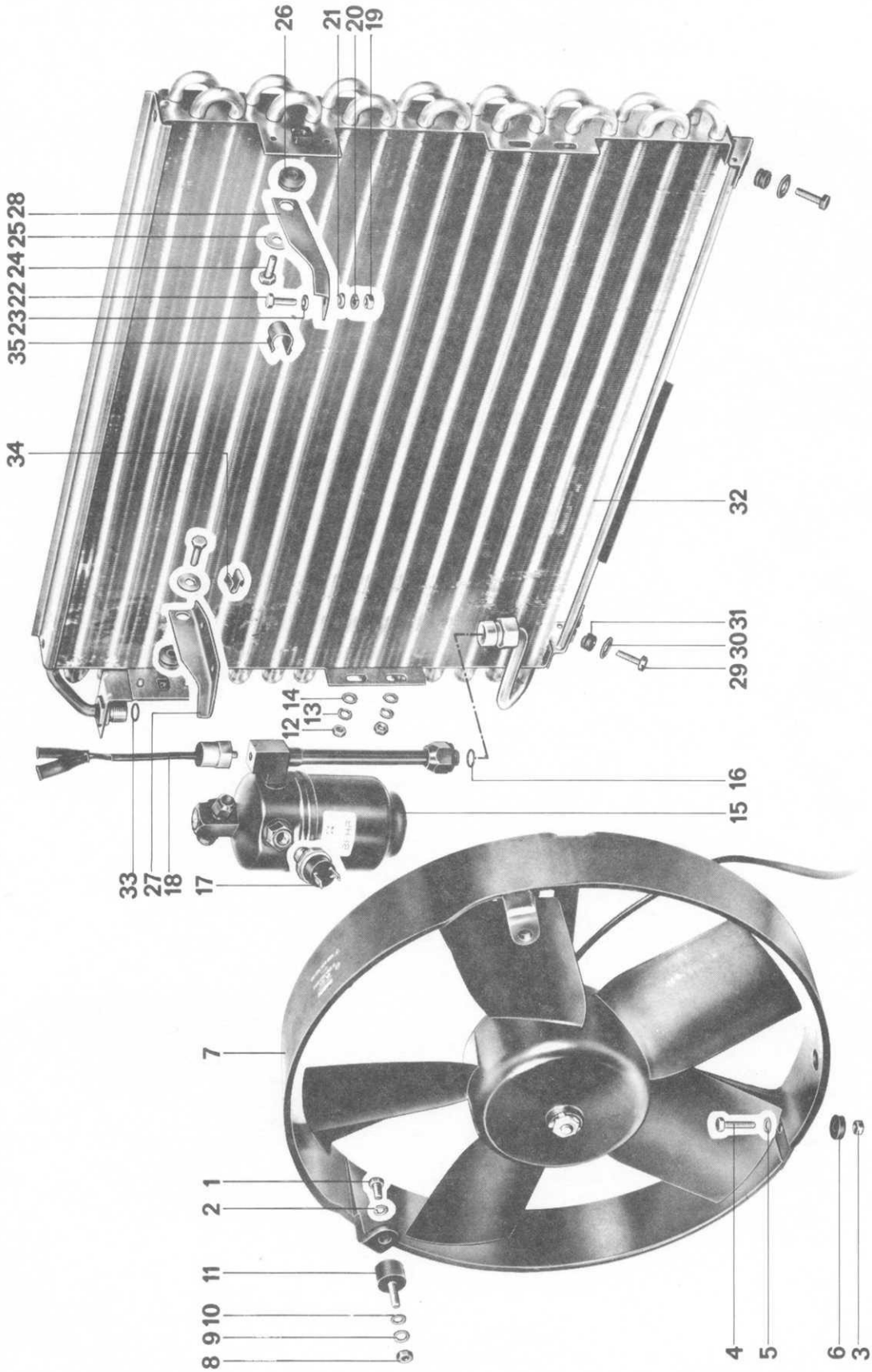
6. Connect and tighten hoses on compressor prior to installation.



7. Install compressor in console. Route hose on suction side up and connect on suction line. Route hose on pressure side toward front between wheel housing and radiator.



8. Install belts in order of compressor, alternator, air pump and power steering pump, and tighten.


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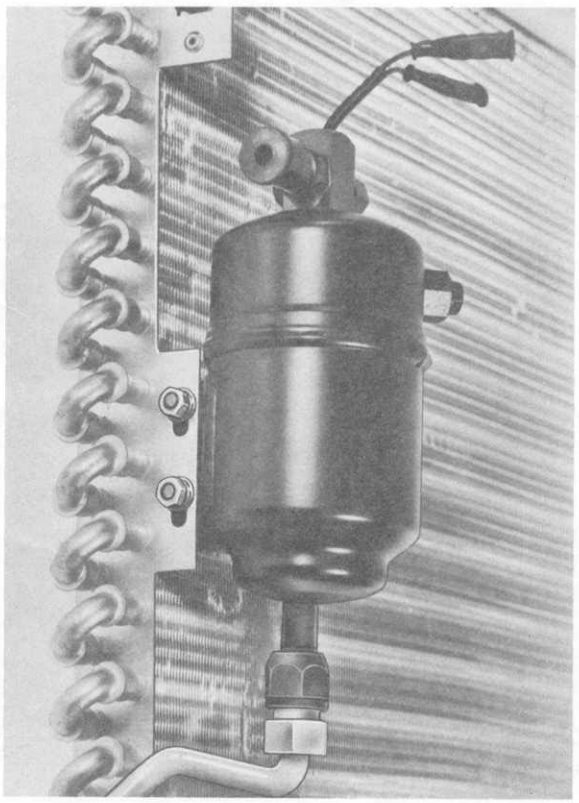
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Screw M 6 x 12	2			
2	Lockwasher	2			
3	Selflocking nut M 6	1		Tighten to 10 Nm (1.0 kpm)	
4	Screw M 6 x 25	1			
5	Washer	1			
6	Rubber washer	1			
7	Fan	1			
8	Nut M 6	2			
9	Lockwasher	2			
10	Washer	2			
11	Rubber pad	2			
12	Nut M 6	2			
13	Lockwasher	2			
14	Washer	2			
15	Tank	1			
16	O-ring 10.6 x 1.8	1			
17	Low pressure switch	1		Tighten to 18 Nm (1.8 kpm)	
18	Temperature sensor	1		Tighten to 4 Nm (0.4 kpm)	
19	Nut M 6	2			
20	Lockwasher	2			
21	Washer	2			
22	Screw M 6 x 16	2			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
23	Washer	2			
24	Screw M 6 x 20	2		Tighten to 8 Nm (0, 8 kpm)	
25	Washer	2			
26	Rubber grommet	2			
27	Holder, right	1			
28	Holder, left	1			
29	Screw M 6 x 20	2			
30	Washer	2			
31	Rubber grommet	2			
32	Condenser	1			
33	O-ring 10, 6 x 1, 8	1			
34	Clamp, right	1			
35	Clamp, left	1			

Installing Condenser and Fan

1. Install temperature switch on tank.

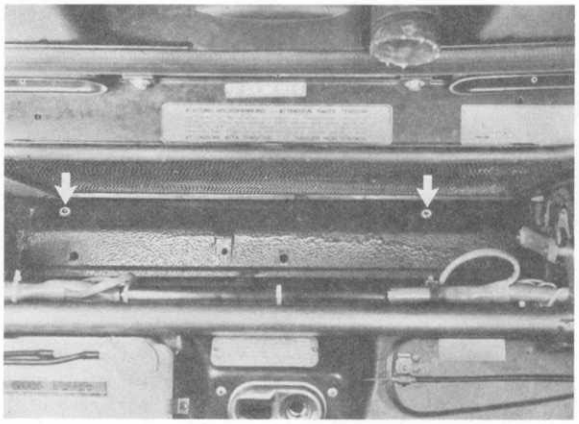
2. Connect condenser outlet with tank inlet and bolt tank.



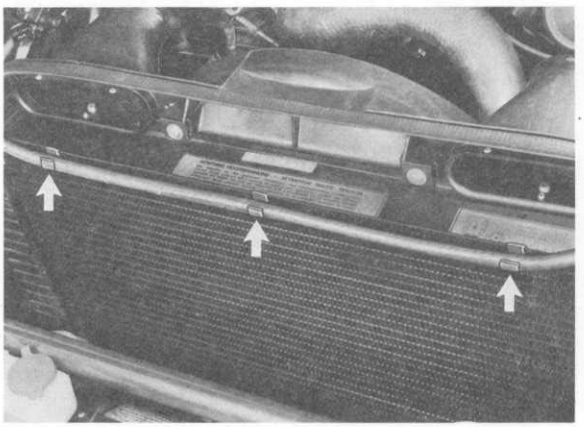
Note

Be careful not to damage condenser plates!
Straighten deformed plates with a plate comb.

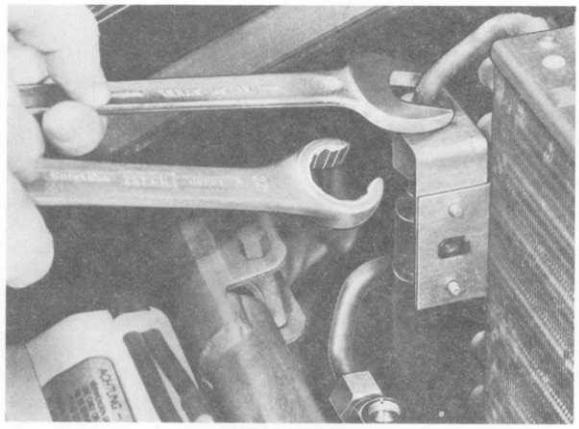
3. Install rubber grommets in holes provided in cross member.



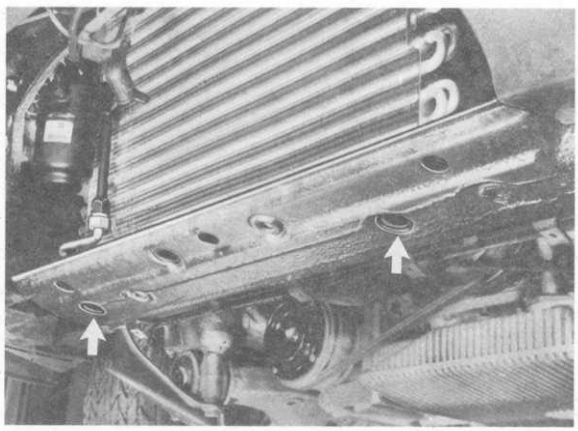
4. Pull off hose clamps on radiator.



5. Slide in condenser ahead of radiator. Connect tank with pressure line leading to expansion valve. Connect condenser inlet with hose leading to compressor.



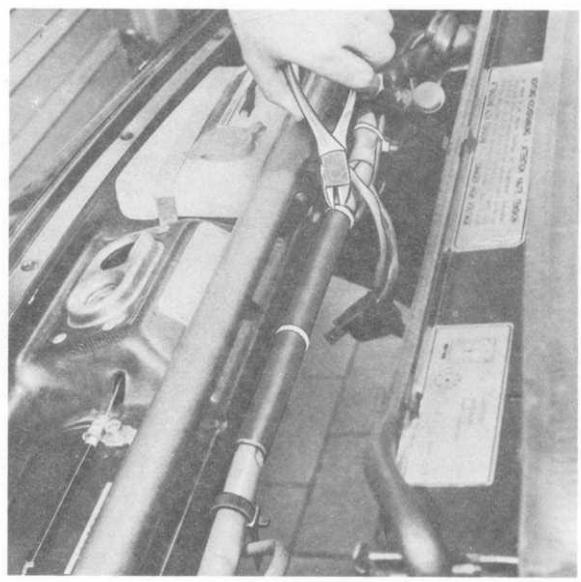
6. Bolt condenser from below.



7. Install low pressure switch (O-ring belongs to switch).

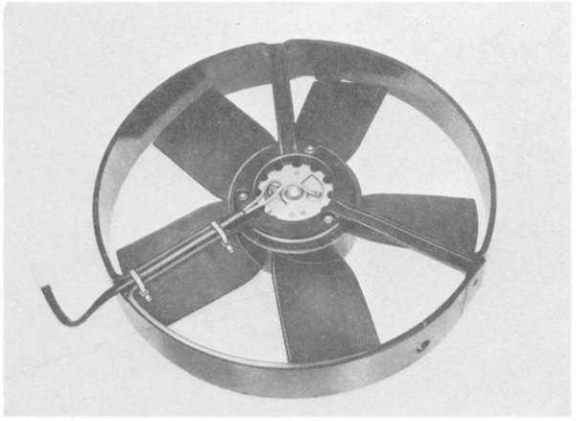


8. Loosen wire harness on lock cross member and take off cover.



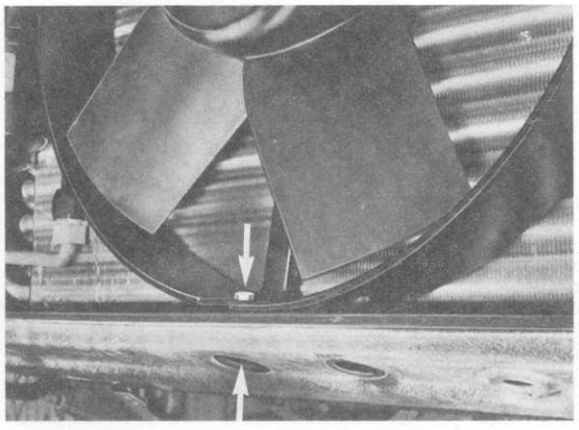
9. Screw rubber pad for fan on lock cross member.

10. Mount wire harness on fan housing with a strap.

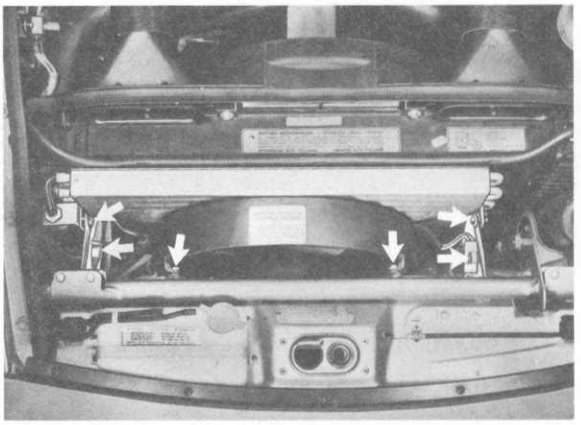


11. Install fan from above carefully, to prevent damaging the condenser plates.

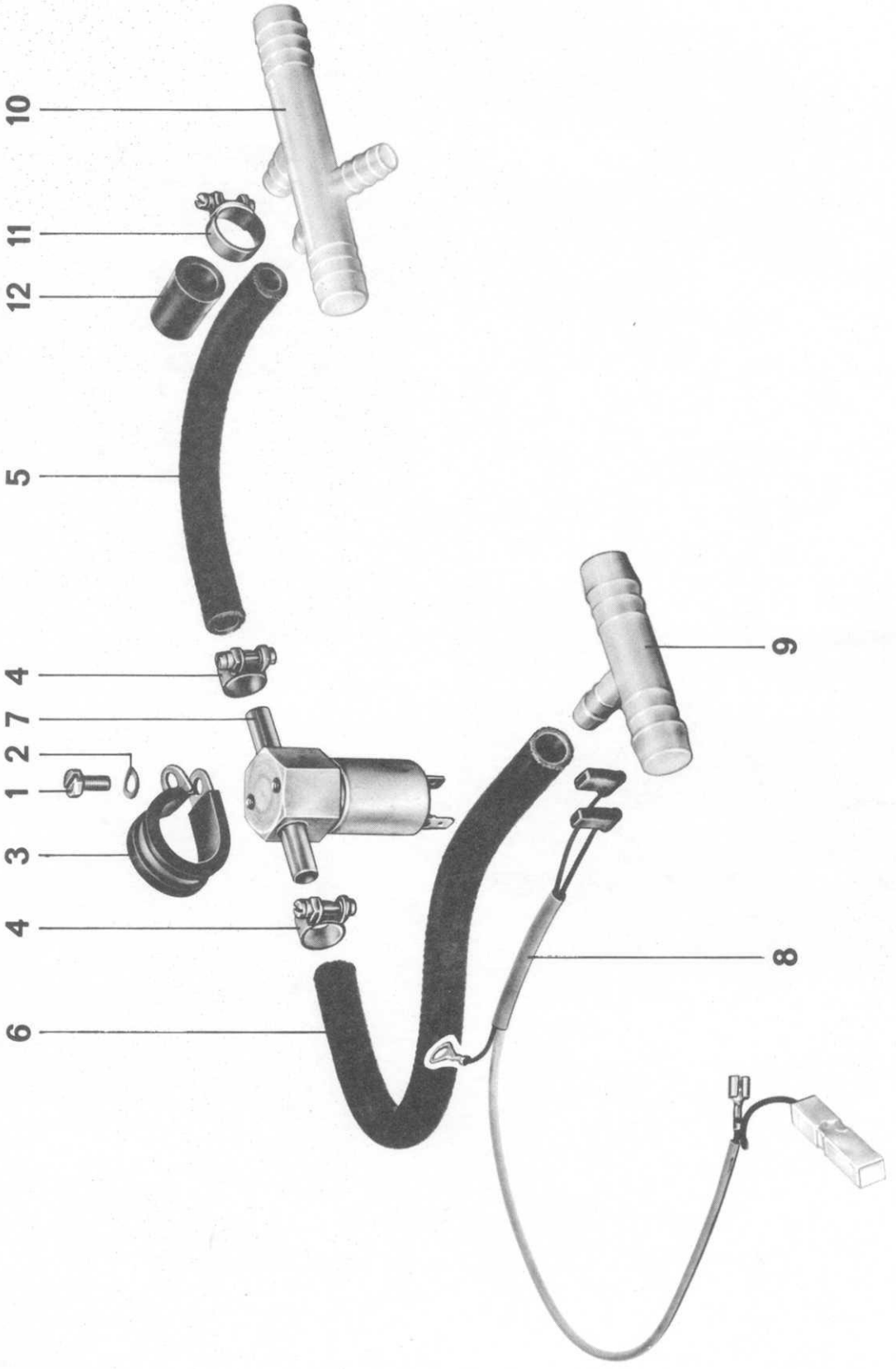
12. Bolt fan from below.



13. Bolt fan from above.
Bolt condenser at top with left and right holders. Connect low pressure switch, temperature switch and fan with wire harness. Hold wire plugs on left and right sides with clamps.



14. Secure wire harness and cover with straps.

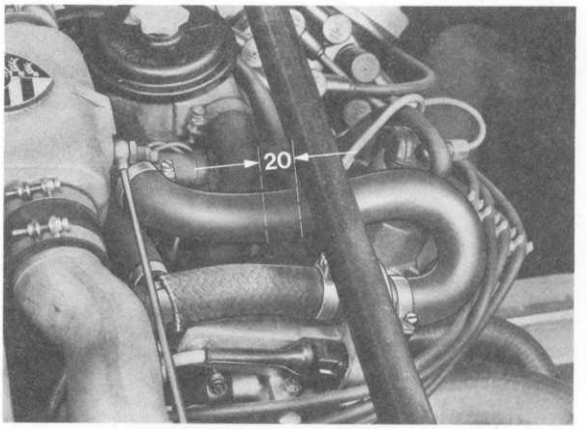

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No.	Description	Qty.	Note When Removing / Installing	Special Instructions
1	Screw M 6 x 12	1		
2	Washer	1		
3	Clamp	1		
4	Clamp	2		
5	Hose 9.5 x 15.5 x 150	1		
6	Hose 9.5 x 15.5 x 290	1		
7	Electric air valve	1		
8	Wire harness	1		
9	T-adapter	1		
10	Branch	1		
11	Clamp	1		
12	Cap	1		

Installing Electric Air Valve

1. Install cross member.

2. Mark hose between throttle bypass valve and intake branch, and unscrew. Cut out a piece about 20 mm long at marked position.

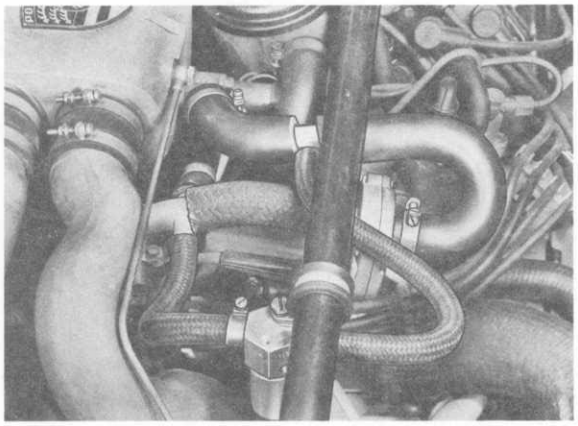


3. Remove hose with t-adapter between throttle bypass valve and air guide housing. Take off t-adapter and shorten long hose by about 30 mm.

4. Mount electric air valve on cross member.

5. Cut two hoses 9.5 x 15.5 to lengths of 150 and 250 mm.

6. Install hoses and connectors.



7. Install wire harness, connecting both angled plugs on electric air valve. Screw wire clip on engine with standard ground wire. Connect plug from engine wire harness and insulated plug with magnetic coupling.

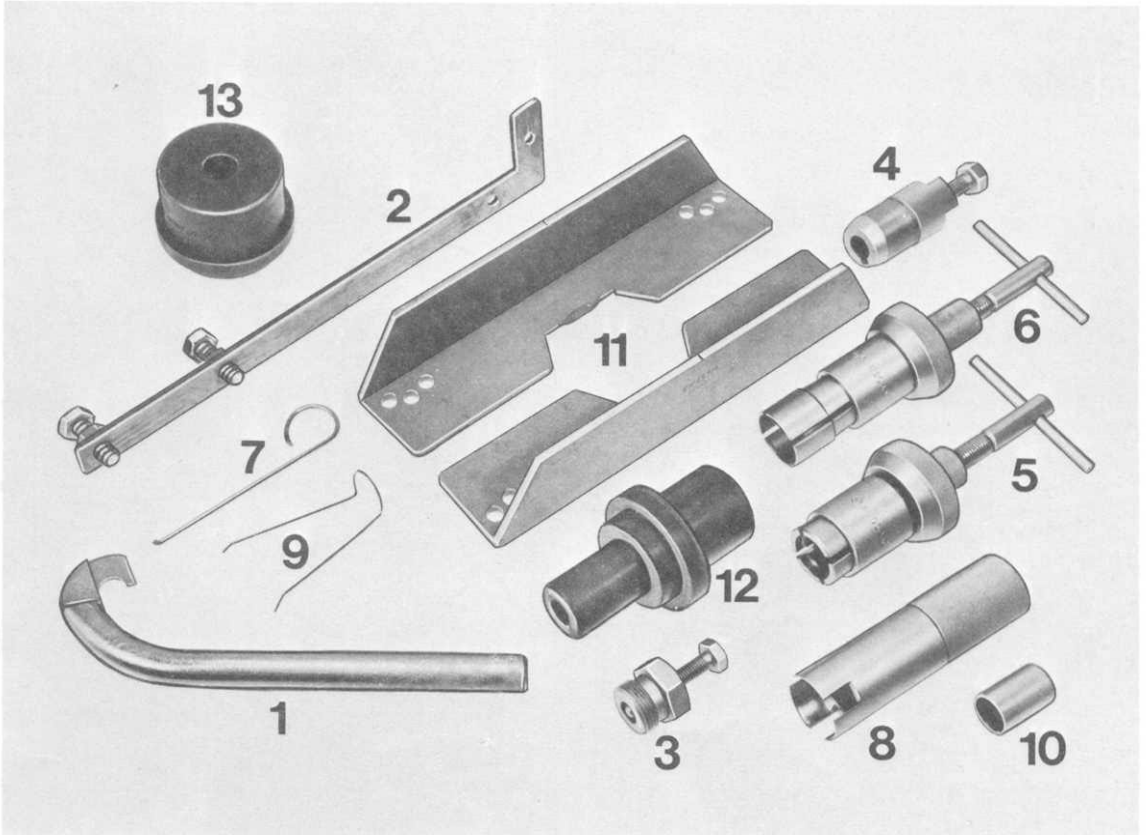
8. Install or tighten all removed or loosened parts.

Flush, drain and charge air conditioner according to instructions.

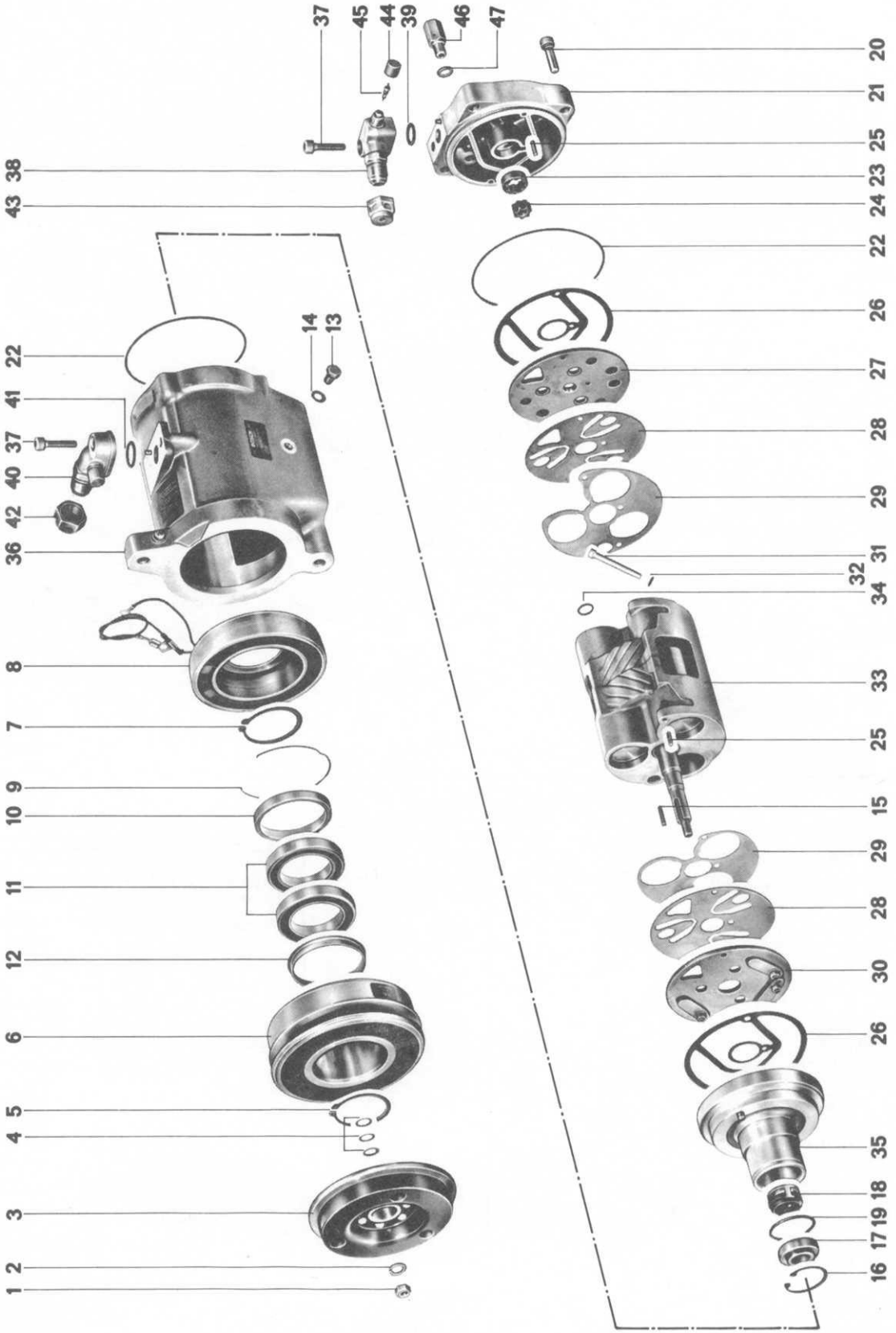
Let compressor run 15 minutes at idle speed with magnetic coupling operated.

Check air conditioner function and for leaks.

TOOLS



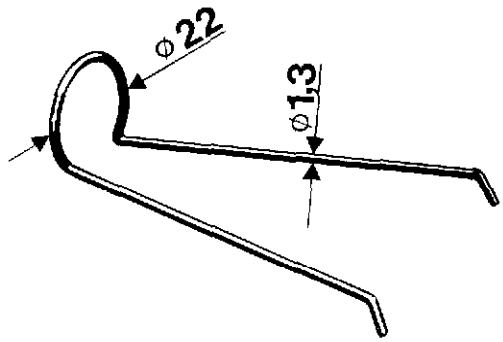
No.	Description	Special Tool	Remarks
1	Holding wrench	95458-02070	Source of supply - see Workshop Handbook
2	Holding wrench		Local manufacture from 924 Sankyo compressor
3	Puller	95458-03064	
4	Woodruff key puller	95456-21060	
5	Thrust washer puller	95456-03060	
6	Seal puller	95456-02060	
7	Oil pipe pulling hook		Local manufacture
8	Seal installer	95456-08010	
9	Thrust washer installer		Local manufacture
10	Thrust washer pad	95456-09010	
11	Holding rails	VW 457/1	For removing and installing bearing
12	Thrust pad	VW 195	To remove bearing
13	Thrust pad	VW 472/1	To remove bearing

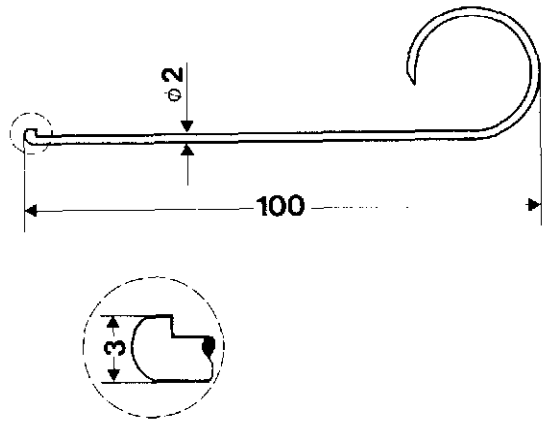

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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Nut	1		Tighten to 17 Nm (1.7 kpm)	
2	Lockwasher	1			
3	Coupling	1		Check for damage	
4	Set of shims	1		Adjust play between pulley and coupling to 0.4 - 1.0 mm	
5	Circlip	1		Bevel faces shaft end	
6	Pulley	1		Replace pulley assembly with ball bearing, if friction surface is worn or oil splattered	
7	Circlip	1		Bevel faces shaft end	
8	Coil unit	1		3.7 ohm resistance	
9	Circlip	1			
10	Spacer	1			
11	Ball bearing	2			
12	Dust ring	1			
13	Oil filler screw	1		Tighten to 15 Nm (1.5 kpm)	
14	Seal	1			
15	Woodruff key	1			
16	Circlip	1			

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
17	Thrust washer	1		Don't damage sealing surfaces. Check for scratches, replacing both parts if necessary. Lubricate with refrigerating oil	
18	Seal	1			
19	O-ring	1			
20	Screw	4		Tighten to 26 Nm (2.6 kpm)	
21	Housing cover, rear	1			
22	O-ring	2			
23	Oil pump outer race	1			
24	Oil pump inner race	1			
25	Dowel pin	4			
26	Valve plate seal	2			
27	Valve plate, rear	1			
28	Suction valve	2			
29	Cylinder gasket	2			
30	Valve plate, front	1			
31	Oil suction tube	1			
32	O-ring	1			
33	Cylinder block	1			Must not be disassembled
34	O-ring	1			
35	Housing cover, front	1			
36	Housing	1			
37	Screw	2		Tighten to 19 Nm (1.9 kpm)	
38	Pressure connection	1			

No.	Description	Qty.	Note When Removing / Installing	Special Instructions
39	O-ring	1		
40	Suction connection	1		
41	O-ring	1		
42	Plug, suction end	1		
43	Plug, pressure end	1		
44	Cap	2		
45	Spring valve	2		
46	Safety valve	1		
47	Seal	1		

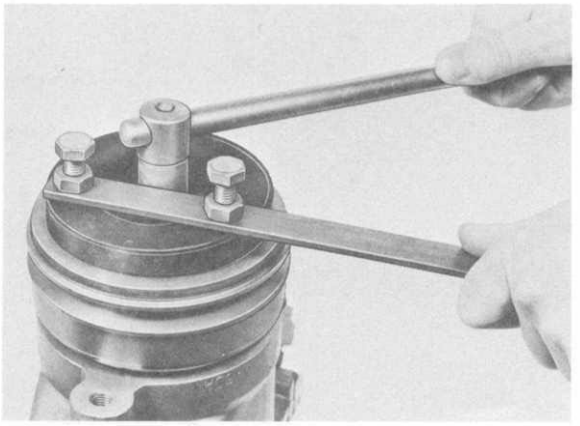




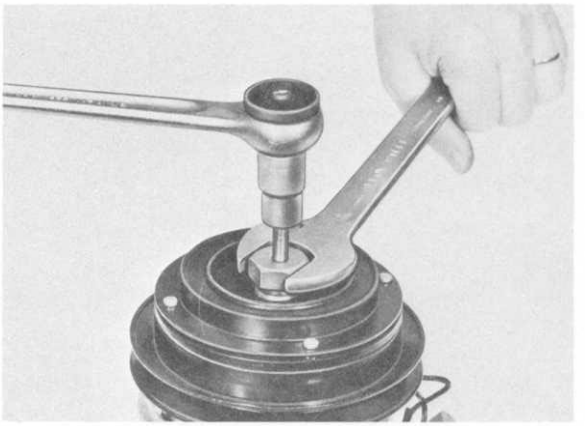
DISASSEMBLING AND ASSEMBLING COMPRESSOR

Removing and Installing Magnetic Coupling

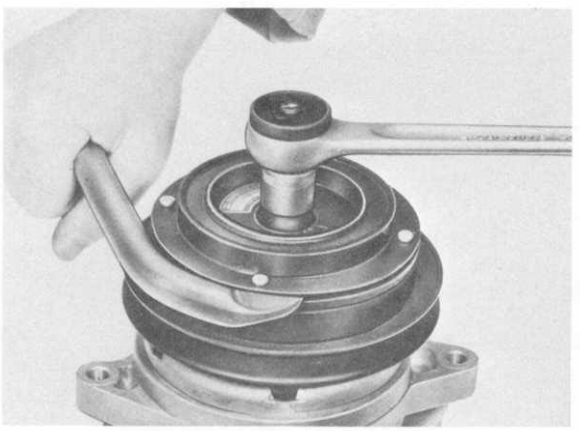
1. Counterhold with pertinent wrench depending on version to loosen or tighten mounting nut.

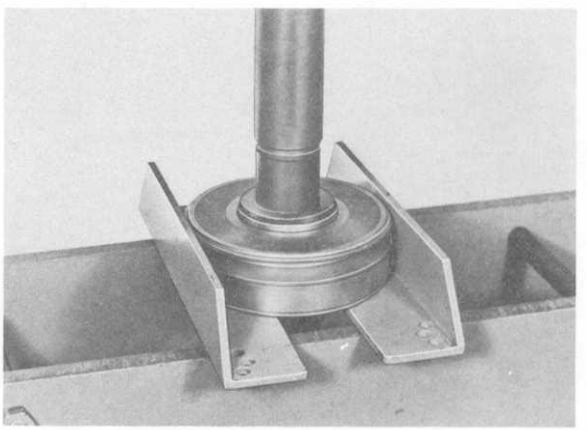


2. Remove coupling plate with puller.

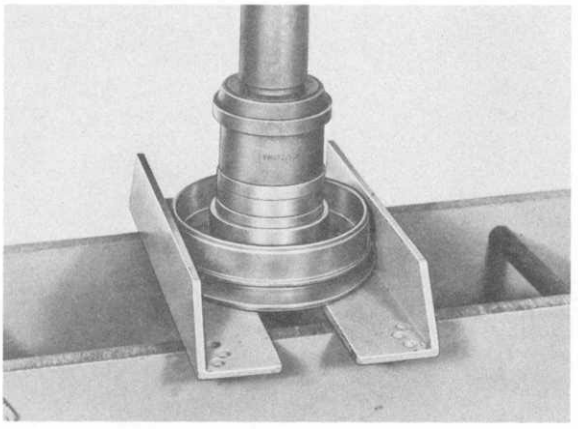


3. Remove ball bearing.

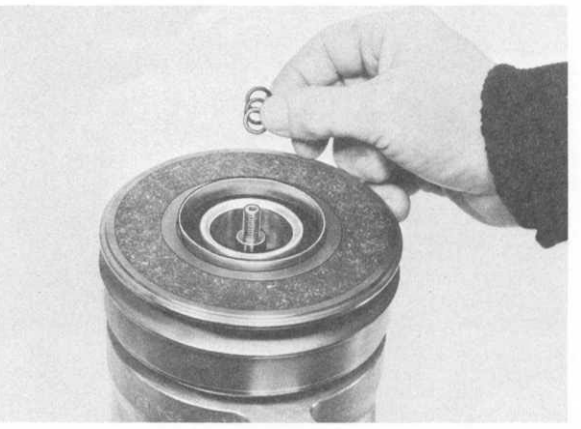




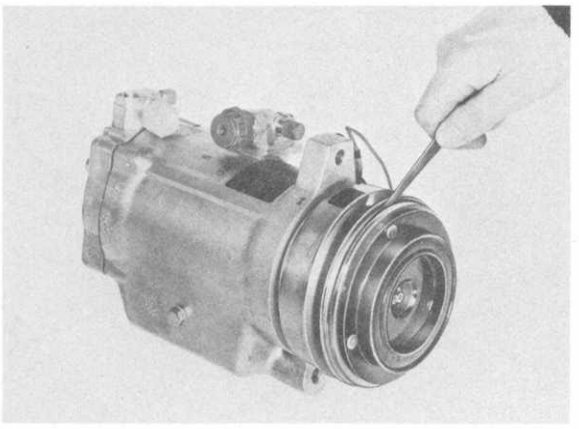
4. Install ball bearing.



If necessary, adjust play with set of shims.



5. Play between coupling plate and pulley is 0.4 to 1.0 mm.



Disassembling Compressor

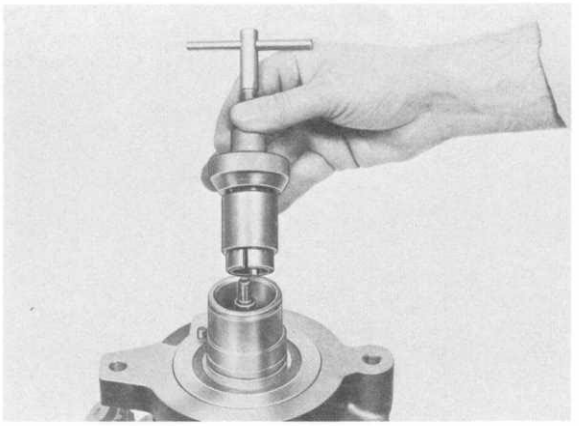
Note

Remove any plugs from line connections to let residual gas escape.

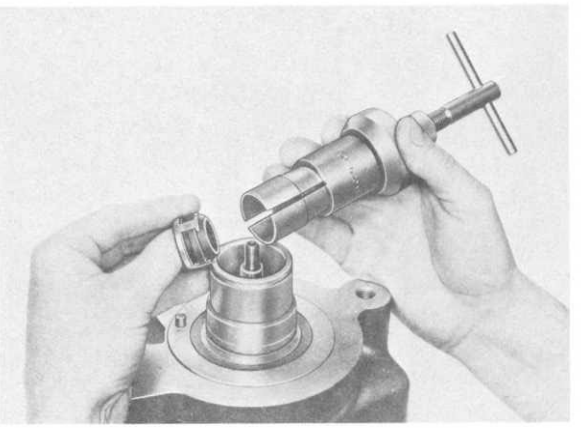
1. Drain refrigerating oil (never reuse).

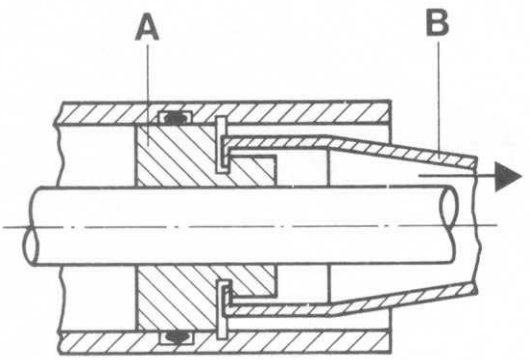
2. Remove woodruff key with woodruff key puller.

3. Pull out thrust washer with puller.



4. Remove seal with puller.

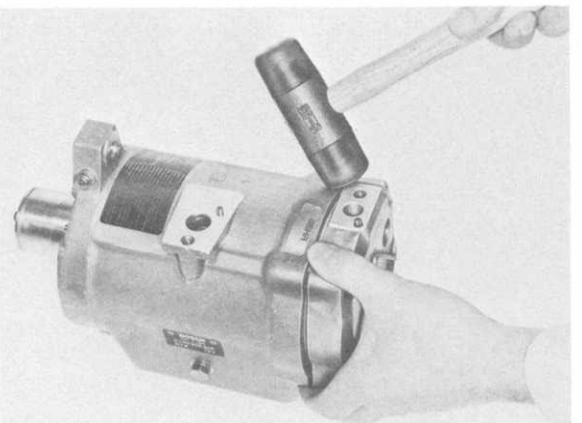




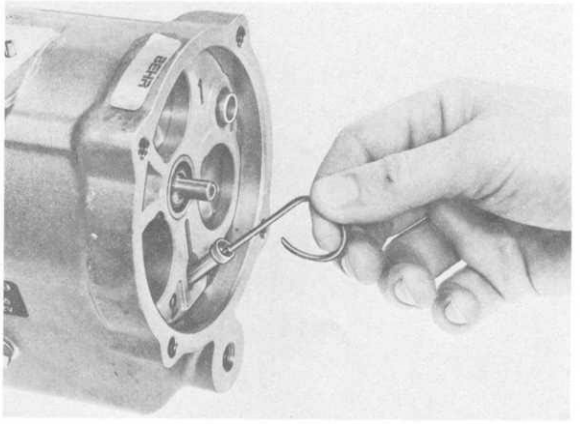
A - Thrust washer

B - Puller

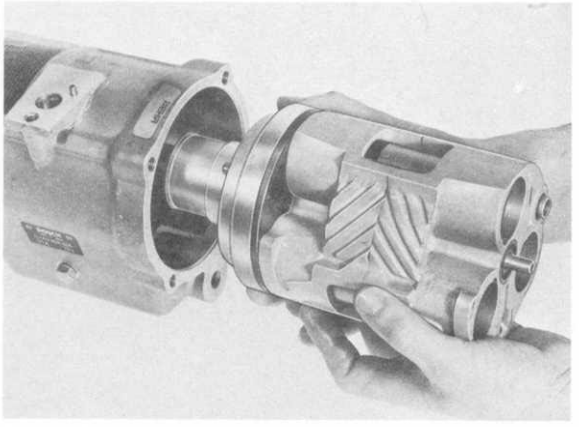
5. Unscrew mounting bolts from rear housing cover. Take off housing cover, applying light knocks with a plastic hammer when necessary.



6. Pull out oil suction tube with pulling hook.



7. Remove cylinder block from housing.



Note

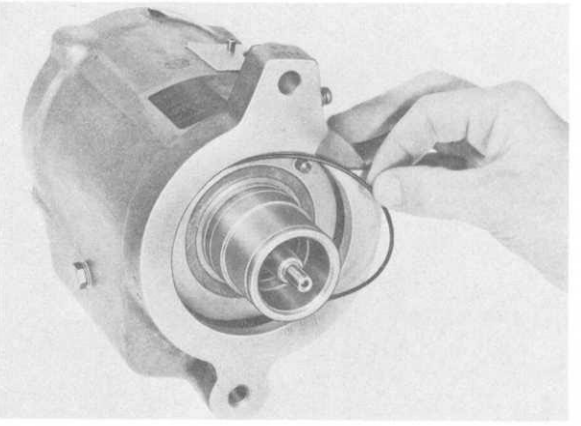
Never disassemble cylinder block!

Assembling Compressor

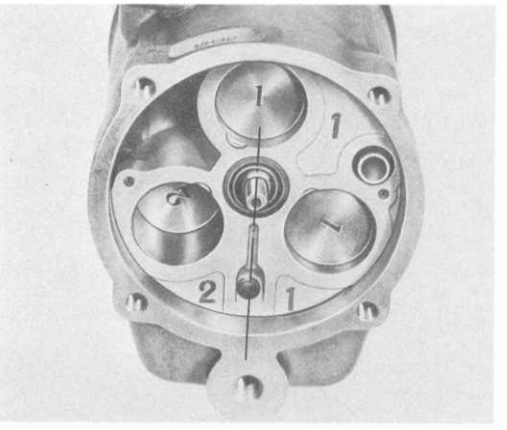
Note

Coat all gaskets and seals with clean refrigerating oil prior to installation.
(See page 87 - 01 for types of oil).

1. Place O-ring in front of housing and push in cylinder block.

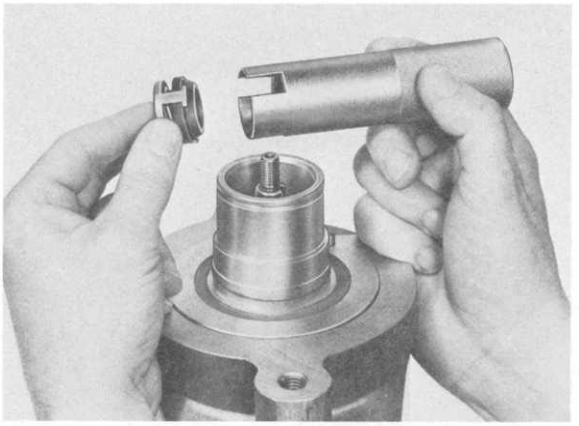


2. Align cylinder block that bore of oil suction tube faces down.



3. Place seal in assembly tool and push on to input shaft.

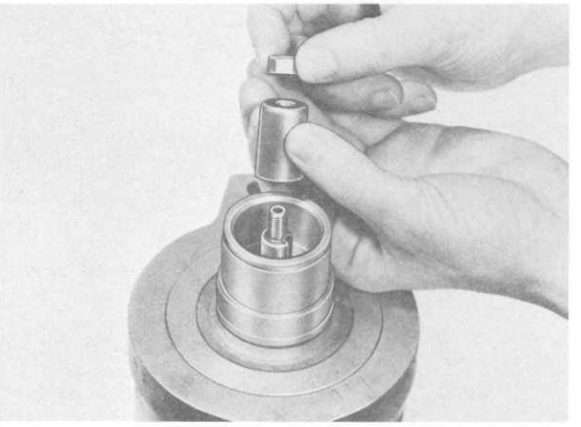
   Turn seal on shaft with tool until seal engages.



4. Guide in thrust washer with assembly tool carefully.

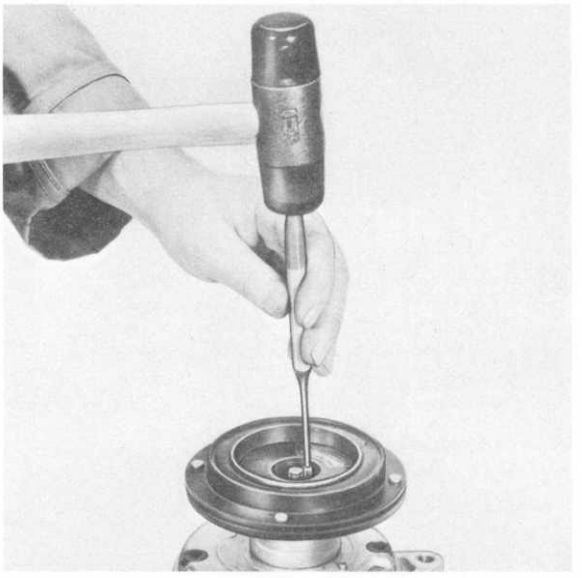


5. Press in thrust washer with thrust pad and nut so far, until groove for circlip is visible.



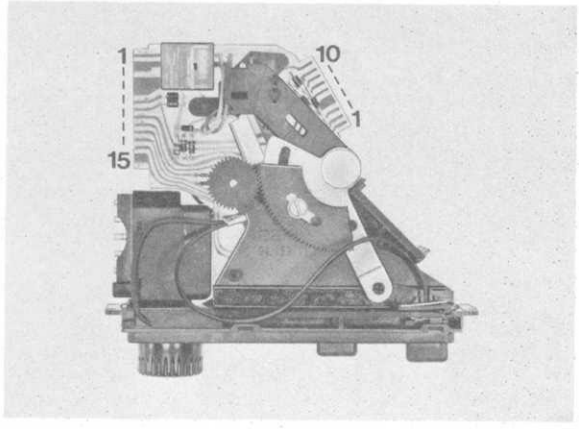
   Insert circlip and take off thrust pad.

6. Install woodruff key by mounting coupling plate and driving in key.

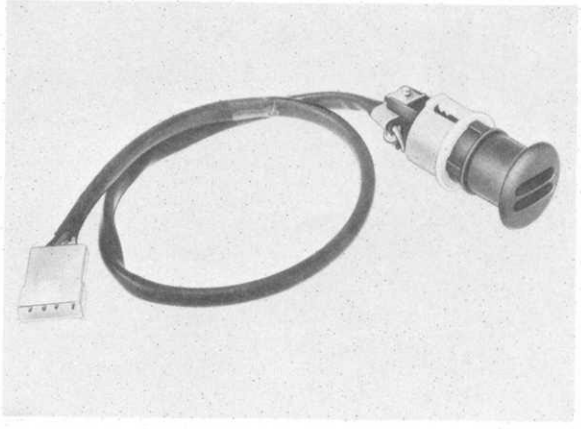


REGULATORS AND CONTROL UNITS FOR AUTOMATIC AIR CONDITIONER

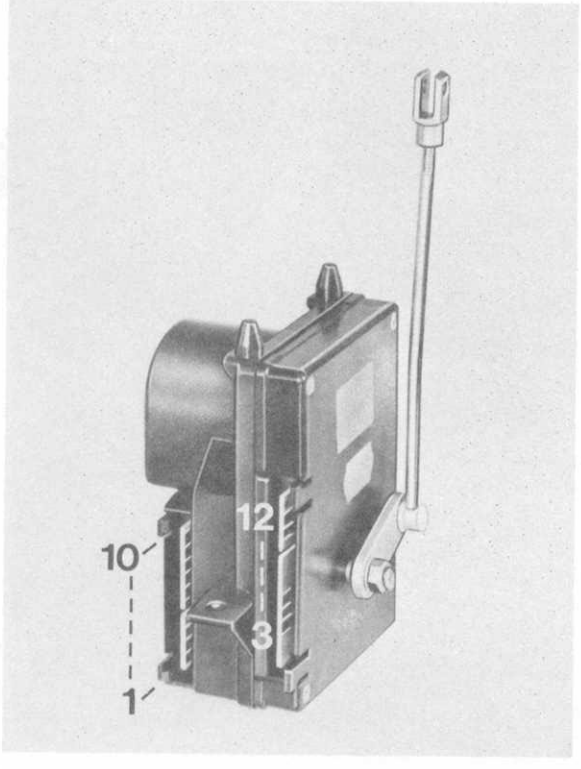
Control Switch (opened)



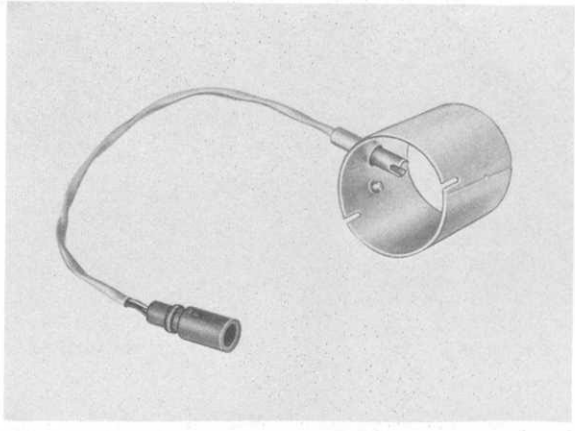
Inside Sensor



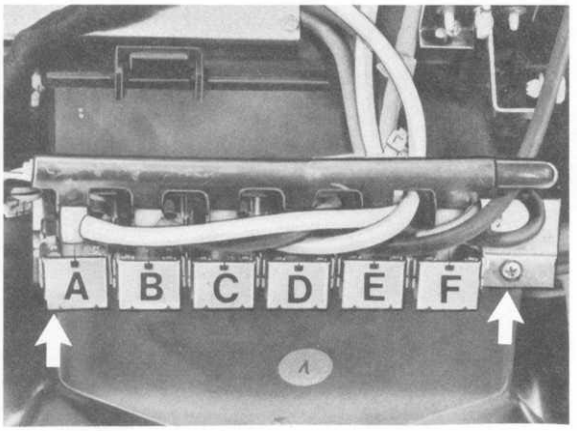
Control Unit



Outside Sensor



Solenoid Valves



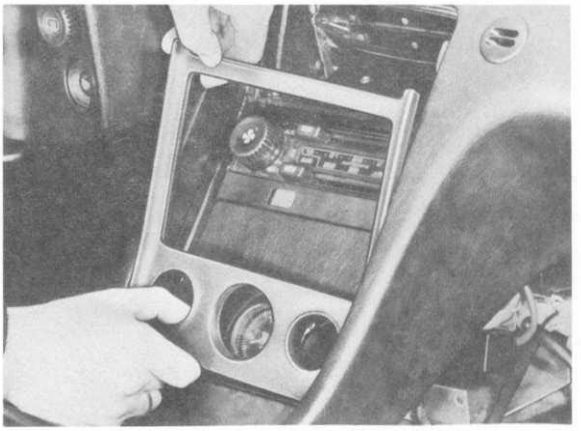
A - Footwell flap (yellow)
B - Defroster flap (green)
C - Center nozzle stage I (orange)
D - Center nozzle stage II (brown)
E - Mixing flap and heating valve (red)
F - Fresh air bypass flap (blue)

Removing and Installing Control Switch

1. Press out center nozzle with a putty knife.



2. Pull off cover frame starting at top.



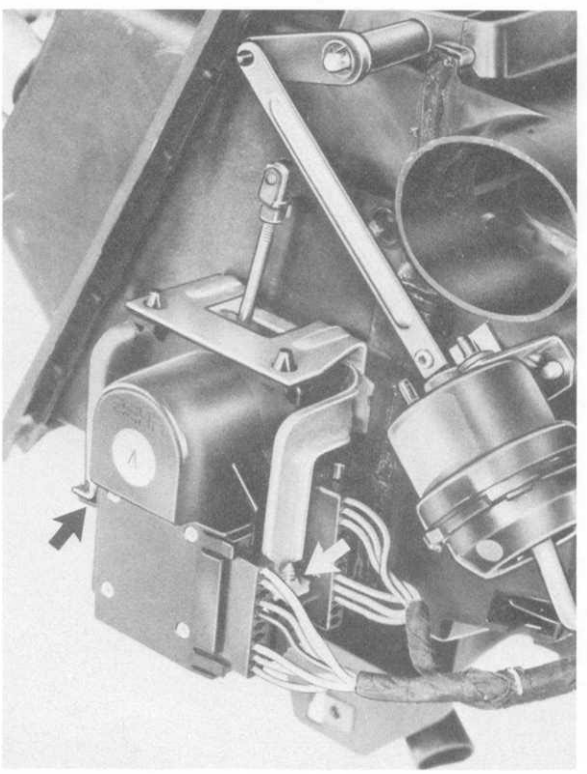
3. Loosen and remove control board (wires can remain connected).

4. Loosen and pull out control switch. Pull off plugs.

Removing and Installing Control Unit

1. Pull off both plugs.

2. Unscrew front and rear mounting bolts. Pull out control unit downward and disconnect operating rod at bottom.



Removing and Installing Inside Sensor

1. Remove control switch.

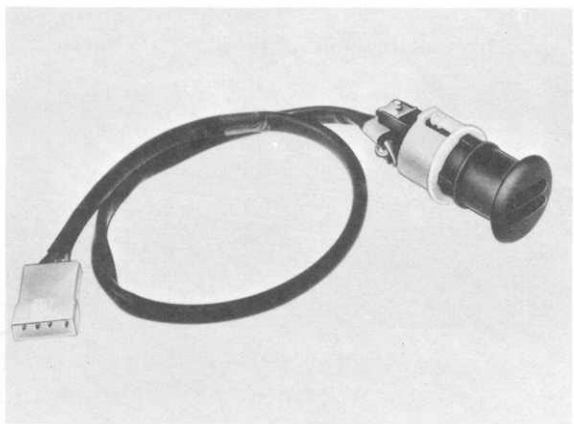
2. Remove tray and glove box.

3. Unscrew trim panels on left and right sides of center console.

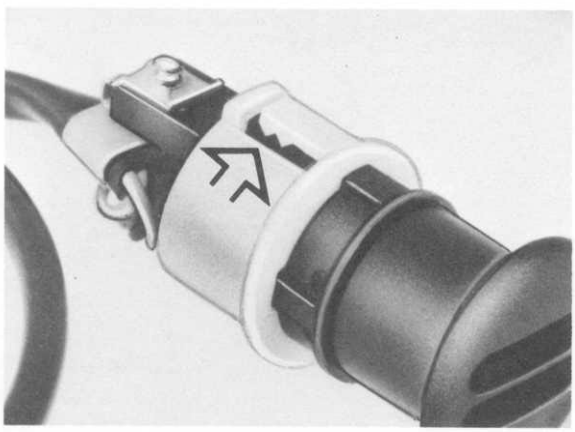
4. Unscrew center console mounting screws on instrument panel and frame tunnel. Wires remain connected.

5. Lift center console far enough and pull back toward rear, that inside sensor is accessible.

6. Press out inside sensor from inside.

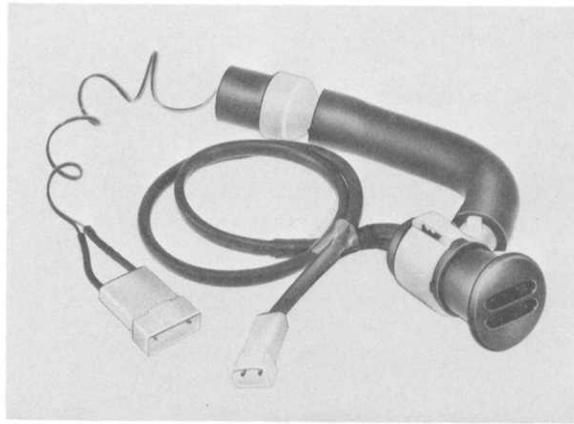


The mounting ring is pressed on and held in position by retaining tabs.



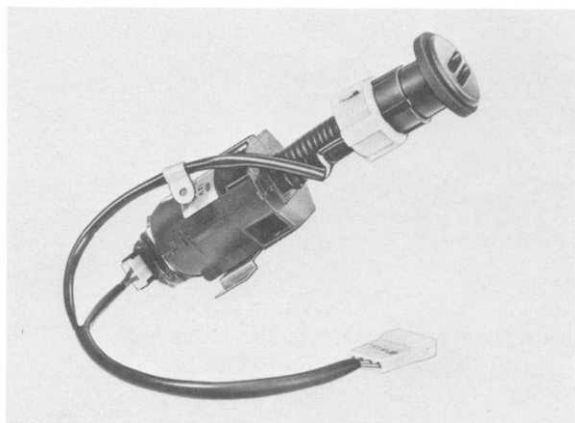
Note

Some cars since standard production of 1980 models have an inside sensor with a separate blower.



This inside sensor is not available as a spare part. When installing a new inside sensor in these cars, the wires must be transferred in the multiple pin plug. Note colors of wires.

Inside Sensor with Blower Beginning With February, 1981

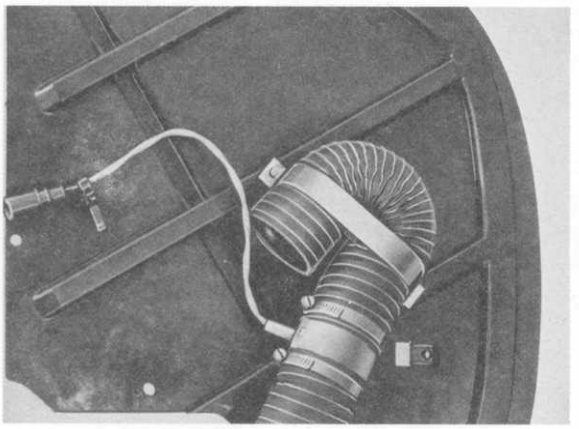


Removing and Installing Outside Sensor

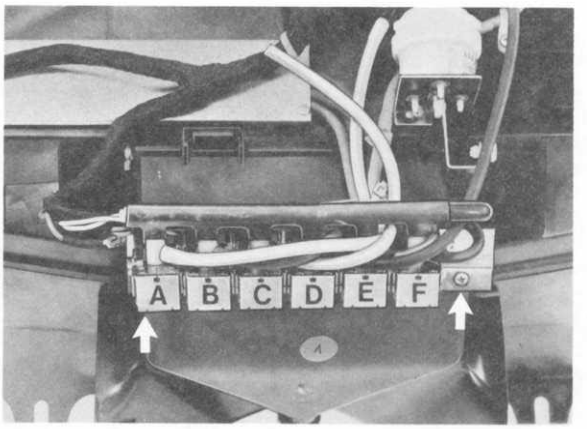
Outside sensor is located in fresh air hose of alternator.

1. Unscrew cover in front left wheel house.

2. Loosen hose straps on fresh air hoses and pull off of outside sensor housing. Disconnect plugs.



3. Unscrew valve carrier (2 screws).

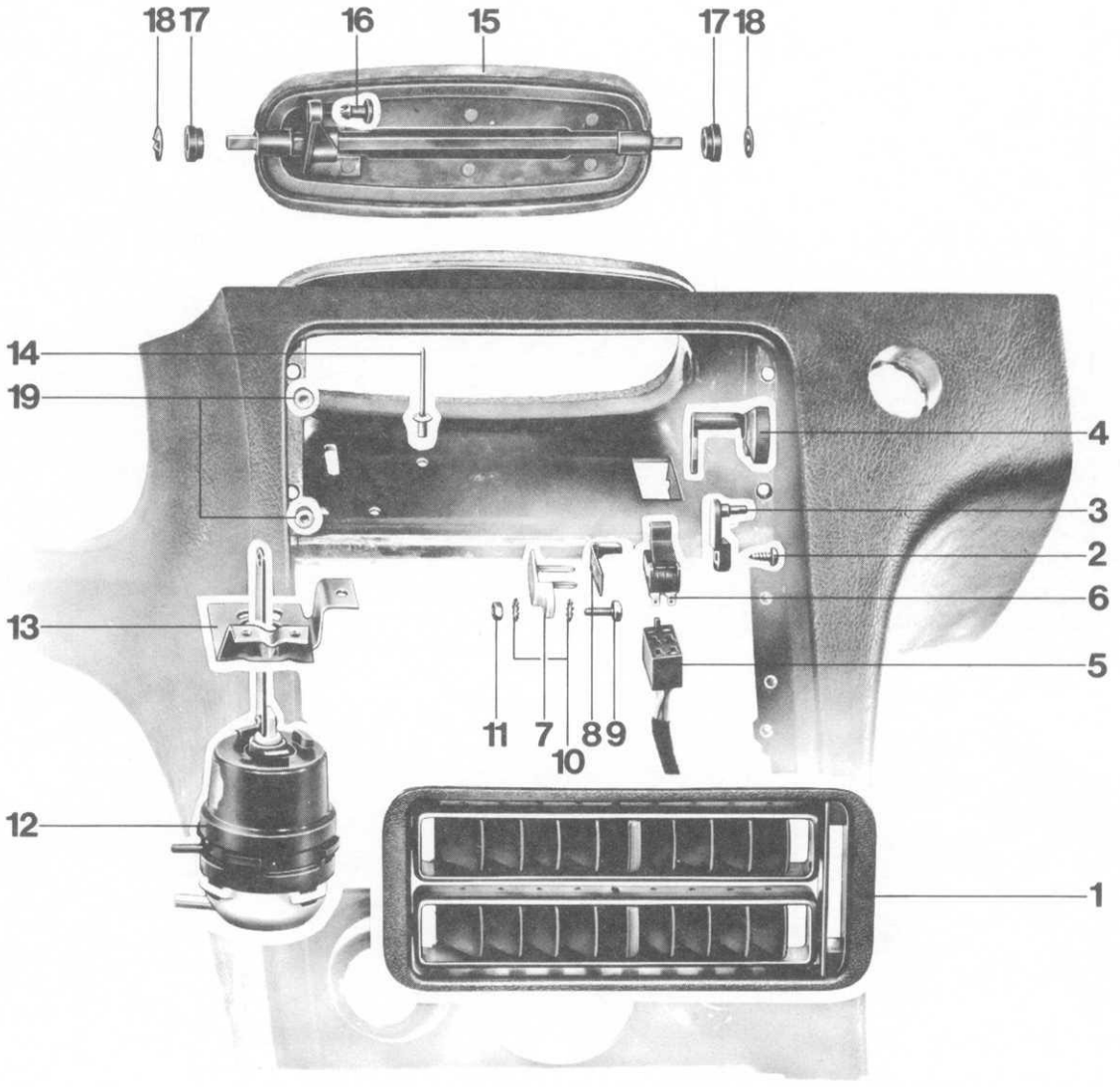


4. Unscrew mounting bolt of valve being replaced and disconnect by moving up.
Pull off vacuum line and electric wire.

Removing and Installing Solenoid Valves

1. Remove tray.

2. Unscrew trim panels on left and right sides of center console.


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No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Center nozzle	1			
2	Metal screw	1			
3	Mounting part	1			
4	Operating lever	1			
5	Plug	1			
6	Microswitch	1			
7	Microswitch holder	1			
8	Holder	1			
9	Bolt	1			
10	Lockwasher	2			
11	Nut	1			
12	Vacuum box for center nozzle	1			
13	Holder	1			
14	Rivet	3			
15	Flap, center nozzle	1			
16	Pin	1			
17	Bearing sleeve	2			
18	Speed fix	2			
19	Grommet	4			

AUTOMATIC AIR CONDITIONER
84 MODELS ONWARD

Technical data of air conditioning system

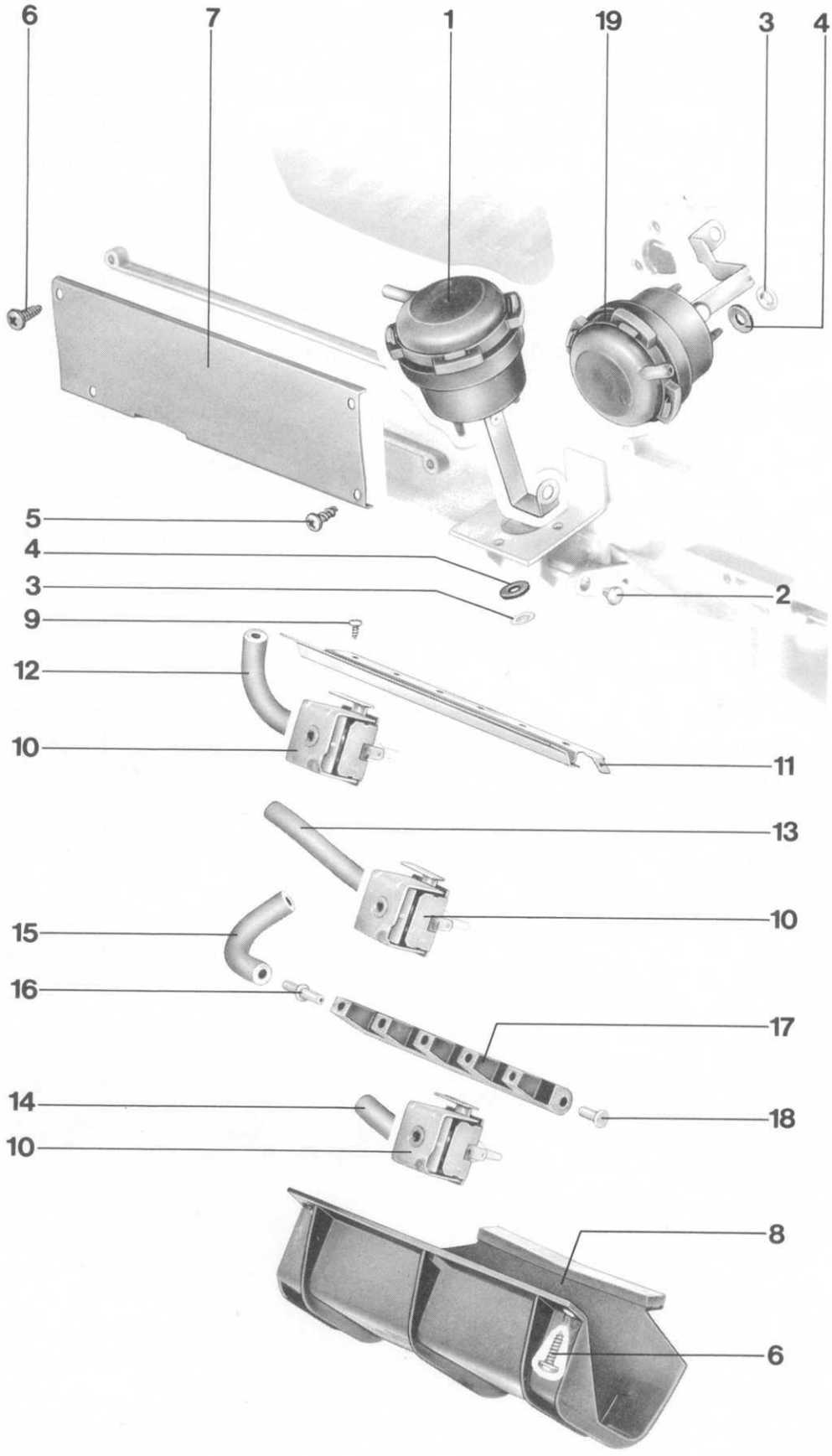
		up to June, 88	as of July, 88
Refrigerant volume	Refrigerant R12	1050 g	950 g
with auxiliary A/C system	Refrigerant R12	1200 g	1150 g
Refrigerant in compressor	Type 6 E 171	280 ± 20 c.c. Densoil 6	
	Type 10 PA 20 C	120 ± 20 c.c. Densoil 6	
Safety valve at fluid tank	The safety valve opens at a pressure of 40 ±5 bar.		
Compressor type installation 10 PA 20 C	Club-Sport and 928 GT as of MY '89 928 S4 as of MY '90		

Printed in Germany - XXVII, 1991

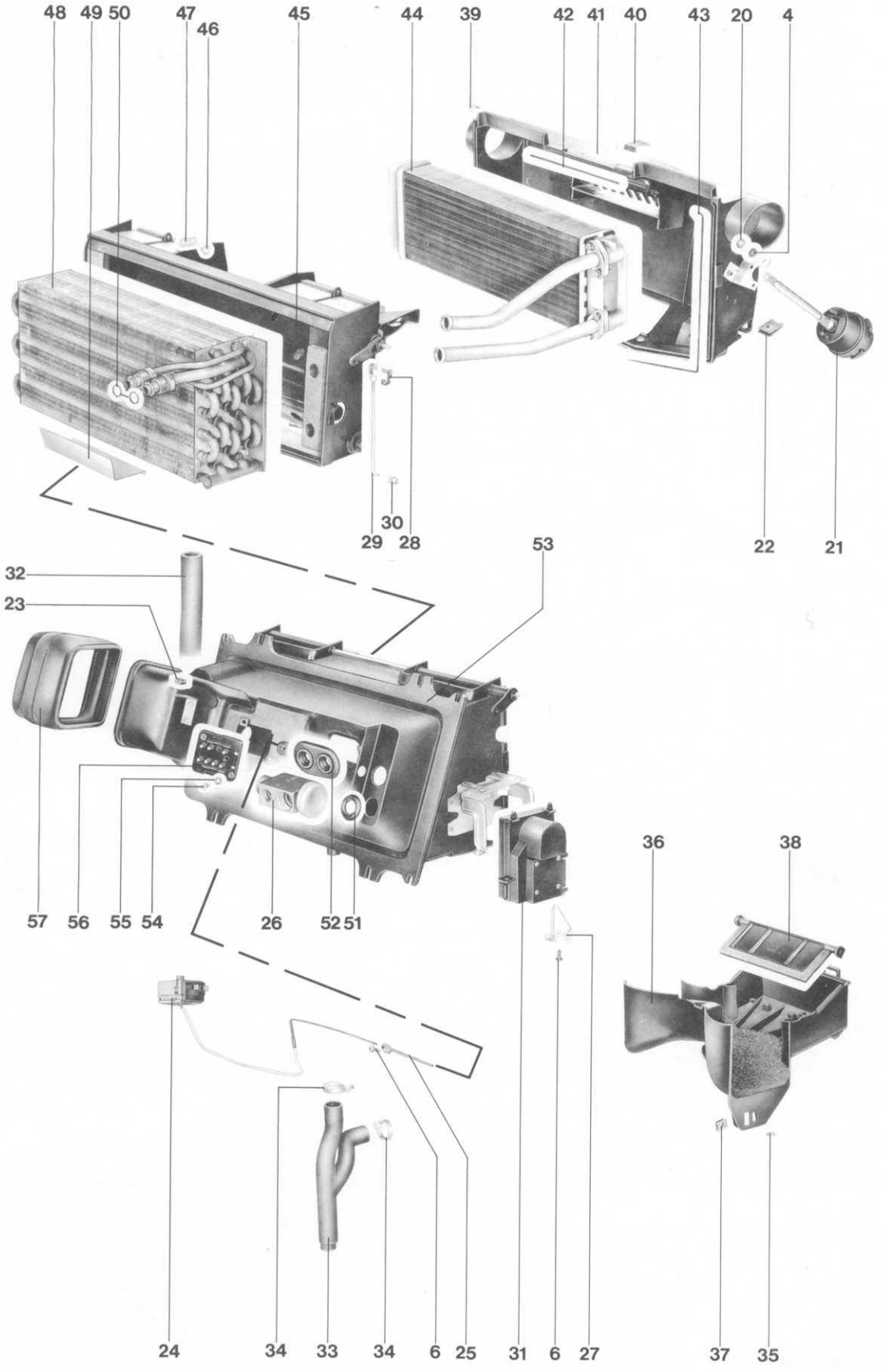
TIGHTENING TORQUES

Location	Description	Thread	Torque in Nm (ftlb)
Compressor - intake line	Union nut	7/8''x 14 UNF	33 (24)
Compressor - delivery line	Union nut	3/4''x 16 UNF	24 (17)
Condenser - inlet	Union nut	3/4'' x 16 UNF	24 (17)
Condenser - fluid tank	Union nut	3/4'' x 16 UNF	24 (17)
Fluid tank - evaporator	Union nut	5/8'' x 18 UNF	17 (12)
Expansion valve - delivery line	Gland screw	5/8'' x 18 UNF	17 (12)
Expansion valve intake line	Gland screw	7/8'' x 18 NS	33 (24)
Expansion valve - evaporator	Gland screw	3/4'' x 18 NS	24 (17)

DISASSEMBLING AND ASSEMBLING HEATER-AIR CONDITIONER



No.	Description	Qty	Note When: Removing	Installing
1	Vacuum unit	1		
2	Pin	1		
3	Speed fix	6		renew
4	Rubber washer	9		
5	Self-tapping screw	3		
6	Self-tapping screw	8		
7	Cover	1		
8	Cover	1		
9	Self-tapping screw	5		
10	Solenoid valve	5		
11	Holder	1		
12	Vacuum hose	1		
13	Vacuum hose	1		
14	Vacuum hose	3		
15	Vacuum hose	1		
16	Connector	1		
17	Header	1		
18	Plug	1		
19	Vacuum hose	1		


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No.	Description	Qty	Note When: Removing	Installing
20	Castellated nut lock	3		renew
21	Vacuum unit	1		
22	Sheet-metal	2		
23	Nut	1		
24	Antifreeze unit	1	Do not damage capillary tube.	Push in to mark
25	Guide tube	1		
26	Expansion valve	1		
27	Holder for cable plug	1		
28	Pin	1		
29	Linkage	1		
30	Clip	1		
31	Setting motor	1		
32	Hose	1		
33	Water drain hose	1		
34	Cable connector	2		
35	Castellated nut lock	1		renew
36	Housing - footwell	1		
37	Sheet-metal	1		
38	Footwell flap	1		
39	Clamp	2		renew if necessary

No.	Description	Qty	Note When: Removing	Installing
40	Clamp	8		renew if necessary
41	Housing, rear	1		
42	Sealing profile	1		renew
43	Sealing profile	1		renew
44	Heat exchanger	1		
45	Vent body	1		
46	Clip	4		
47	Linkage	2		
48	Evaporator	1		
49	Holder	1		
50	O-ring	2		renew
51	Rubber grommet	2		check that grommet is correctly seated
52	Rubber grommet	1		check that grommet is correctly seated
53	Housing, front	1		
54	Screw	2		
55	Washer	2		
56	Thermo-bimetal switch	1		
57	Rubber adapter	1		install with a suitable adhesive, e.g. Loctite IS 424

REMOVING AND INSTALLING HEATER-AIR CONDITIONER

1.Disconnect battery. If car has electrically adjustable seats, move seats to rearmost, lowest position (easier access).

2.Discharge air conditioner.

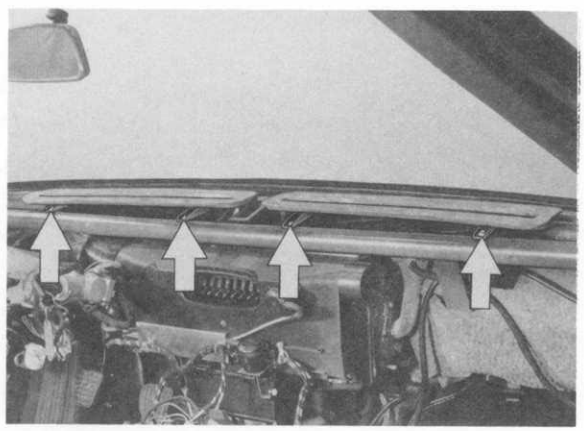
3.Drain coolant.

4.Remove instrument scoops.

5.Remove center console.

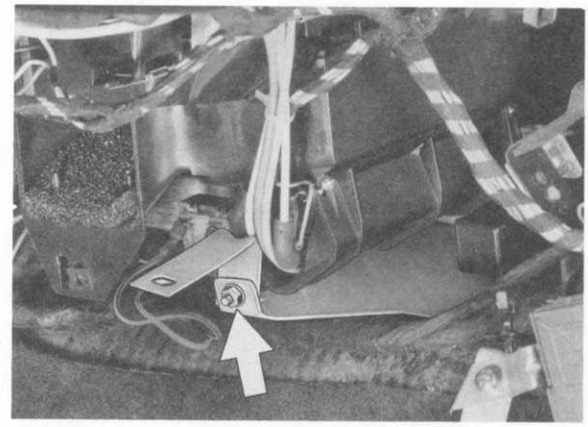
6.Remove instrument panel.

7.Remove air ducts to the side vents and to the glove compartment vent.



8.Remove defroster vents.

9.Remove bracket for left-hand oddments tray.



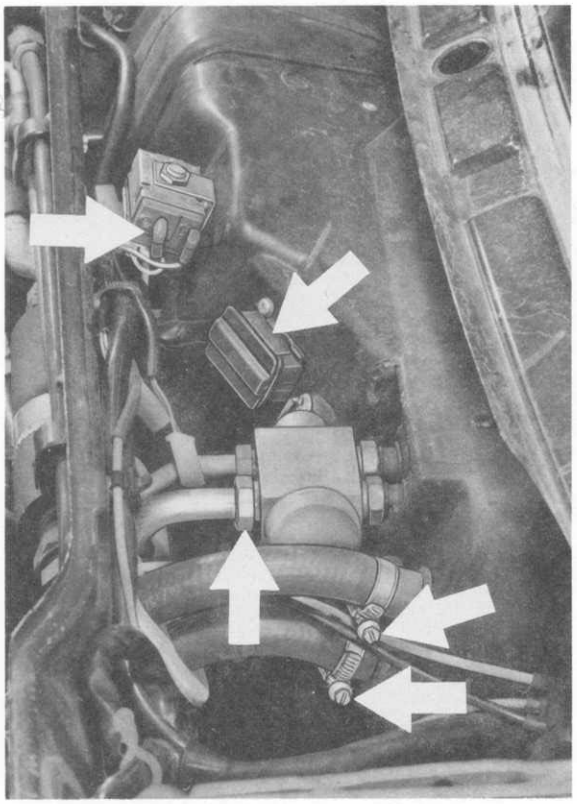
10.Unscrew bracket holding control unit of cruise control and move to right.

11.Remove blower cover in engine compartment.

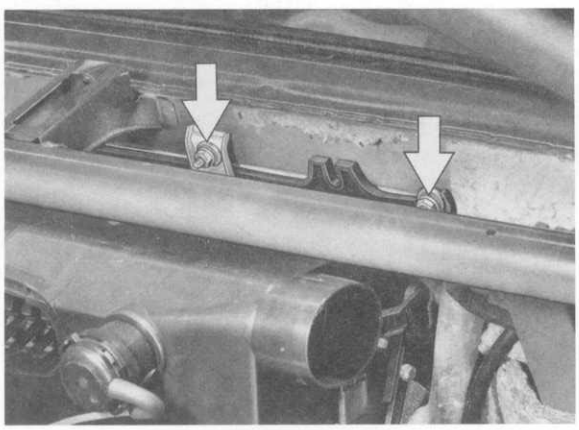
12.Remove wiper motor.

13.Disconnect plug from thermo-bimetal switch and antifreeze unit.

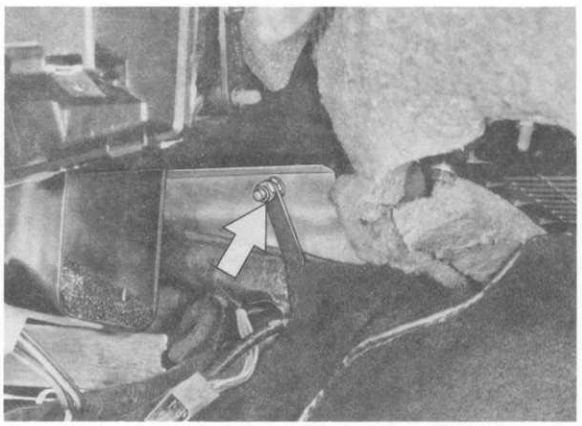
14.Unscrew low-pressure and high-pressure lines from expansion valve and plug lines.



15.Detach coolant hoses.



16.Unscrew 4 upper and 2 lower mounting nuts.
Remove mounting plate.



17.Detach vacuum hoses for fresh air/recirculating air flap (blue), water valve (white) and vacuum line (black).

18.Pull off water drain hose.

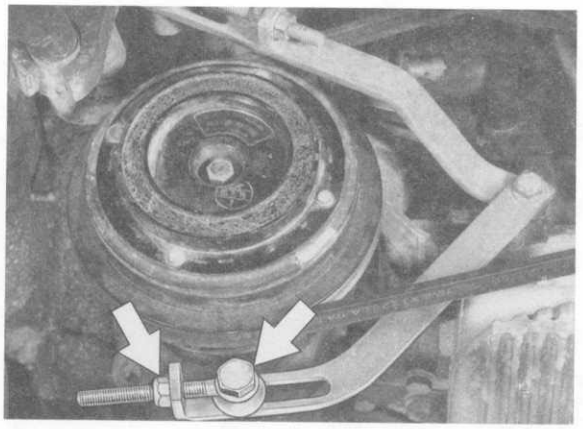
19.Withdraw heater-air conditioner.

REMOVING AND INSTALLING COMPRESSOR

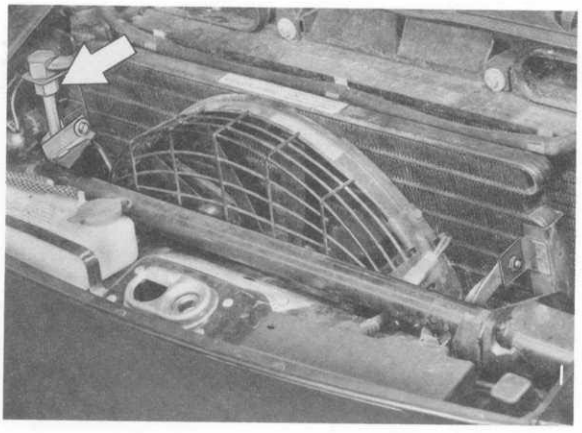
1.Drain air conditioner.

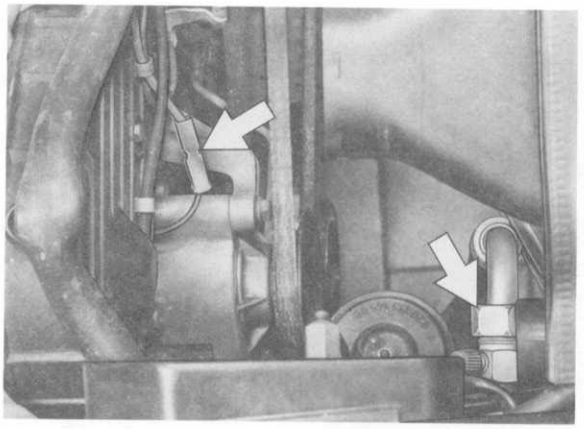
2.Unbolt guard beneath cooler.

3.Slacken compressor Vee belt and remove belt.



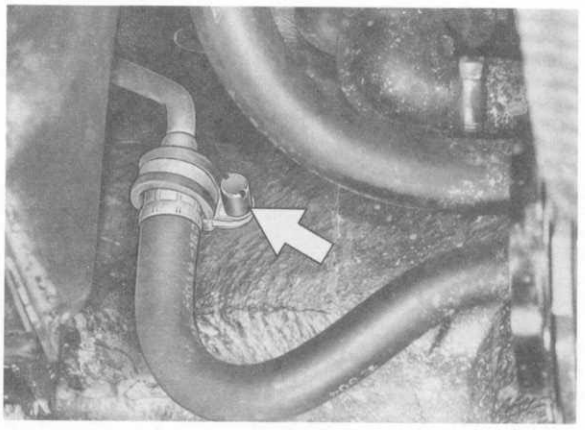
4.Disconnect hoses.



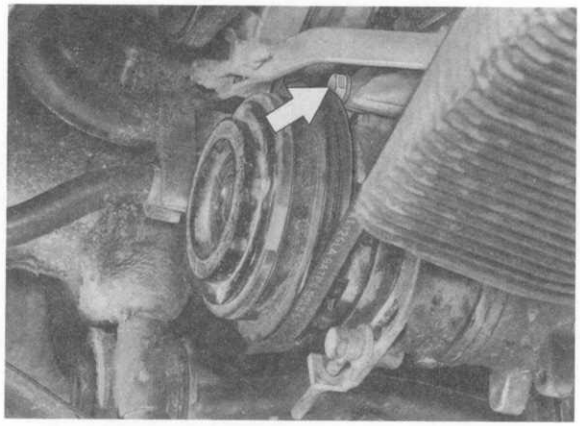


5.Disconnect plug-type connectors.

6.Slacken hose clamp.



7.Unscrew compressor mounting bolts and remove compressor complete with hoses.



8.Insert plugs in connections and lines.

N o t e :

New compressors are pressurized. Always unscrew caps slowly until refrigerant escapes with an audible hiss. Do not remove caps until compressor is depressurized.

Before installation, attach hoses to compressor and tighten clamps.

A d j u s t i n g V e e - B e l t

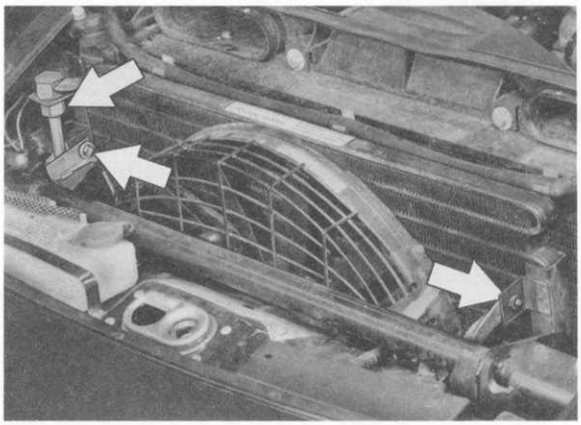
Check tension at a point halfway between pulleys by pressing belt with thumb. Deflection approx. 10 mm (see also page 13 - 18).

REMOVING AND INSTALLING CONDENSER

1.Discharge air conditioner.

2.Remove air intake screens.

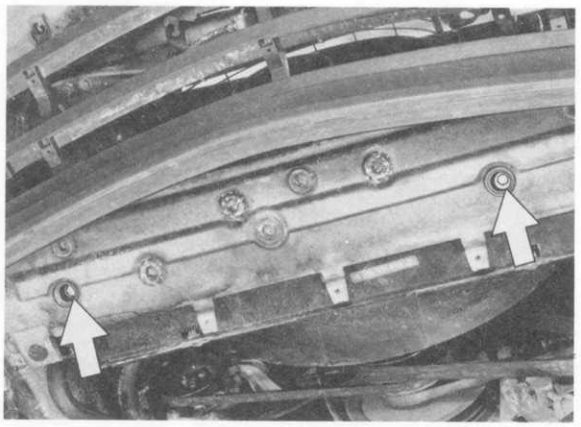
3.Remove fluid tank (see page 87 - 101).



4.Loosen holders at top left and right of lock transverse member and swing aside.

5.Remove hose.

6.Remove condenser lower mounting screws.



7.Remove condenser by lifting upward.

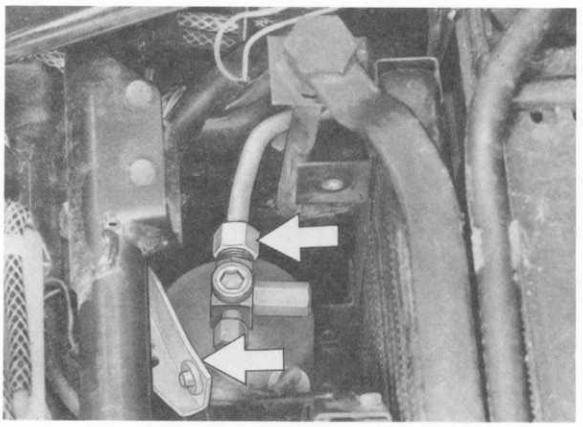
8.Plug connectors and lines.

REMOVING AND INSTALLING FLUID TANK

1.Discharge air conditioner

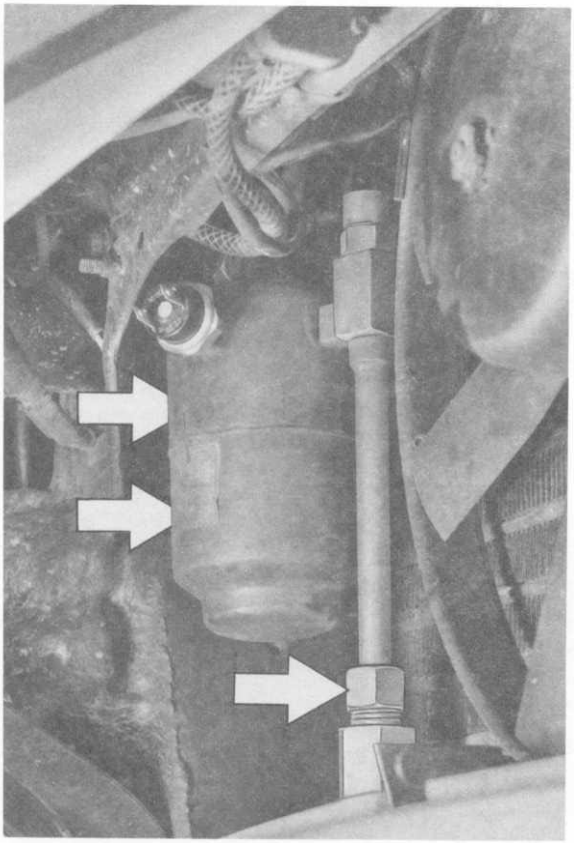
2.Remove air intake screens.

3.Disconnect plug for temperature and low-pressure switch.



4.Detach bracket at top right of lock transverse member and swing aside.

5.Disconnect feed lines.



6.Unscrew mounting bolts.

N o t e :

Always fit a replacement fluid tank if the system is defective or if the coolant circuit is opened.

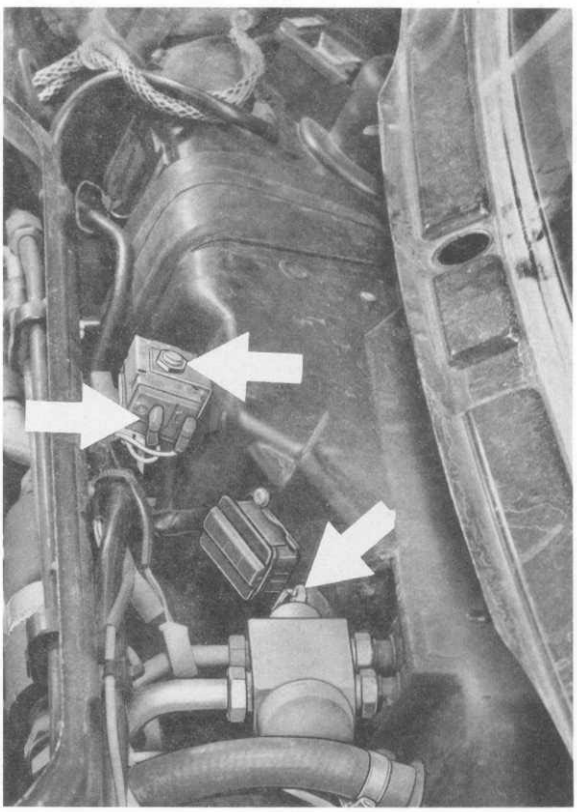
7.Plug connectors and lines.

REMOVING AND INSTALLING ANTIFREEZE UNIT

1.Remove lower cover in engine compartment.

2.Disconnect cable plug.

3.Unscrew mounting bolts.



4.Carefully withdraw capillary tube from guide tube.

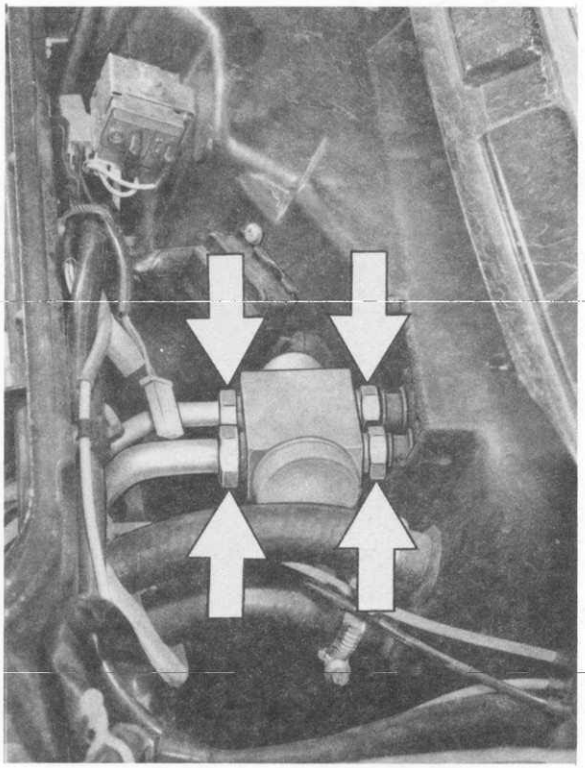
N o t e :

When installing, push capillary tube in to mark.

Removing and installing expansion valve

1. Remove blower cover in engine compartment.

2. Disconnect high and low-pressure lines.



86/468c

3. Disconnect evaporator connections.

4. Plug connectors and lines.

Distribution of oil in refrigeration circuit

Compressor	40%
Evaporator	35 %
Condenser	15 %
Fluid tank / lines	10 %

These values are approximations.

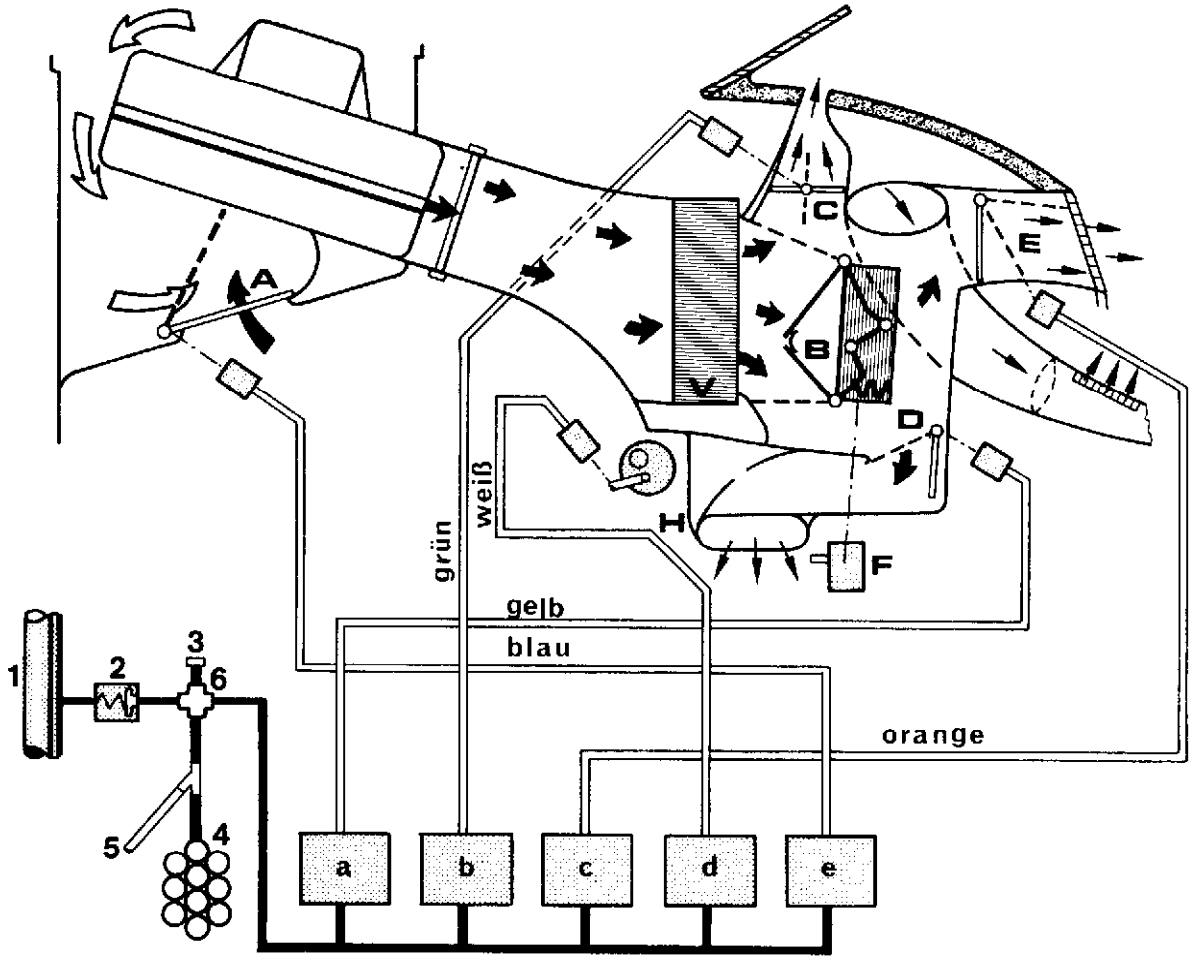
If a replacement compenent is fitted, top up the oil by an amount equal to the quantity left in the component removed.

The correct amount of oil can be poured directly into the new component.

If a replacement compressor is fitted, 60% of oil must be drained from the new compressor which contains the quantity for the entire system.

Printed in Germany – XXXI, 1993

VACUUM SYSTEM - SCHEMA



A - Fresh air/recirculating air flap

B - Temperature mixer flap

C - Defroster flap

D - Footwell flap

E - Bulkhead

F - Setting motor

H - Heating valve

V - Evaporator

W - Heat exchanger

1 - Intake line

2 - Non-return valve

3 - Test socket

4 - Vacuum tank

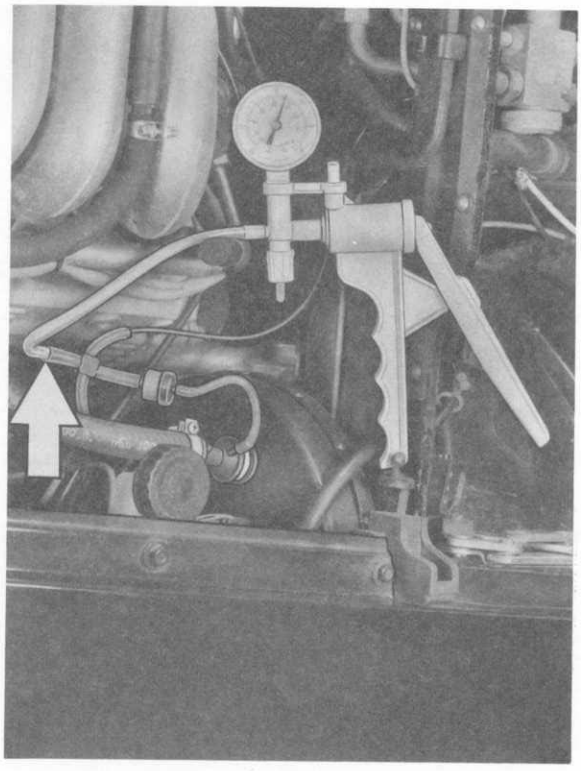
5 - To cruise control actuator

6 - Distribution manifold

a to e - Solenoid valves

CHECKING VACUUM SYSTEM

1. Connect vacuum handpump to test connection.



2. Pump until vacuum is established.

3. If no vacuum is created, use fuel-line clamps, for example, to close distribution manifold lines one by one until leak is located.

4. Eliminate any leaks found.

FLAP POSITION PROGRAM

	off	middle	bottom	top/ bottom	top	defrost
A	open	closed	closed	closed	closed	closed
C	closed	closed	closed	open	open	open
D	closed	closed	open	open	closed	closed
E	open	open	open	open	open	closed

Temperature regulator at max. cooling output

Flap A: open - recirculating air
closed - fresh air

FLAP POSITION PROGRAM

	off	defrost	BS	AC	TR
A	closed	open		0 - 10 open 10 - 100 closed	
B		max. heating output			0-100
E	open	closed			0-20 open 20-100 closed
Heating valve	closed	open			0-20 open 20-100 closed
Blower	off	stage 4	stages 1-4		
Compres- sor	off	on		on	

BS - Blower switch

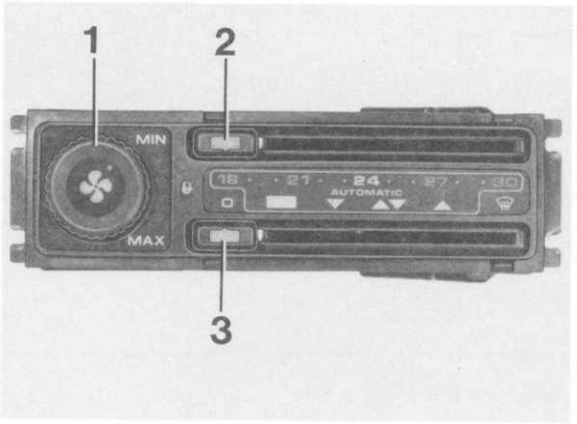
AC - Air-conditioner switch

TR - Temperature regulator

The figures from 0 - 100
indicate the position of the
setting motor in percent.

0% - max. cooling output
100% - max. heating output

CHECKING FLAP POSITION PROGRAM



1 - Switch for fresh-air blower

2 - Slide control for temperature adjustment

3 - Slide control for air distribution

Testing preconditions:

Vacuum system leaktight and depressurized.

Switch ignition on. Open central vent.

1.Set slide 2 to max. cooling output. Set slide 3 to "Off".

The positions of the flaps must be as follows:

Flap A - recirculating air

Flap C - closed

Flap D - closed

Flap E - open

Water valve - closed

2.Set slide 3 for air supply to central vent.

Flap A - fresh air.

The other flaps remain at positions as for check 1.

3.Set slide 3 for air supply from bottom vent.

Flap D - opens.

4.Set slide 3 for air supply from upper/lower vents.

Flap C opens.

5.Set slide 3 for air distribution from top vent.

Flap D closes.

6. Set slide 3 to defrost.

   Flap A - recirculating air.
   Flap E closes.
   Water valve opens.
   Compressor switchs on.
   Blower switchs to Stage 4.
   Setting motor moves to max. heating output.

7. Set slide 3 to air supply from central vent. Setting motor moves to max. cooling output.

   Set slide 2 to 27.
   The setting motor moves toward heating. As of 20% heating output, water valve opens and flap E closes.

   Close central vent.
   Flap E opens.

   Press AC button.

   At 10%, flap A switches to recirculating air.

If the specified statuses are not attained, check operating switch, solenoid valves and setting motor.

N o t e :

The position of the fresh air/recirculating air flap can be checked by inserting a finger through the hole in the intake screen in the passenger-side footwell.

The position of the bulkhead flap is visible with the cover removed from the central vent and the vent open.

The position of the temperature mixer flap can be tested by inserting a finger between setting motor and air deflector chamber.

CHECKING OPERATING SWITCH

N o t e :

With operating switch removed and all connections made, use a voltmeter to test voltages at the 15-pole plug.

1.Switch on ignition.

2.Connect voltmeter to terminal 1 (plus) and terminal 4 (minus).

Air-distribution slide at bottom and bottom/top.

Reading: Battery voltage.

3.Connect voltmeter to terminal 2 and terminal 4.

Air-distribution slide at off, center and bottom..

Reading: Battery voltage

4.Connect voltmeter to terminal 3 and terminal 4.
Switch on position lights.

Reading: Battery voltage.

5.Connect voltmeter to terminal 5 and terminal 4.
Air-distribution slide at centre, bottom, bottom/top, top and defrost.

Reading: Battery voltage.

If no voltage is registered, check whether fresh-air blower relay switches. If the fresh-air blower relay does not switch, test the signal at terminal 86. Connect voltmeter to terminal 15 and terminal 4 of operating switch.
Air-distribution slide at the same positions.

Reading: Battery voltage.

6.Connect voltmeter to terminal 7 and terminal 4.
Air-distribution slide at center, bottom, bottom/top and defrost.
Switch on auxiliary air conditioner.

Reading: Battery voltage

If no voltage is registered, check air-conditioner switch.

7.Connect voltmeter to terminal 6 and terminal 4.
Air-distribution slide at center, bottom, bottom/top and top.
Switch on auxiliary air conditioner.

Reading: Battery voltage.

8. Connect voltmeter to terminal 8 and terminal 4.
Air-distribution slide to center, bottom, bottom/top and top.
Temperature regulator slide at 18.

Reading: Battery voltage

Move temperature regulator slide to 27. The setting motor moves toward heating. At 10%, the voltage in interrupted.

9. Connect voltmeter to terminal 9 and terminal 4.
Air-distribution slide at off.

Reading: Battery voltage

10. Leave voltmeter connected to terminal 9 and terminal 4.
Air-distribution slide at center, bottom, bottom/top and top.
Switch on air conditioner.
Temperature regulator slide at 18.

Display: Battery voltage.

Set temperature regulator slide to 27. The setting motor moves toward heating. Voltage is interrupted at 10%.

11. Connect voltmeter to terminal 10 and terminal 4.

Reading: Battery voltage

12. Connect voltmeter to terminal 11 and terminal 4.
Air-distribution slide at defrost.

Reading: Battery voltage

The fresh-air blower must run at top speed. If not, check defrost relay or fresh-air blower.

13. Connect voltmeter to terminal 12 and terminal 4.
Air-distribution slide at center, bottom, bottom/top and top. Temperature regulator slide at 18.

Reading: Battery voltage

Move temperature regulator slide to 27. The setting motor moves toward heating. Voltage is interrupted at 20%.

14. Connect voltmeter to terminal 15 and terminal 4.
Air-distribution slide at center,
bottom, bottom/top, top and defrost.

Reading: Battery voltage

15. Disconnect cable plug. Connect ohmmeter to terminal 13 and terminal 14.
Move temperature regulator slide to 18.

Reading: approx. 750 ± 100 Ohm

Move temperture regulator slide to 30.

Reading: approx. 1750 ± 100 Ohm

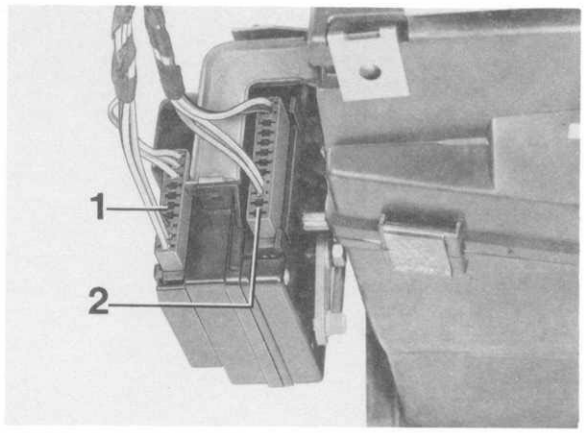
N o t e :

The resistance must change by approx. 1000 Ohm.

If the values at terminals 1, 2, 6, 9, 11, 12, 13, 14 and 15 are not attained, the operating switch is defective and must be replaced.

If the values are not attained at the other terminals, check the wiring using the circuit diagram.

TESTING SETTING MOTOR



1.Disconnect plug 2.

2.Switch on ignition.

3.Air-distribution slide at center, bottom, bottom/top and top. Temperature regulator slide at 18. Open central vent.

4.Connect voltmeter to terminal 3 (minus) and terminal 11 (plus).

Reading: Battery voltage.

5.Connect ohmmeter to terminal 4 and terminal 12.
Set temperature regulator slide to 18.

Reading: at 20°C approx. 3.7 kOhm.

Set temperature regulator slide to 30.

Reading: at 20°C approx. 4.7 kOhm.

N o t e :

Resistance increases as temperature drops and decreases as temperature rises. A resistance change of some 1000 Ohm is important. If no change in resistance is recorded, the operting switch must be checked separately.

If the ohmmeter reads infinity, there is an interruption in the sensor chain which comprises internal sensor, external sensor and operating switch.

If the reading of the ohmmeter is smaller by a significant margin, there is a short-circuit in a sensor or in the operating switch.

Check switching functions of setting motor with plug 1 connected. Probe wires from back of plug.

6.Connect voltmeter to terminal 3 and vehicle ground.

Reading: Battery voltage.

7.Connect voltmeter to terminal 8 and vehicle ground.

Reading: Battery voltage

8.Connect voltmeter to terminal 2 and vehicle ground.

Reading: Battery voltage.

Set temperature regulator slide to 27. Setting motor moves toward heating. Voltage is interrupted at 20%.

9. Connect voltmeter to terminal 9 and vehicle ground. Temperature regulator slide to 18.

   Reading: Battery voltage.

   Set temperature regulator slide to 27. The setting motor moves toward heating. Voltage is interrupted at 10%.

10. Connect voltmeter to terminal 10 and vehicle ground.

    Reading: 0 volt.

    Close central vent.

    Reading: Battery voltage

11. Reopen central vent. Connect voltmeter to terminal 1 and vehicle ground.

    Reading: 0 volt

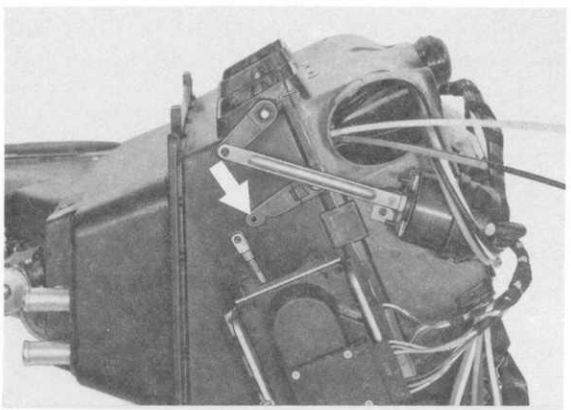
    Close central vent.

    Reading: Battery voltage.

ADJUSTING TEMPERATURE MIXTURE FLAPS

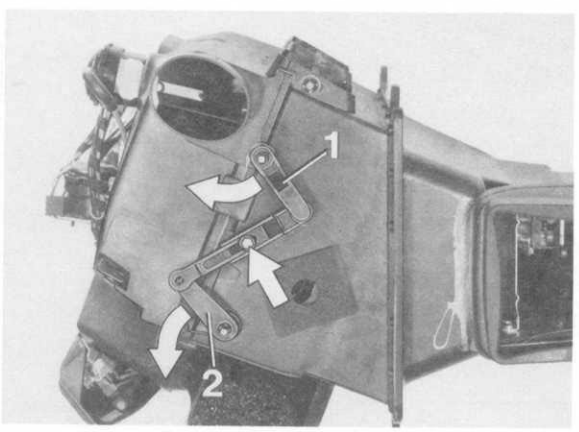
1.Set setting motor to maximum cooling output.

2.Disconnect setting motor linkage.



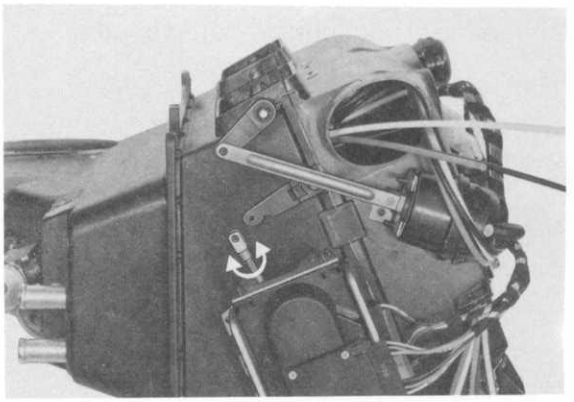
3.Move lever downward to maximum cooling position.

4.On right-hand side, remove securing screw of lever system.



5.Press lever 1 forward and lever 2 down as far as possible. Retighten securing screw.

6.Turn linkage until holes are aligned.



7.Engage pin.

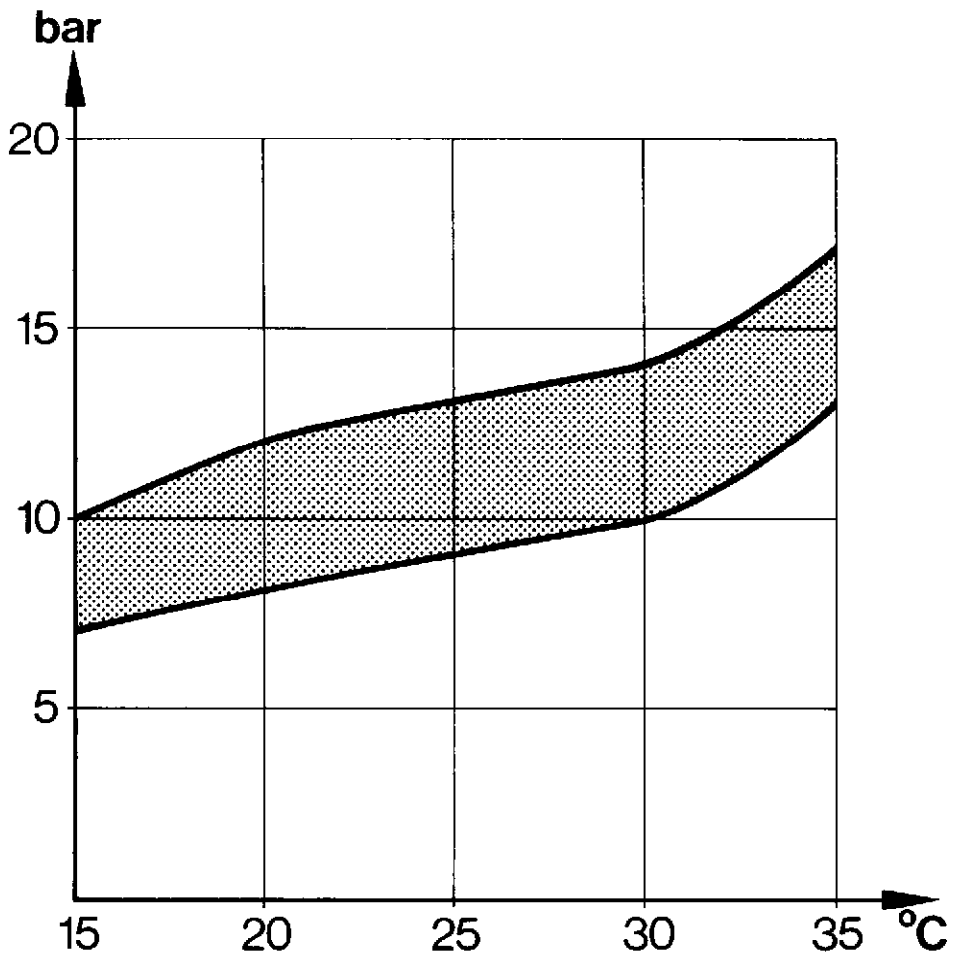
PRESSURE AND TEMPERATURE SPECIFICATIONS

General preconditions:

- Vee-belt properly tensioned.
- Vacuum system OK.
- Flap position program OK.
- Magnetic coupling engages.
- Condenser clean.

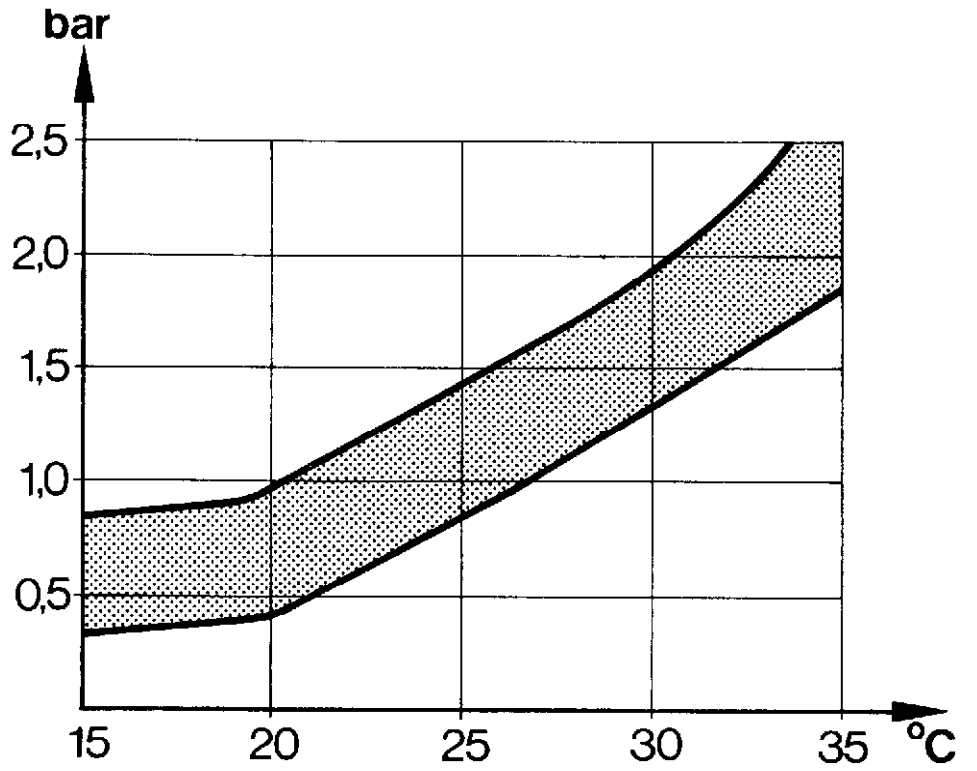
1. Switch on air conditioner.
2. Set temperature regulator to max. cooling output.
3. Set fresh-air blower to stage 2.

After running for approx. 10 minutes at a speed of 2000 rpm with compressor switched on, the pressures and temperatures must be as shown in the graphs below.



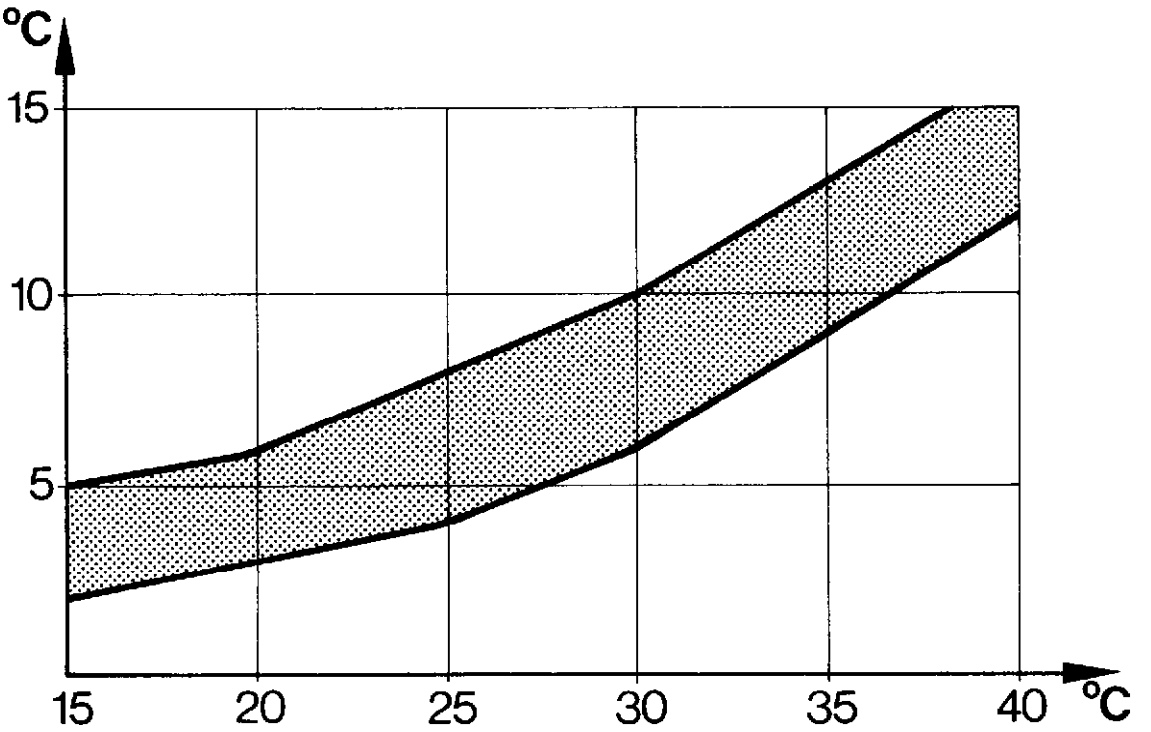
Air-intake temperature

High-pressure in the refrigeration circuit plotted against air-intake temperature



Low-pressure in the refrigeration circuit plotted against air-intake temperature.

Temperature at central vent



Temperature of air at the central vent plotted against air-intake temperature.

AIR CONDITIONER, TROUBLESHOOTING

Complete cooling failure

1.Rupture element in fluid tank ruptured.

The system has overheated. Check operation and direction of rotation of cooling blower.

2.Connect service device and check pressure values.

Low pressure too low.
High pressure too low.

No refrigerant in the system. Look for leak. Refill air conditioner.

3.Switch on air conditioner and check pressure values.

Low pressure too high.
High pressure too low.

Compressor defective.

Low pressure too low.
High pressure too high.

Expansion valve defective.

Insufficient Cooling Output

Connect service device.

Switch on air conditioner and check pressure readings.

1.Low pressure normal.
High pressure too high.

The system is overfilled. Discharge air conditioner and refill.

2.Low pressure too low.
High pressure too low.

Insufficient coolant in system. Look for leak. Refill air conditioner.

3.Low pressure too high.
High pressure normal.

Expansion valve defective.

Insufficient Cooling Output After Brief Period of Operation

Initial cooling output is satisfactory, but diminishes after a period of time.

Ice accretion on evaporator. Anti-freeze protection switches off air-conditioning compressor. Check correct seating of capillary tube and inspect for damage.

or

Ice accretion on expansion valve. Heat expansion valve with a hot-air blower. The cooling efficiency of the air conditioner must return to normal. Cause: moisture in refrigerant. Fit replacement fluid tank. Recharge air conditioner.

N o t e :

If the air conditioner is refilled, the air-conditioning compressor may only be switched on for the first time when the engine is idling. Subsequently, the compressor can be fully loaded under all operating conditions.

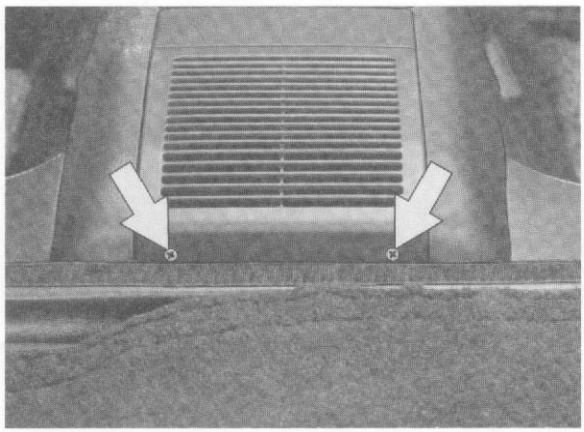
AUXILIARY AIR CONDITIONER

An auxiliary evaporator for increased refrigeration output is available as an option (M 570). The auxiliary evaporator with 3-stage blower is installed instead of the rear parcel shelf.

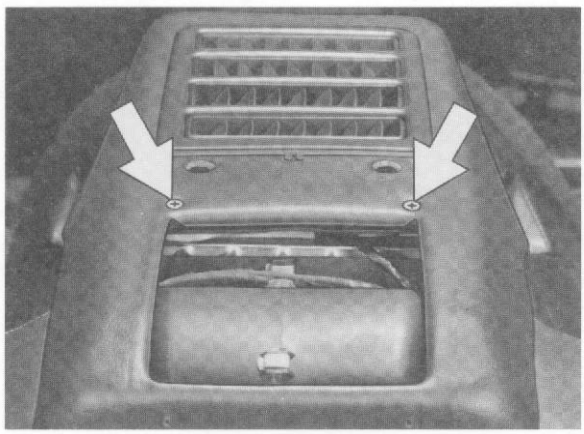
R e m o v i n g a n d
I n s t a l l i n g
E v a p o r a t o r

1.Remove rear seat backrests.

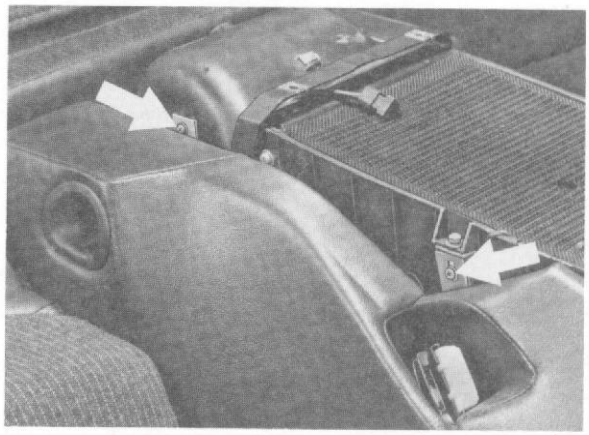
2.Remove air intake screen.



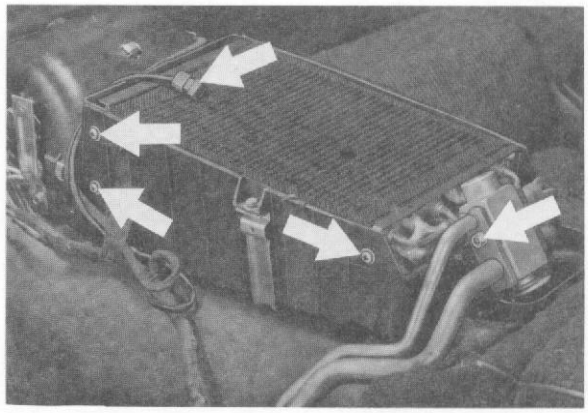
3.Remove upper cover.



4.Remove lower cover.



5.Withdraw temperature sensor.



6.Unscrew Allen-head bolt.

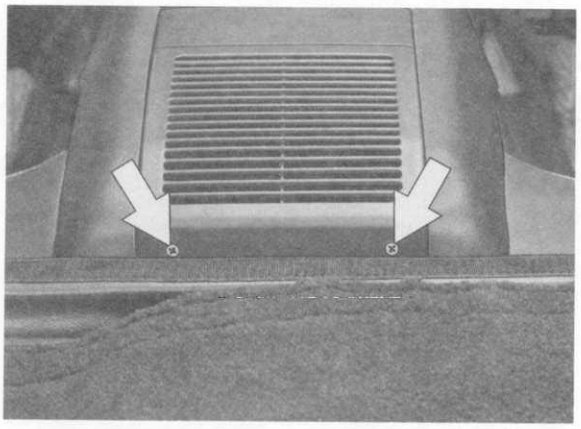
7.Remove mounting screws (6 screws).

N o t e :

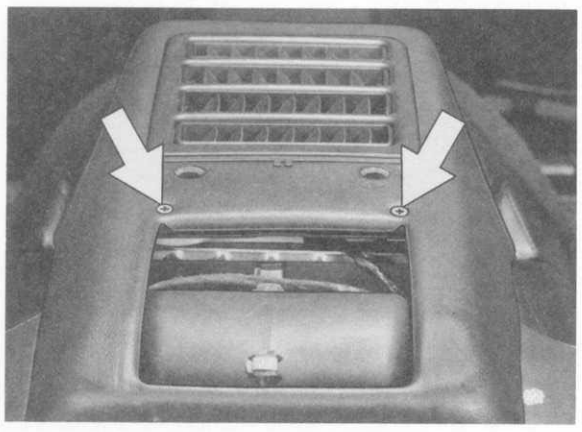
The tightening torque for the M 6 Allen-head bolt is 9 Nm (7ftlb). Renew O-rings in the connections in the lines to the expansion valve.

Removing and Installing Expansion Valve

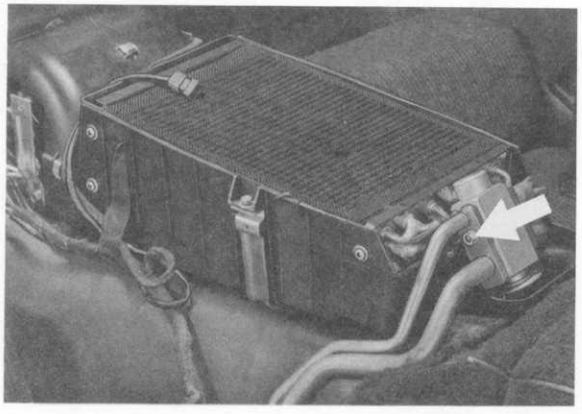
1.Remove air intake screen



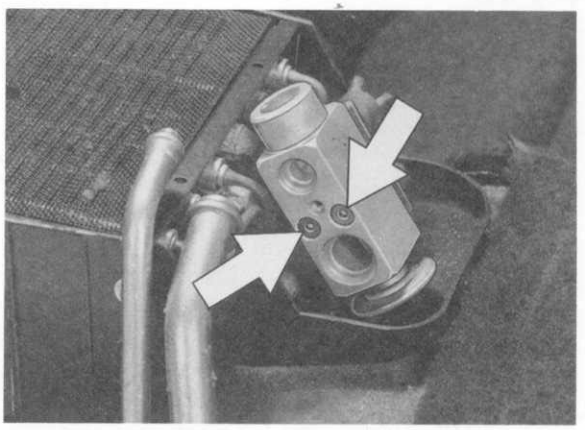
2.Remove upper cover.



3.Unscrew M 6 Allen-head bolt.



4.Unscrew M 5 Allen-head bolts.



Note:

Tightening torques

M 5 bolt: 6 Nm (4 ftlb)
M 6 bolt: 9 Nm (7 ftlb)

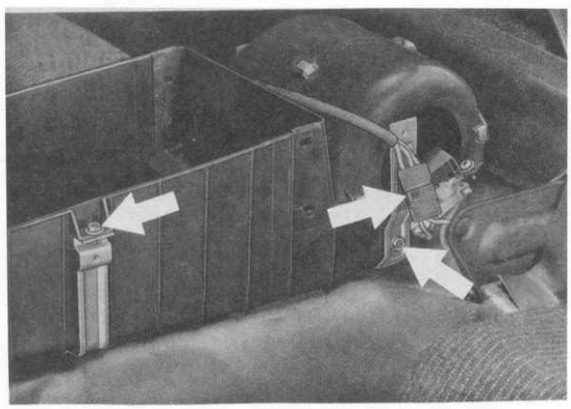
Renew all 4 O-rings.

Removing and Installing Blower

1. Remove evaporator (see page 87 - 120).

2. Disconnect cable from blower.

3. Disconnect plug-in connector to series resistors.

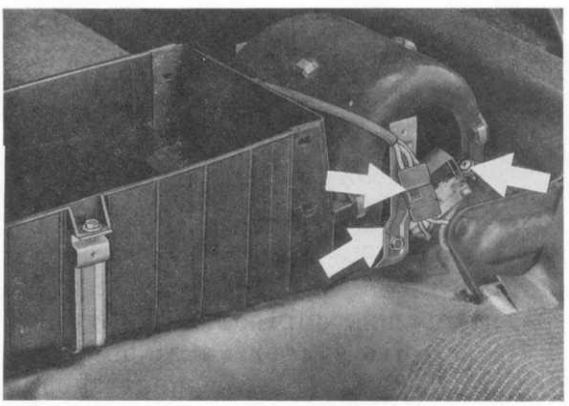


4. Remove 4 mounting screws.

Removing and Installing Series Resistors

1. Remove covers, see section headed Removing and Installing Evaporator.

2. Disconnect plug-in connector.

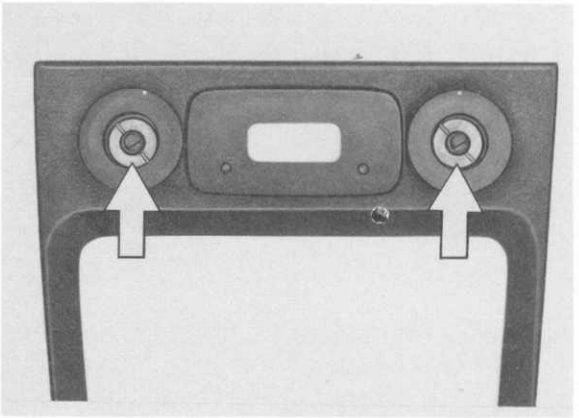


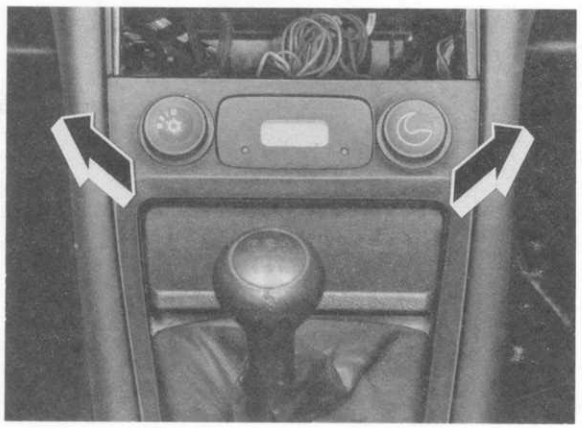
3. Remove mounting screws.

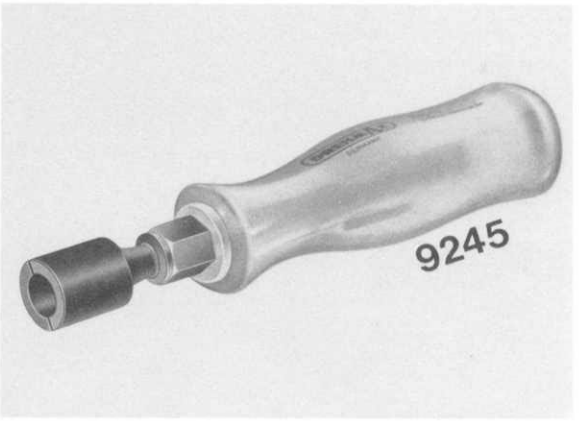
Removing and Installing Blower Switch and Temperature Regulator

1.Remove radio.

2.Beginning at top, pull frame up and out.







3.Pull socket housing off switch and regulator.

Special tool P 9245

4.Disconnect cable to clock.

5.Remove control knobs.

6.Unscrew covers with special tool P 9245.

Removing and Installing Solenoid Valve

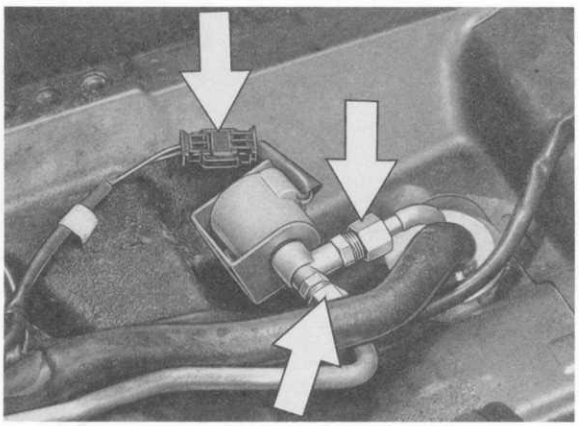
Note:

The solenoid valve is located beneath the passenger seat.

1. Remove passenger seat. If seat is electrically adjustable, move seat to highest position to facilitate removal.

2. Remove carpet.

3. Disconnect plug-in connector.



4. Unscrew threaded couplers.

Note:

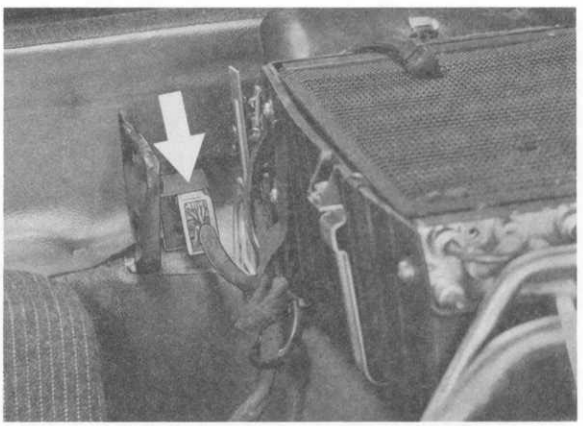
Use a suitable wrench to counter when unscrewing or tightening threaded couplers.

Renew O-rings.

Checking Control Unit

Note:

The control unit is located to the right of the blower.



1. Remove covers, see section headed Removing and Installing Evaporator.

2. Disconnect plug.

Note:

The terminal designations on plug receptacle and control unit are not identical. The inspection described below refers to the designations on the control unit. Check receptacle after unplugging.

3. Connect voltmeter to plus and terminal 1.

Reading: Battery voltage

4.Connect voltmeter to minus and terminal 4. Switch on ignition and blower for auxiliary air conditioner.

Reading: Battery voltage

5.Connect ohmmeter to terminal 2 and minus.

Reading: 10 kOhm ± 10%

6.Connect ohmmeter to terminal 2 and terminal 3.

Reading: 1 - 10 kOhm ± 10%, depending on setting of temperature regulator.

N o t e :

If the readings under points 4 and 5 are not attained, check temperature regulator separately.

Terminals I and II: 10 kOhm ± 10%
Terminal II and +: 0-10 kOhm ± 10%

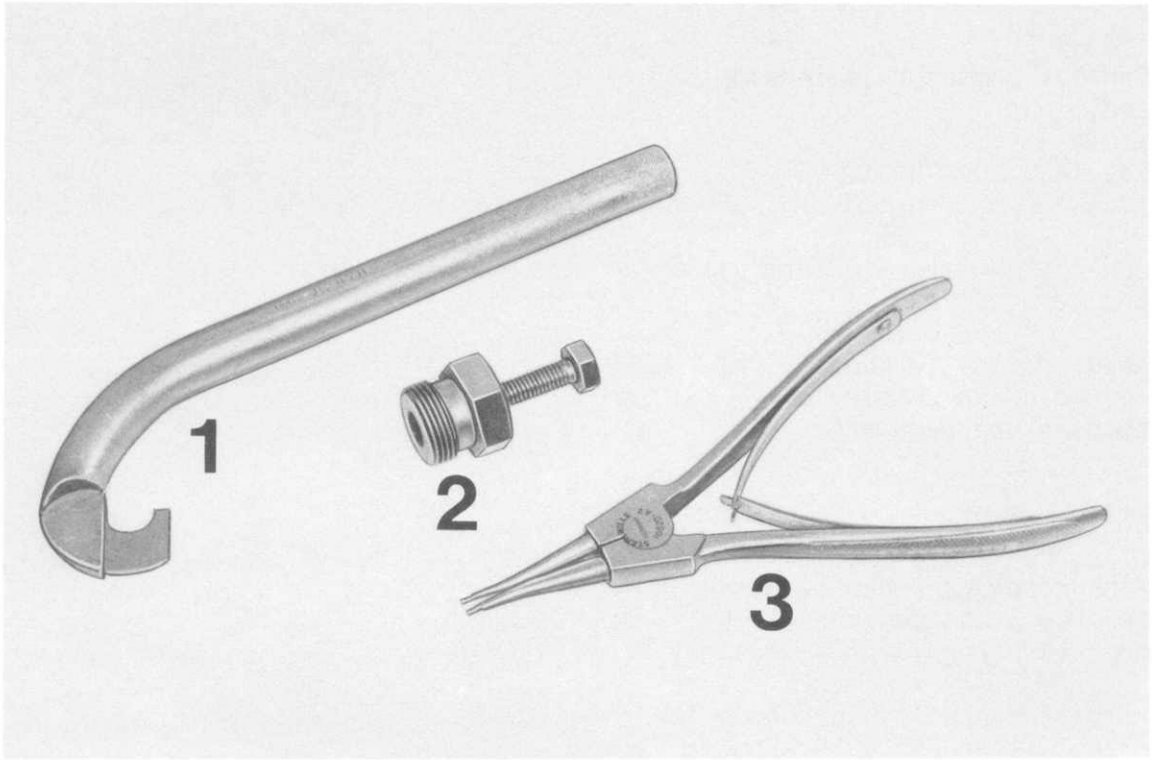
7.Connect ohmmeter to terminal 6 and minus.

Reading: at 20°C approx. 3.5 kOhm
at 25°C approx. 2.8 kOhm

The resistance diminishes as temperature increases.

8.With ignition and auxiliary blower switched on, bridge terminal 4 and terminal 5 with a suitable jumper lead. The response of the solenoid valve must be audible.

TOOLS



No.	Designation	Special Tools	Remarks
1	Strap wrench	95458 - 02070	Source: see Workshop Manual
2	Clutch plate puller	95458 - 03064	
3	Pliers for circlips		commercially available

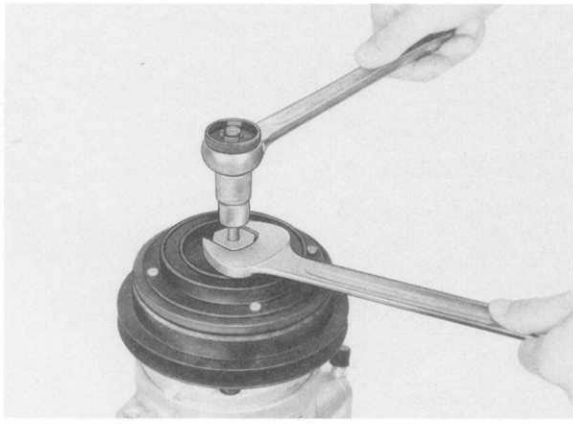
REMOVING AND INSTALLING MAGNETIC CLUTCH

1.Use strap wrench to counterhold when loosening or tightening the mounting nut.

Tightening torque: 16 Nm (12 ftlb)

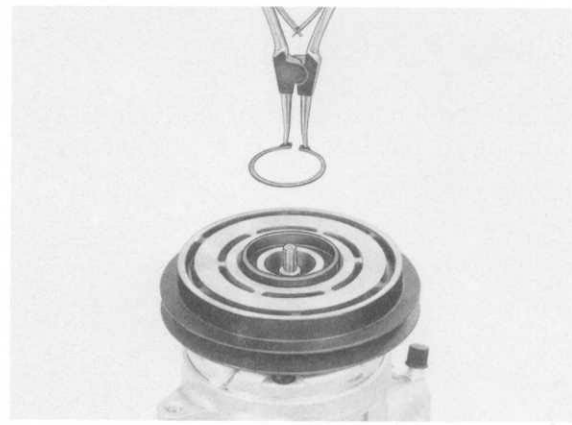


2.Remove clutch plate with puller.

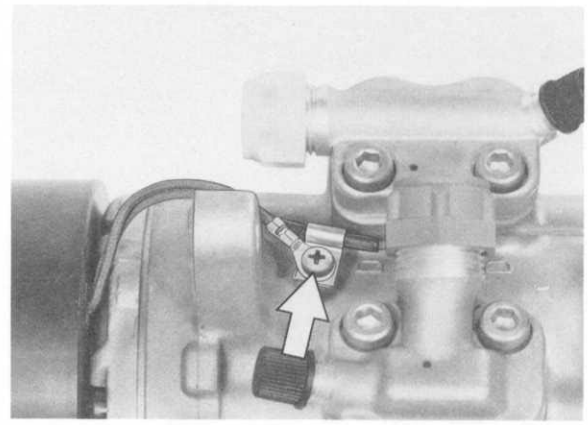


3.Remove shims.

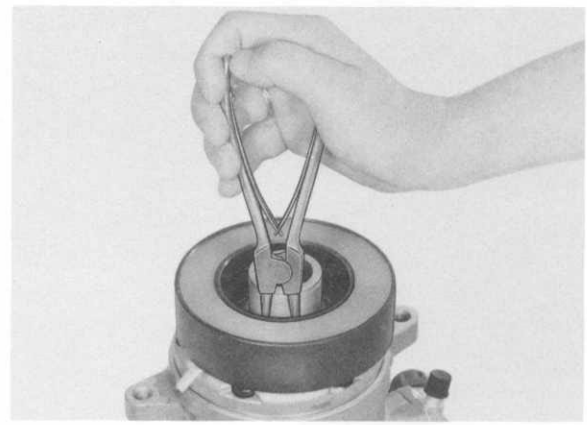
4.Remove circlip and take off pulley.



5.Unscrew cable holder



6.Remove circlip and lift off magnetic coil.

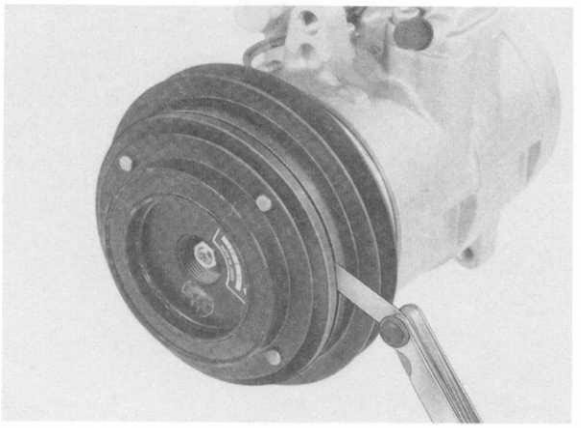


N o t e :

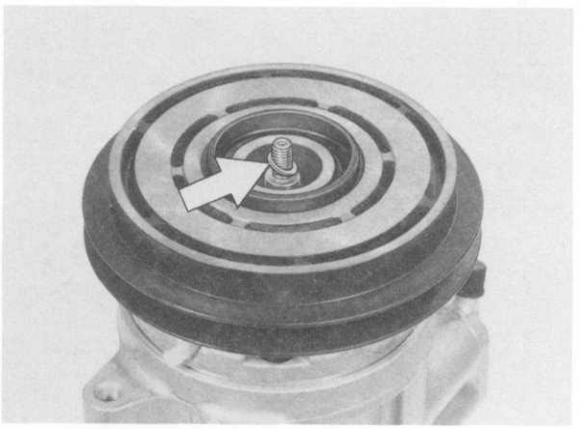
Coil resistance is 3.8 ± 0.2 Ohm.

I n s t a l l i n g

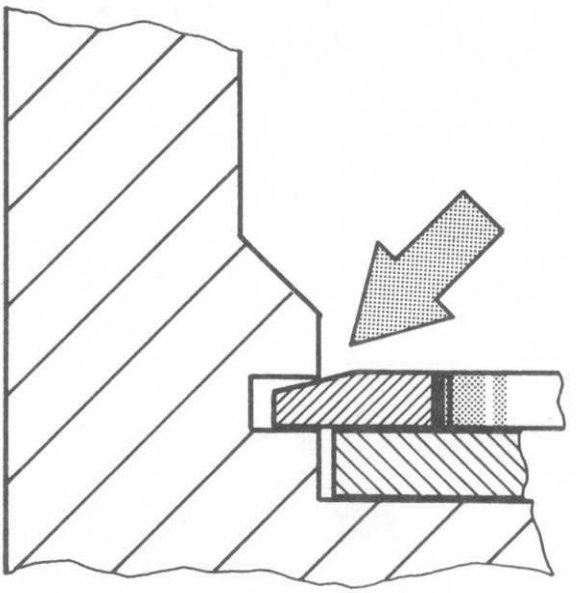
The clearance between clutch plate and belt pulley is 0.4 - 0.7 mm.



If necessary, correct clearance by inserting or removing shims.



Install both circlips with bevelled edges facing upward.



Technical data of air conditioning system

As of MY '93

Refrigerant charge	**Refrigerant R 134 a**	860 g
with auxiliary air conditioning		1050 g
Refrigerant oil in compressor		160 ± 20 c.c. ND 8
Compressor type	10 PA 20 C	
Safety valve on fluid tank	The valve opens at a positive pressure of 41 to 43 bar and closes again as soon as the pressure drops below this value.	

Note

When fitting the refrigerant lines, coat the fittings and O-rings with refrigerant oil.

Dispose of the refrigerant oil as **hazardous waste.**

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Pressure and temperature specifications

Refrigerant R 134 a

General Testing Requirements:

– V-belt tightened properly.

– Vacuum system o.k.

– Solenoid clutch energized.

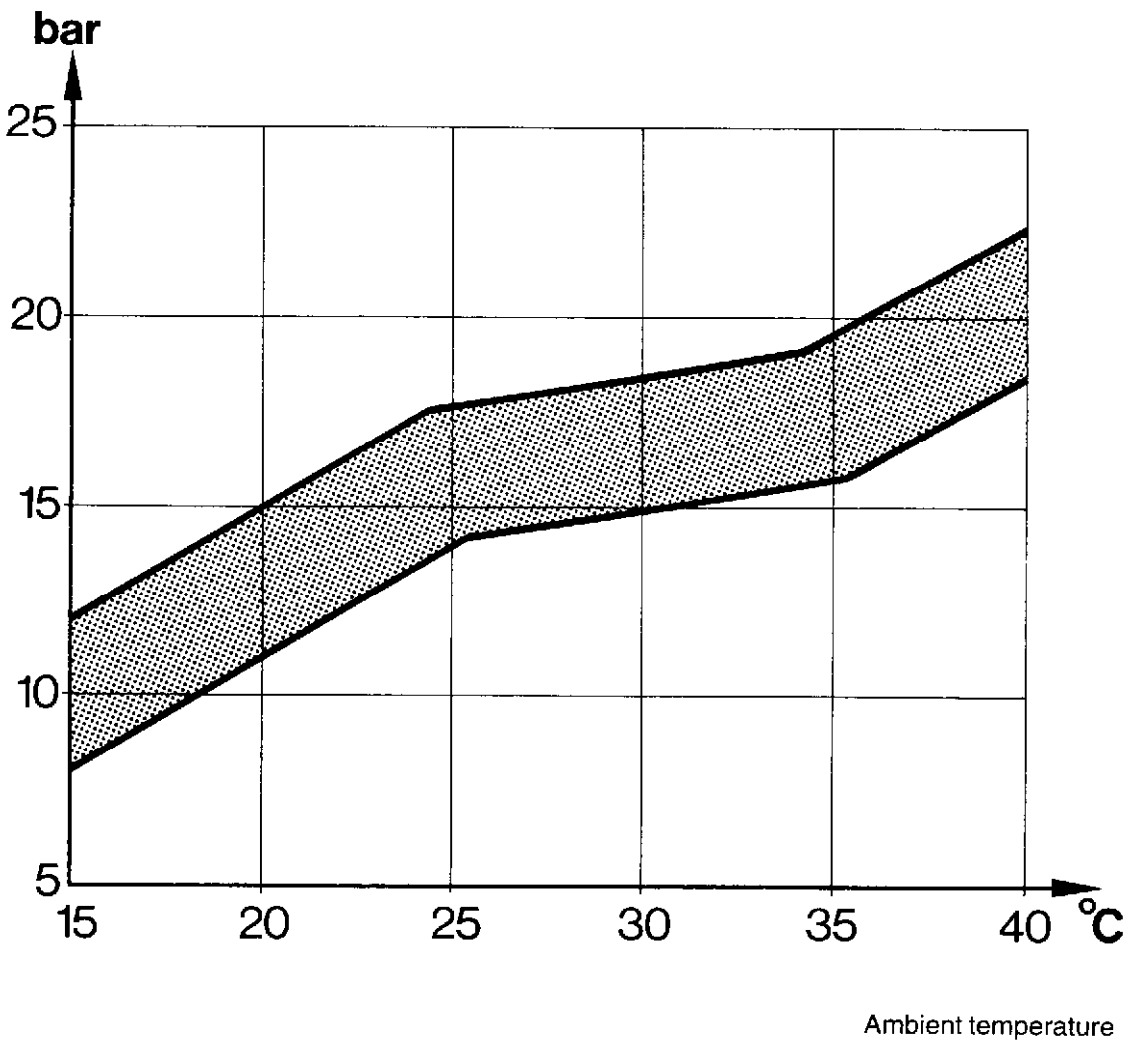
– Clean condenser.

1. Turn on air conditioning.

2. Set temperature control to max. cooling position.

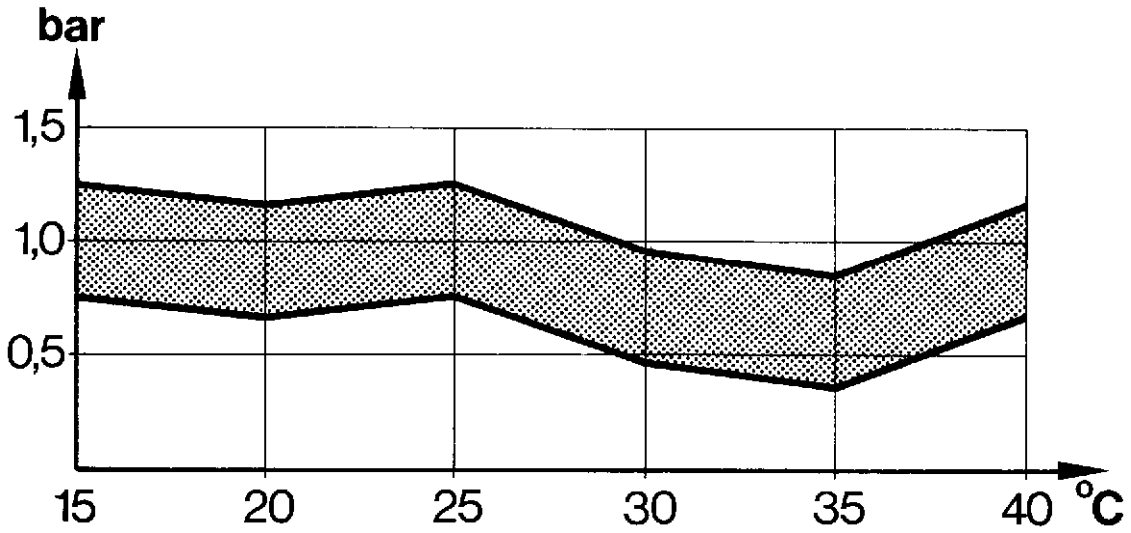
3. Set fresh-air blower to stage 2.

After an operating time of approx. 10 mins., at an engine speed of 2,000 rpm and with the compressor switched on, the pressures and temperatures from the below diagrams must be reached.



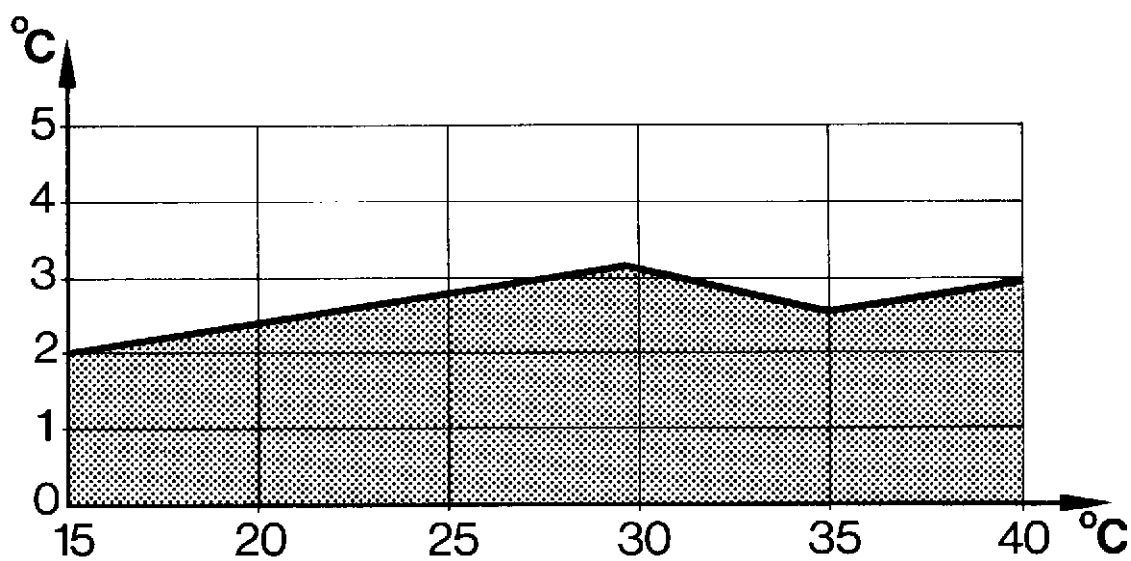
High pressure in refrigerant circuit vs. ambient temperature

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Low pressure in refrigerant circuit vs. ambient temperature

Temperature at center nozzle



Air temperature at center nozzle vs. ambient temperature

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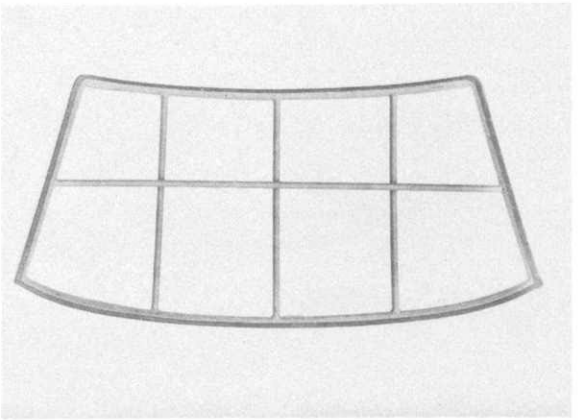
Interior Lights

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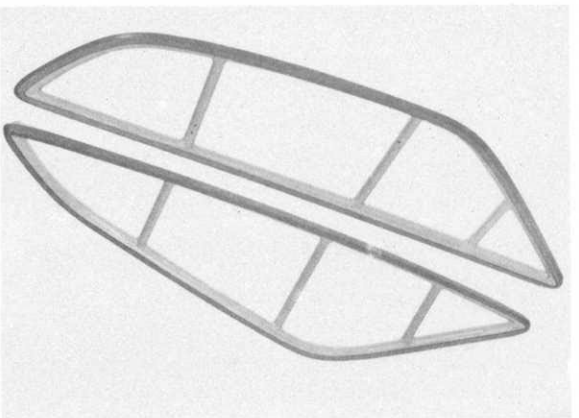
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SPECIAL TOOLS AND SHOP MATERIALS FOR BODY REPAIRS

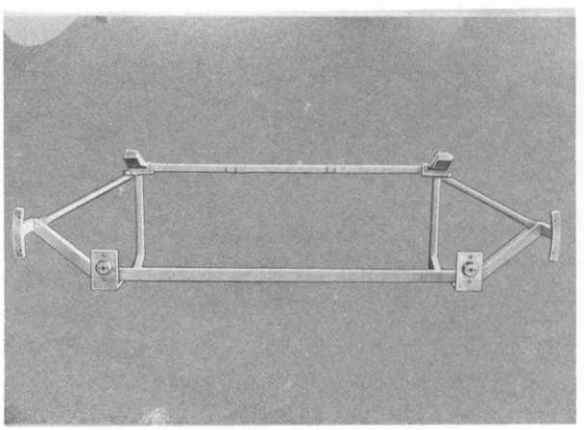
Template for windshield opening - 9158



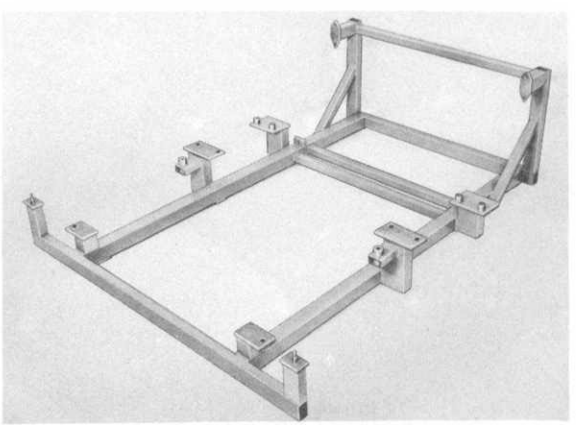
Template for rear window opening - 9159



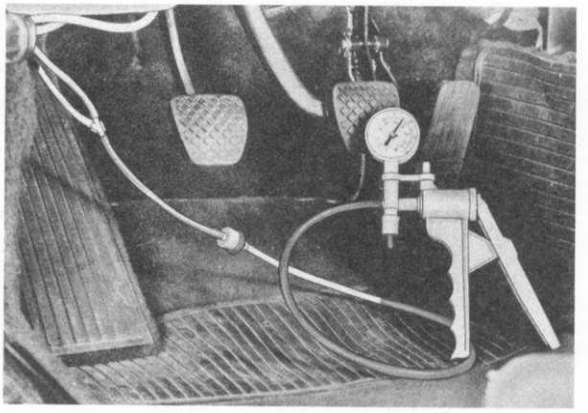
Template for rear side parts to PU trim - 9172



Front end gauge - 9174



Tester for vacuum system - 9160



Spot welder

Inert gas welder for steel and galvanized metal

Inert gas welder for aluminum parts

Gas welder

Cutting-off grinder, swing grinder

Disc grinder - angled grinder

Pneumatic gun with attachments, chisel etc.

Shouldering pliers

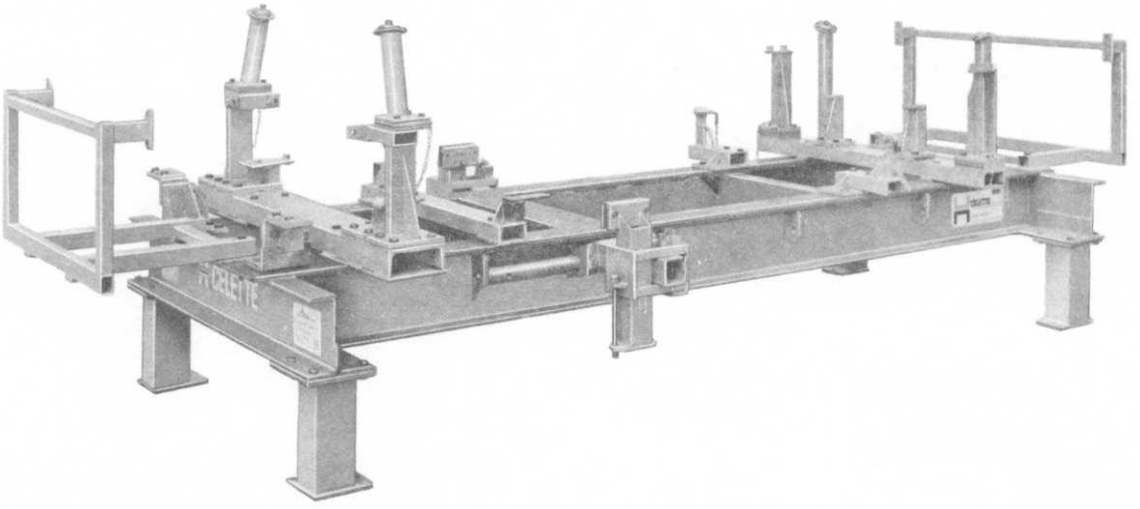
Beam compass - water scale

Hydraulic 10 ton straightener with accessories

Pneumatic guns, equipment and materials

for longterm undercoating
for cavity sealing
for sealing jobs

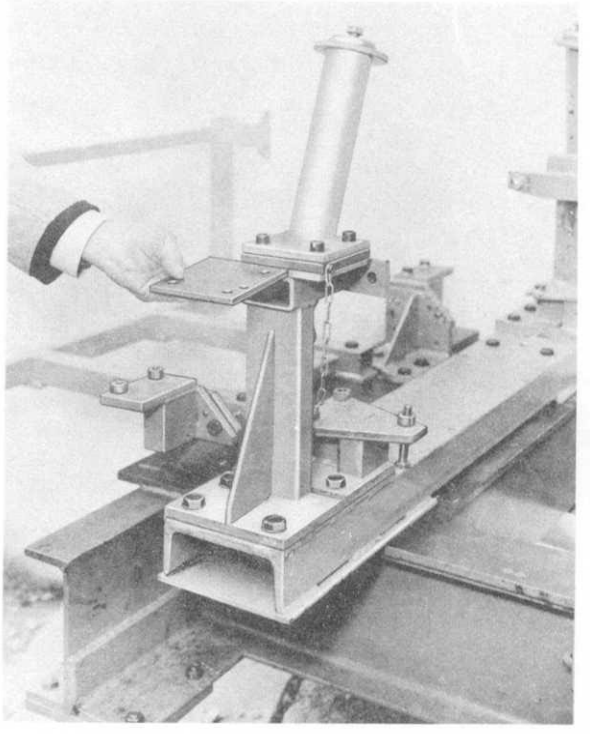
Set of Attachements ENS 243.300 for Celette Alignment/Assembly Stand

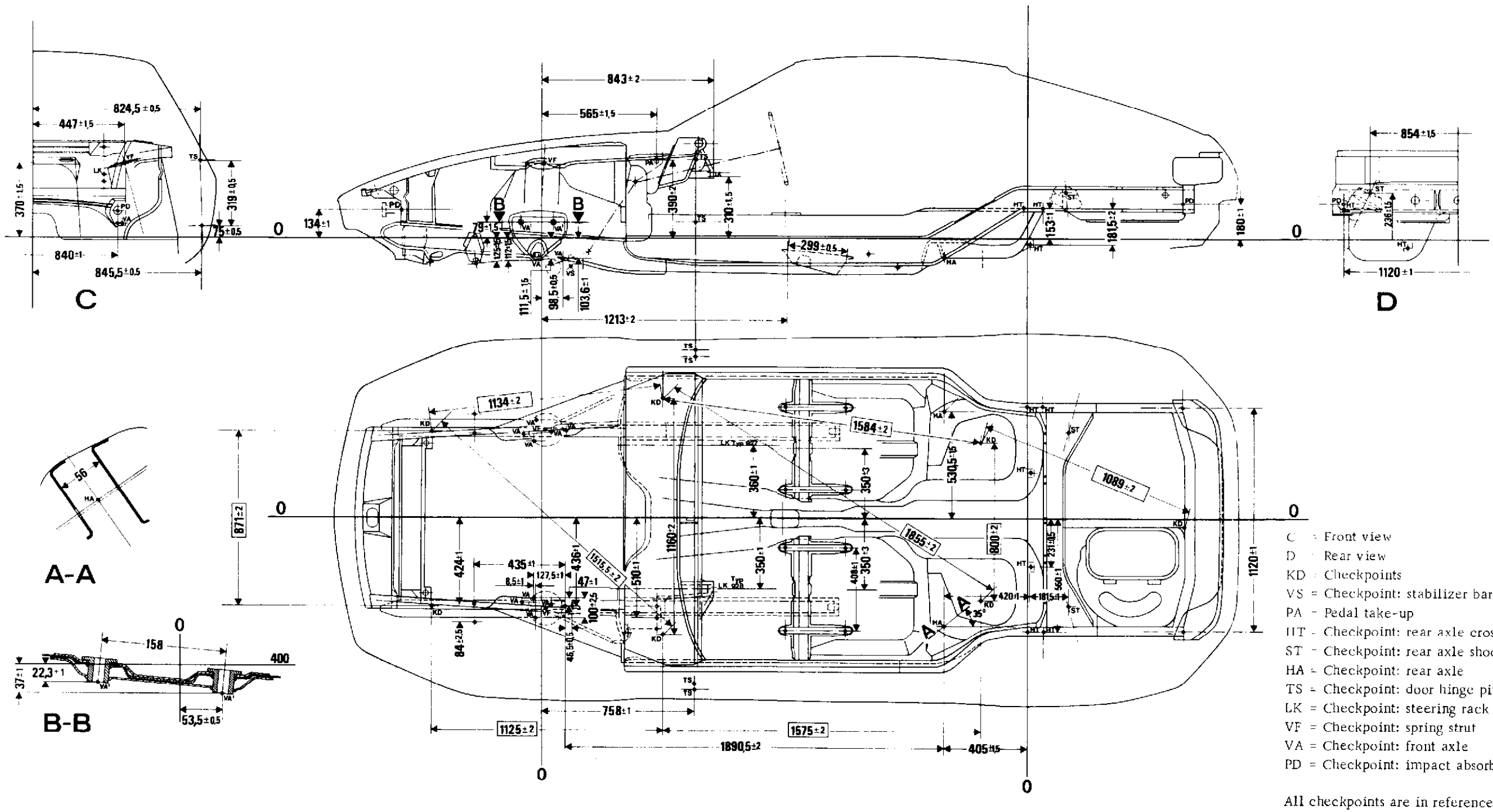


Note

Both M 10 x 80 collared bolts included in attachment set ENS 243.300 are used to bolt the side member mounts to the body as shown in the figure. BY bolting the body at these points first, deviations in distance to the other frame/floor check points can be determined and the front side members can be located accurately.

There are also two thin spacers for measurement of the upper shock absorber mounting point, instead of the thick spacers for models prior to 1979.





C = Front view
D = Rear view
KD = Checkpoints
VS = Checkpoint: stabilizer bar
PA = Pedal take-up
HT = Checkpoint: rear axle cross member
ST = Checkpoint: rear axle shock absorber
HA = Checkpoint: rear axle
TS = Checkpoint: door hinge pivot axis
LK = Checkpoint: steering rack
VF = Checkpoint: spring strut
VA = Checkpoint: front axle
PD = Checkpoint: impact absorber

All checkpoints are in reference to body flange surfaces.

REPAIR DIMENSIONS 928

Safety notes

Observe the following safety notes when performing body repairs:

- Removal of components may change the gravity center of the vehicle.
  The vehicle may therefore have to be tied down by additional measures on the lifting platform.

- If welding or other spark-generating operations are performed in the vicinity of the battery, the battery must be removed as a rule.

- Rooms designated for body repairs may not be used to stock other vehicles without protection (risk of fire damage due to sparks, battery, paint and body glass damage).

- Be extremely careful when grinding or welding in the vicinity of the fuel tank and other parts of the fuel system. If necessary, remove any components affected.

- Do not weld, braze or solder any parts of the filled air conditioning system. This also applies to welding, brazing or soldering operations on the vehicle that may result in the risk of components of the air conditioning system warming up.

- When drying the vehicle following a respray, do not expose the vehicle to temperatures of max. 80°C for more than 2 hours.

To protect electronic control units against excessive voltage when using electric welding equipment, observe the following safety measures:

- Disconnect clamp from negative battery terminal and cover negative battery terminal.

- Connect ground clamp of the electric welding equipment directly and as closely as possible to the component to be welded. Make sure no electrically insulated parts are located between the ground clamp and the welding location.

- Do not touch electronic control units and electric lines with the ground clamp or with the welding electrode.

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Treatment of electronic control units following accident repairs

Following an accident, electronic control units have to be replaced only if at least one of the following conditions is met:

- The housing is visibly deformed or damaged.
- The support area and/or console is deformed (no outside damage evident on the unit).
- The connector is damaged or corroded due to moisture.
- Operation check and/or self-diagnosis of the units reveals the following fault:
  "Control unit faulty ".

If electronic components, e.g. the ABS control unit, have to be removed to allow repair operations to be performed and if they are to be reused afterwards, they must be checked for proper operation according to specifications after they have been refitted.

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REPLACING PART OF FRONT WHEEL HOUSE

Includes

Front bumper, front side member, lock cross member, lower cross member, impact absorber mount, engine hood.

Removing

Radiator with lines, headlight with motor and linkage, engine assembly as far as required. Disconnect battery. Bumper panel with carrier and impact tubes (absorbers), radiator grill, covers beneath fender, vacuum reservoir, control unit (tempostat), both front fenders, lock lower section, hood release cable, data plate.

Note

The main headlights do not have to be removed to take off the front fenders.

Measuring Car

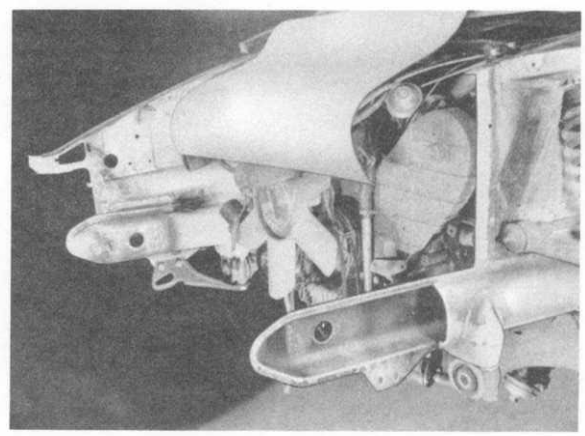
Move car on to a platform and measure front end of car with a water level and compass (see repair control dimensions).

Remarks

A front end gauge and set of Celette straightening bench attachments are being prepared.

Cutting Out Damaged Parts

1. Cut off lock cross member and lower cross member (pneumatic chisel).



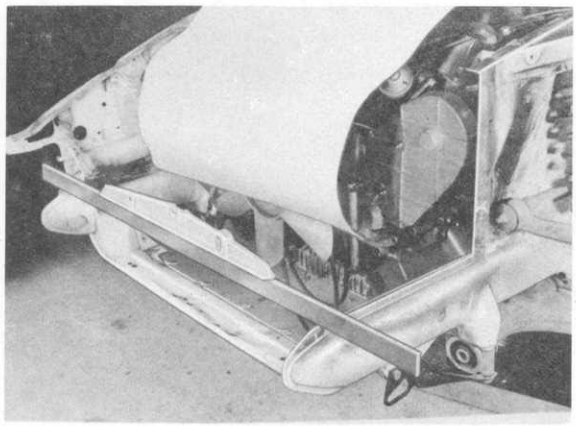
2. Cut through wheel house wall as far as required with a cutting wheel and outside of side member as far as required with a cutting wheel.

Note

Cut surfaces should be offset to each other.

3. Pull or grind off scrap metal. Straighten and grind down mating surfaces.

4. Straighten inside of side member. Check installed position with a water level.



Note

Figure shows this check on car with slight front end damage.

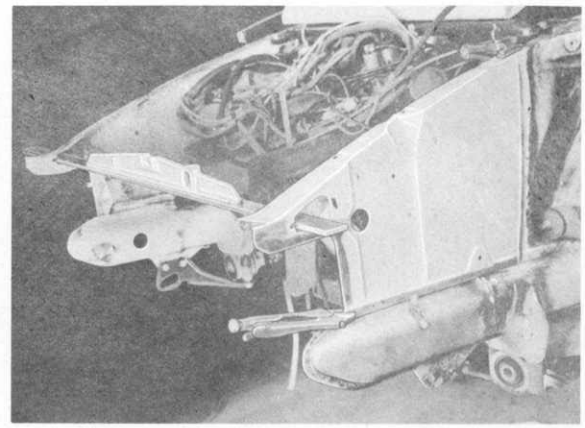
Installing

1. Fit outside of side member and cut it off to overlap by about 10 mm.

2. Grind down spot welding flange and coat with spot welding paint.

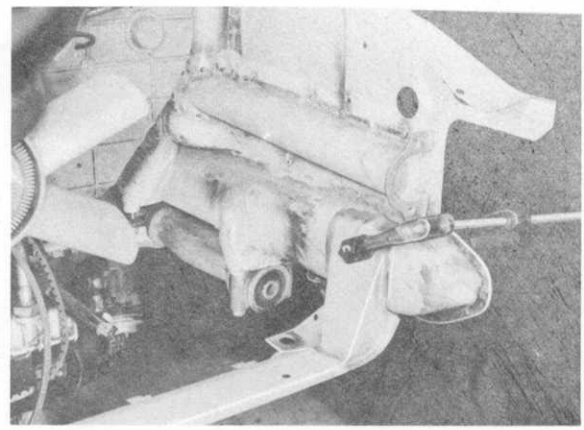
3. Spot weld side member shells and inert gas weld mating surface.

4. Fit wheel house wall, cut mating surface with an overlap and install. Check lateral position with a water level applied at opening for headlight shaft. Spot weld wheel house and arc weld vertical seam on outside.

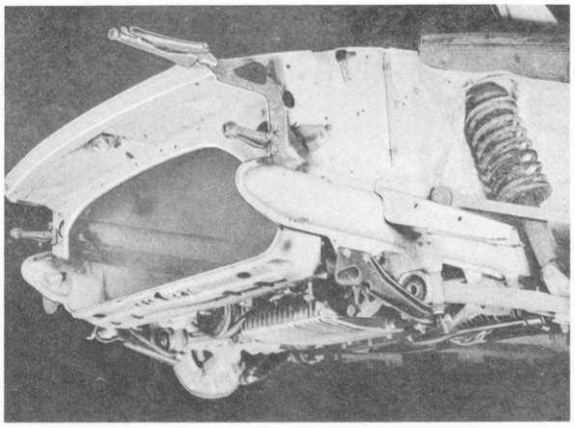


5. Install and spot weld impact absorber mount. Also tack weld with arc welder.

6. Install entire lower cross member, check against front axle and weld.

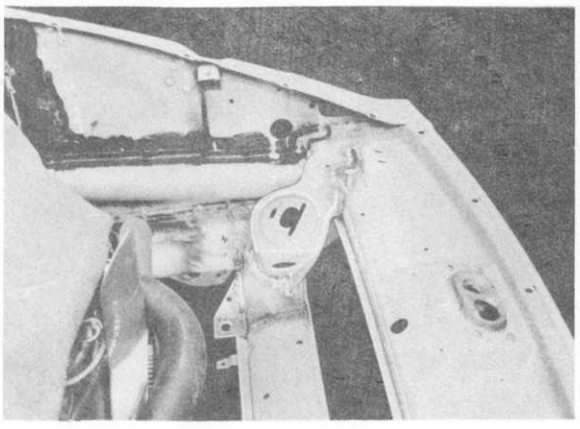


7. Install lock member, spot and inert gas weld it to wheel house, impact absorber mount and side members.

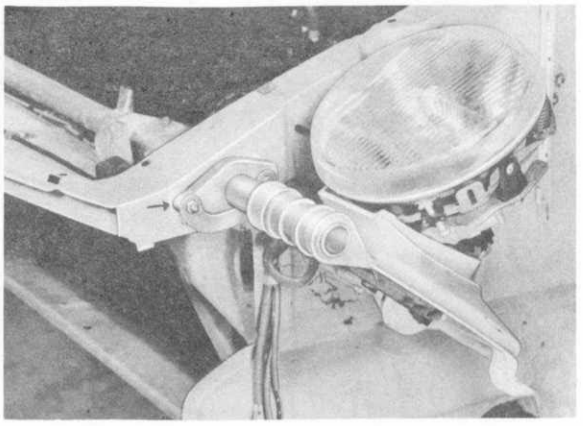


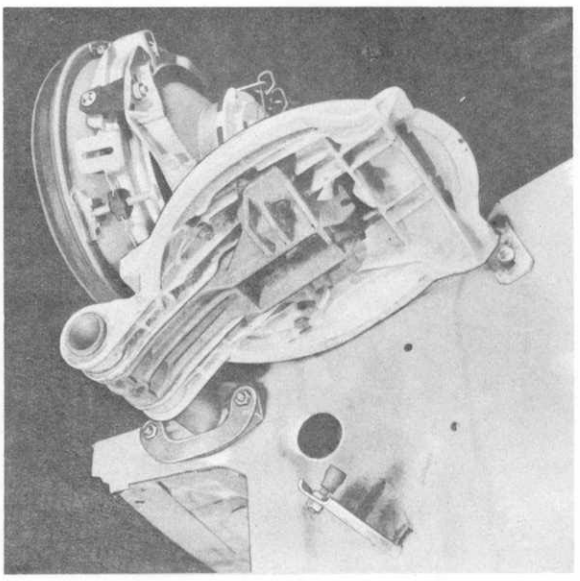
8. Install lid lock lower section. Secure it with pop rivets or 5 mm dia. screws.

9. Install and weld retractable headlight motor console perpendicular and parallel to center-line of car.

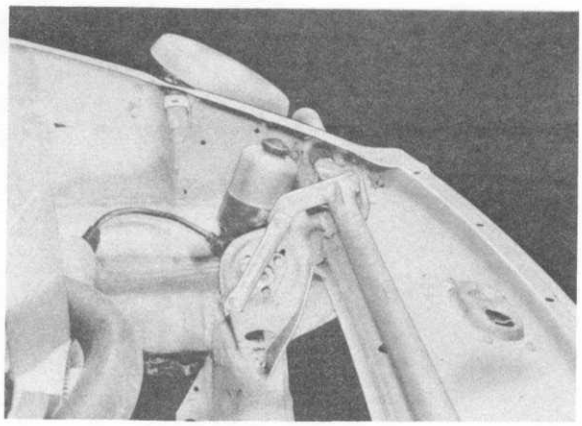


10. Install headlight shafts and mounts.
Make sure that longer section of plastic plates face forward when installed (see arrow)!
Install stop bracket for headlights.





11. Install headlight motor, route wiring and fasten with straps on lock member and wheel house, connect plugs.



12. Install liners and stop pads on lock member, adjust lock cable. Install and adjust lid.

13. Fit fender roughly. Position metal nuts on wheel house and hinge pillar, and install Terostat tape. Bolt fender supports.

14. Install and bolt fender, making sure that there is uniform clearance to lid and doors.

15. Align headlight with fender, tighten mount and outer shaft.

16. Prime coat and seal (undercoat and sealing materials) all welded and spot welded seams as well as flanges.

17. Install covers above and behind lower fender.

18. Prepare car for painting.

REPLACING FRONT END PARTIALLY

General Information

The best method of repairing a damaged front end, of which the side members are bent or distorted in area of front axle or engine mounts, would not be replacing up to the deformation border, but complete replacement of side members and wheel houses at original connection points of floor or firewall.

These repairs can be best performed with help from the Celette straightening bench and pertinent attachment set ENS 243. 300 or front end gauge 9174.

These instructions apply to both one-side and two-side repairs.

Removing

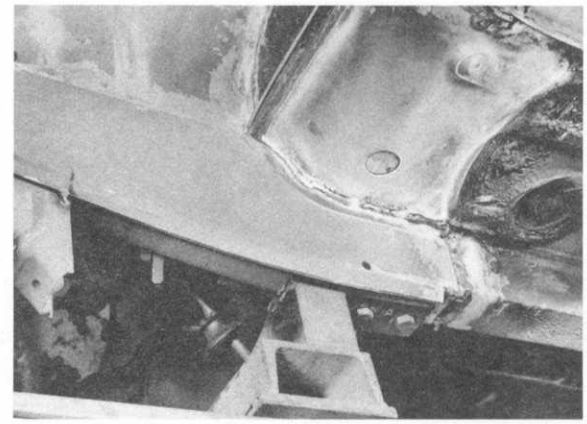
Engine, transmission and front axle, radiator, headlights with motor and holders, fenders, covers and radiator grill, bumper with brackets and impact absorbers.

Includes:

Front bumper, front side member, complete wheel house with reinforcement for spring strut, lock cross member and lower cross member.

Cutting Out Damaged Parts

1. Cut off end plate at body floor plate.



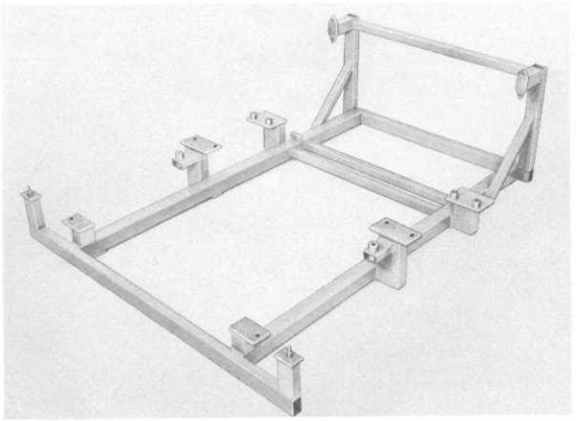
2. Cut off wheel house wall and side member along firewall with a cutting wheel or pneumatic chisel.

3. Cut off cross member and front lock carrier on damaged side, as long as only one side is being replaced.

4. Pull off scrap metal from wheel house and side member.

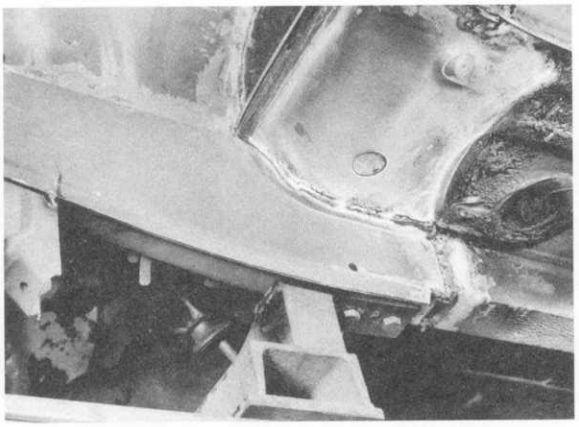
Repairing

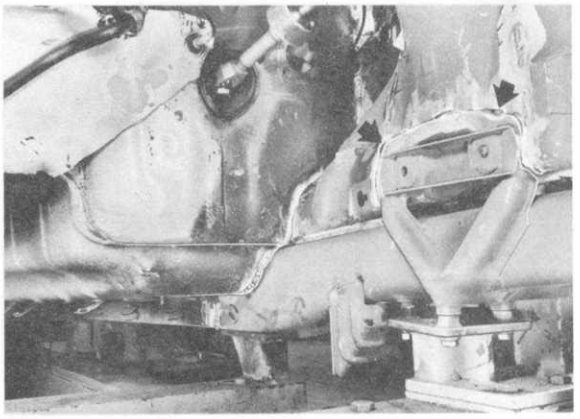
1. Place body on Celette straightening bench and bolt down or use front end gauge 9174 for repairs.



2. Position complete side member and bolt to all attachment take-up points.

3. Inert gas weld side member to floor plate and weld floor member on inside and outside all the way through.

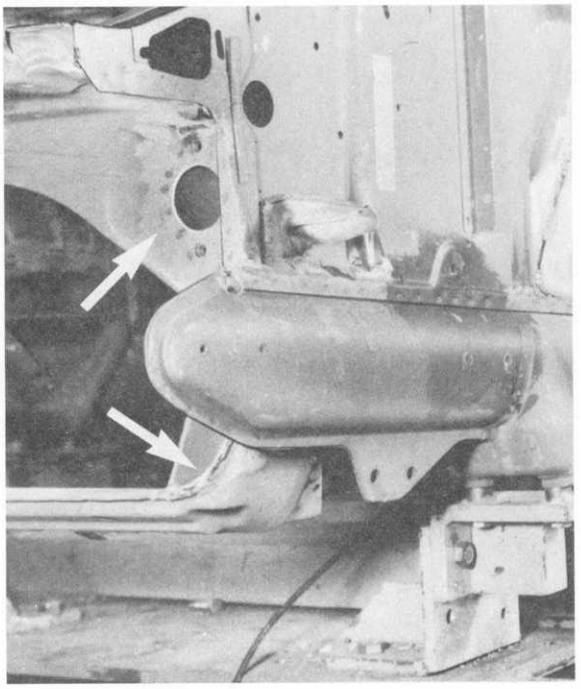




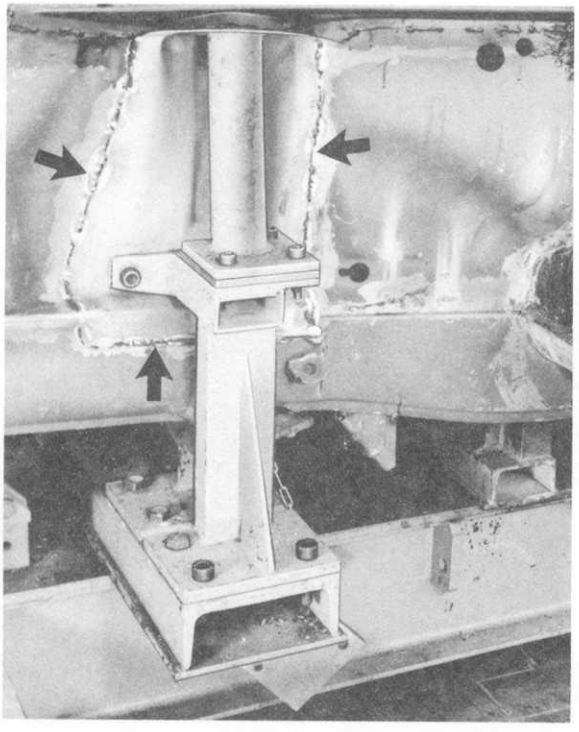
4. Install wheel house, line up at fire wall and side member and tack weld.

5. Spot or inert gas weld wheel house along side member flange and firewall.

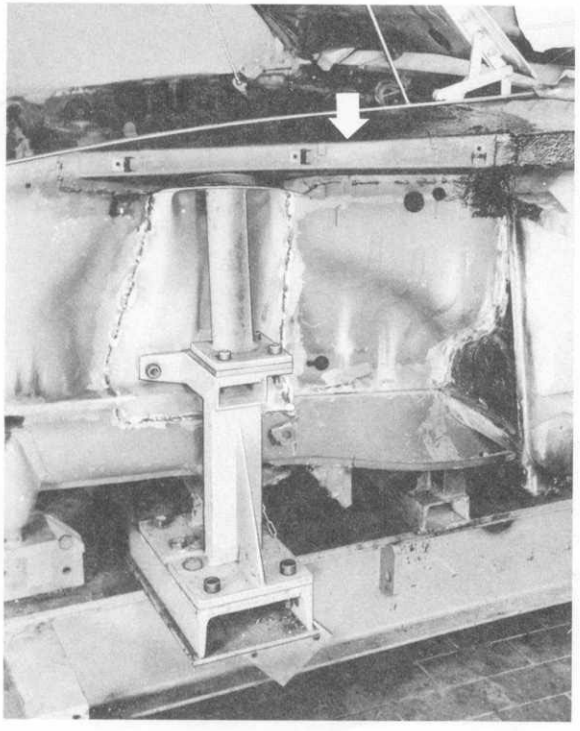
6. Position lower cross member and lock cross member with help from attachments or front end gauge, tack weld and weld.



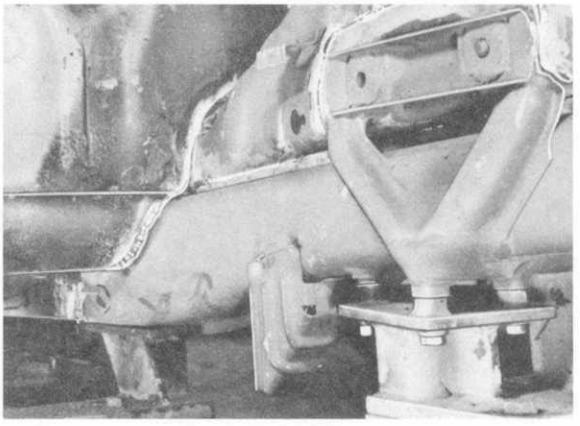
7. Install spring strut console reinforcement, hold with attachment and inert gas weld to side member and wheel house.



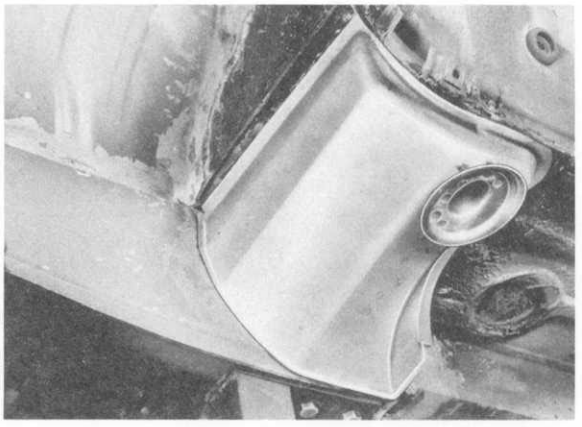
8. Line up top of console with wheel house and spring strut console, cut and weld.



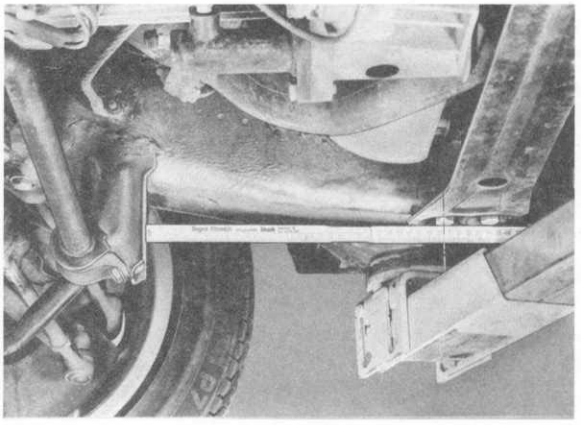
9. Weld control arm console on inside of wheel house.



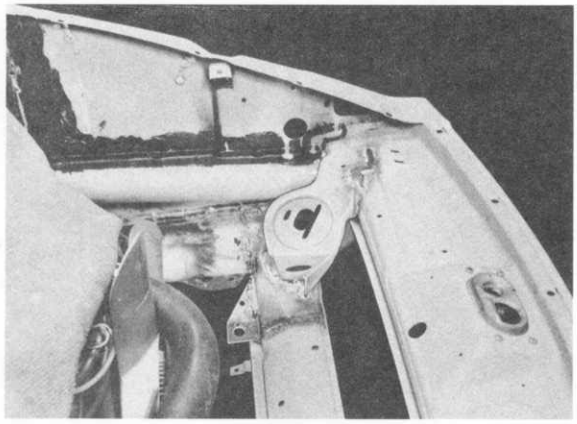
10. Position end plate with take-up shell on floor plate, clamp and tack weld.



11. Position console for stabilizer on side member (295 mm from front cross member bolt, rear edge vertical) and weld to side member.



12. Weld console for concealed headlight motor.



13. Apply prime coat paint and undercoating or sealing material to all welded seams and joints. Spray Tectyl sealant into cavities.

14. Position and mount fenders, headlights and engine hood.

15. Prepare car for painting.

MODIFICATIONS ON BODY FRONT END

From Chassis No. 928 910 0025 (on 5 cars initially),
928 910 0703 (standard production),
928 920 0514 (standard production)
and 928 920 9534 (standard production)
the rear threaded inserts of different version are welded in members 1, Part No. 928 501 015 02/ 928 501 016 03, to facilitate installation of the engine carrier, Part No. 928 375 011 03.

Compare new threaded inserts (Fig. A) with the old version (Fig. B):

1. The 2 mm longer bearing surface protruding from the side member and tapered downward.

2. Inside diameter of threaded insert at bottom changed from 12.2 mm to 10.2 mm.

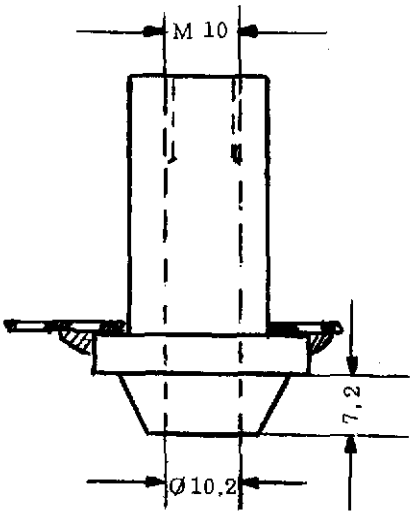


Figure A

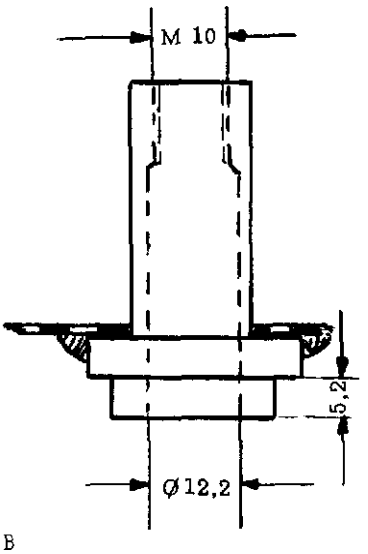


Figure B

3. M 10 x 85 mm bolts required for centering on Celette straightening bench and front end gauge.

4. Take-up pins of straightening attachment for Celette bench and front end gauge 9174 must be shortened by 2 mm for measuring procedures. Cars with old threaded inserts will then require use of 2 mm thick washers.

5. New engine carrier, Part No. 928 473 011 03, can be installed on all cars, while former engine carrier can only be used in cars with old threaded inserts.

6. Cross member, Part No. 928 501 091 02, is no longer used from the above mentioned chassis numbers, so that the welded nuts have been omitted in rear of member 1 for new cars.

7. When repairing the body front end make sure side members are replaced by a side member version corresponding to the opposite side.

   The former member I,

   Part No. 928 501 015 02 left or
   928 501 016 03 right,

   valid up to the mentioned chassis numbers, will be replaced by members with Part No. 928 501 915 00 and 928 501 916 00 after depletion of stocks. These members have welded nuts at the rear for the omitted cross member, Part No. 928 501 091 02, so that they can be used in all cars.

   In only one member of new version is installed in an old car together with an old engine carrier, the tapered section of the threaded insert must be shortened (ground off) by 2 mm.

REPLACING DOOR ENTRANCE RAIL

Removing

1. Jack up car or place on a platform. Make sure that body is not subjected to torsional forces. Check: doors must open and close easily.

2. Remove doors, unscrew hinges and door retainers, disconnect wire plugs, vacuum hoses and connecting pipe on side panel in footwell.

3. Remove entrance rail strip, door weatherstrip, seats, carpet, seat belts, trim and electric wires to an extent required.

Cutting and Straightening

4. Heat mating surface of entrance rail to fender (outer side panel) with a welding torch and melt off the tin.

5. Grind through welded seam at fender with a cutting wheel. Cut off front end of rail according to the extent of damage.

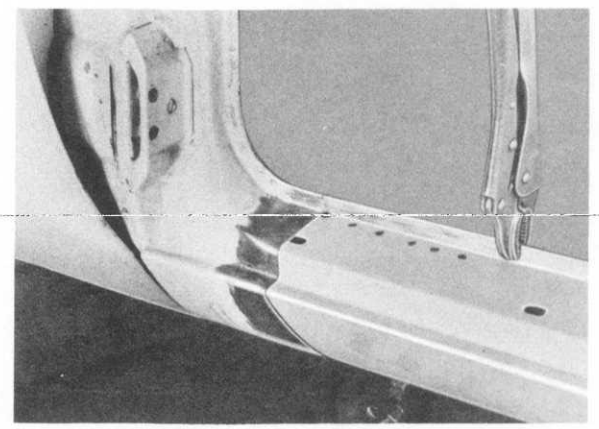
6. Cut off spot welding flange on top and bottom of entrance rail from side member. Remove entrance rail. If necessary, straighten or replace land and side member.

7. Shoulder front mating surface on rail panel with a shoulder pliers, make cuts in edges to be able to have the proper shape.

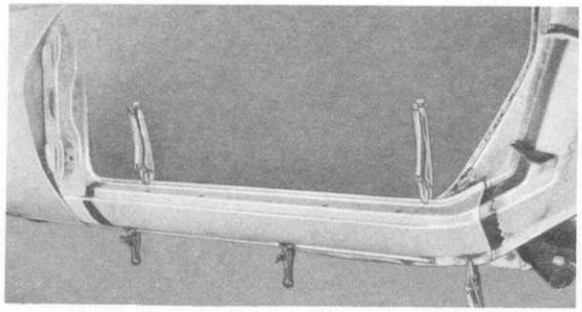
8. Grind off and pull of scrap metal on side member. Coat flanges with spot welding paint.

Installing

1. Fit and cut new rail panel.

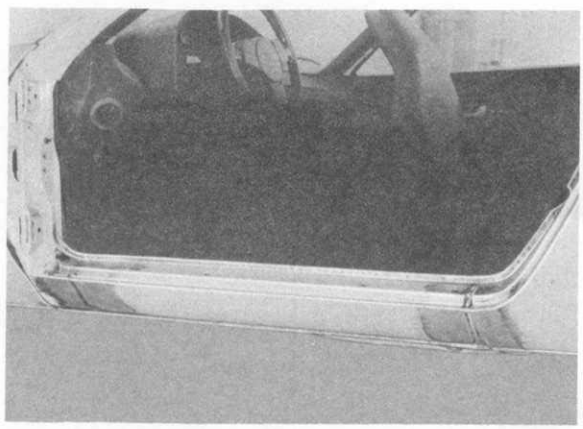


2. Push in rear end of rail on fender (figure does not show fender). Clamp and tack weld rail.

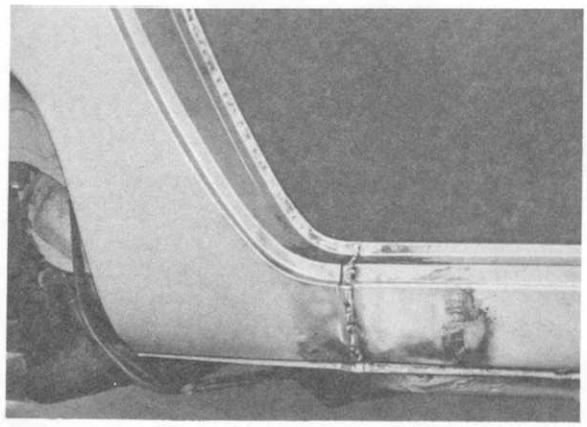


3. Install doors and check alignment with rail.

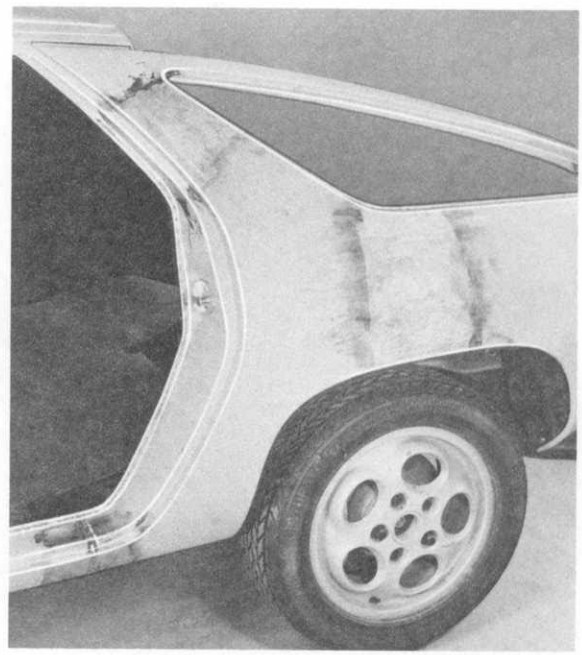
4. Inert gas weld front and rear mating surfaces. Spot weld flanges on side member.



5. Grind down welded seams, tin, solder and finish.



6. Check door alignment. Apply undercoating and cavity sealants.



Prepare car for painting.

REPLACING TAIL PANEL AND FENDER (OUTER SIDE PANEL)

Removing

Place car on platform. Take off rear wheels. Disconnect battery wires. Unscrew covers in wheel house.
Remove bumper panel, member and impact tubes (absorbers).
Remove weatherstrips on lid and door frame, side panel trim, side window, emergency seat, seat belt, luggage compartment cover, front seat and carpets.
Remove fuel tank flap, fuel and expansion tanks, filter and fuel pump, wires, hoses and holding straps. Detach insulation sheet on inside of side panel to an extent as required.

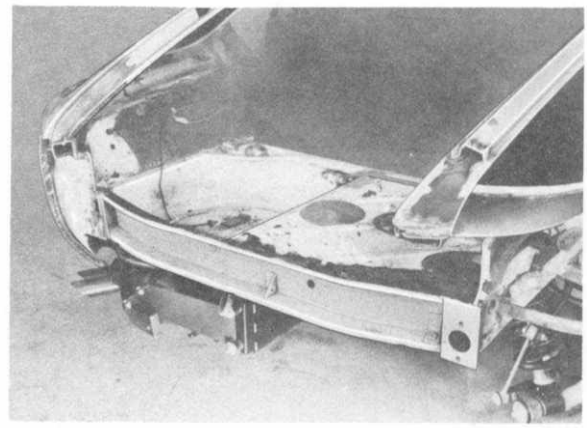
Cutting

1. Cut out damaged fender at spot welding flanges with a pneumatic chisel and at sectional surfaces with a cutting wheel. First heat and melt tin off of rail mating surface with a welding torch.

2. Cut off tail panel, pull off all scrap metal and weld damaged spots.

3. Heat undercoating with a welding torch, and scrape or brush off undercoat.

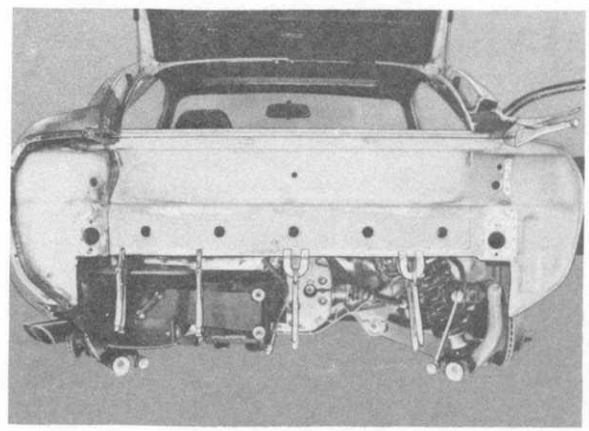
4. Straighten rear cross member, side member and luggage compartment floor plate.



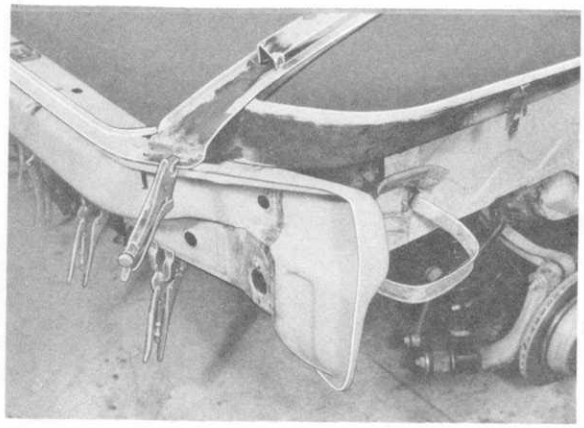
5. Straighten and grind down spot welding flange.

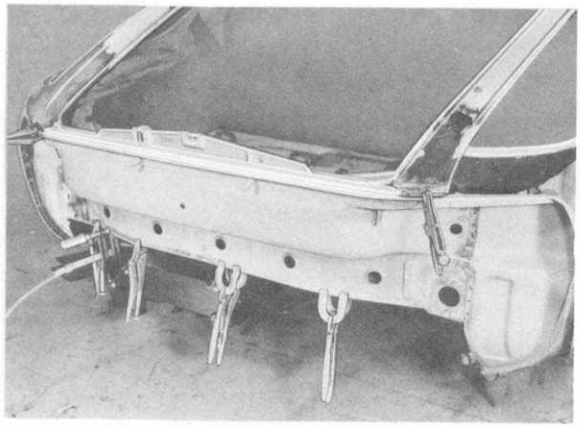
Assembling

1. Spot weld tail panel and outer panel, align and cut to size.

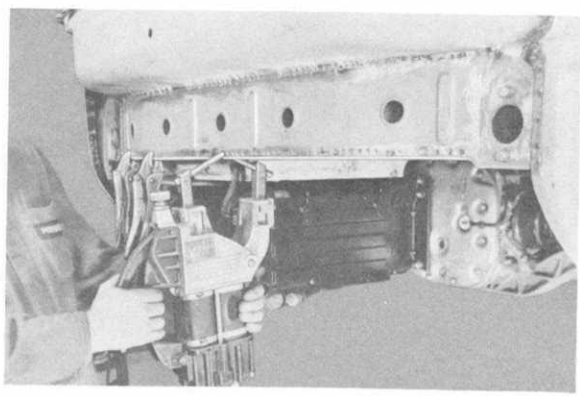


2. Coat flanges with spot welding paint. Bolt tail panel to impact tube mounts, clamp on cross member and straighten with a water level.
Check installed position of lock to trunk lid.

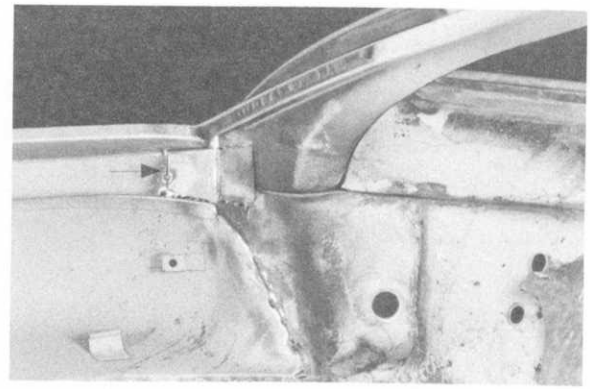




3. Depending on accessibility, spot weld if at all possible or, if not, inert gas weld the mating surfaces.



4. Weld both sides of reinforcement bracket on inside of roof frame.



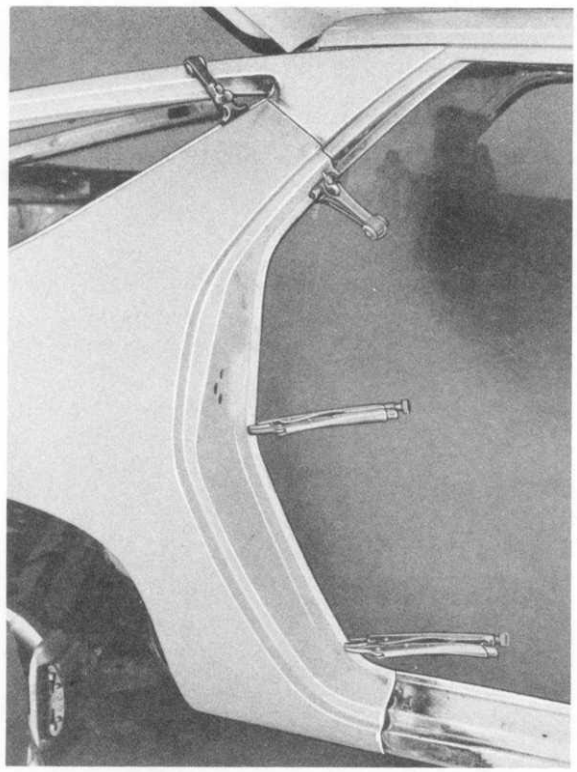
5. Coat spot welding flanges with a welding paint.

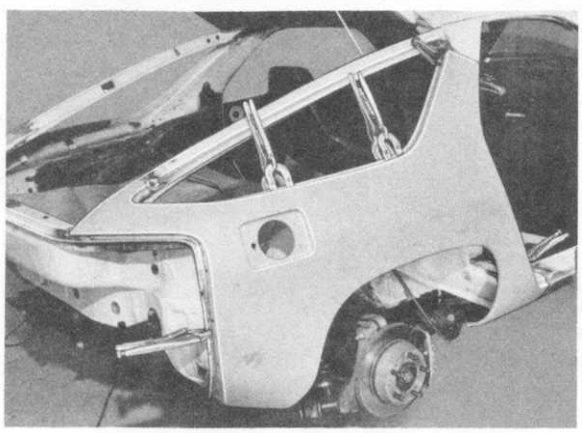
6. Fit fender and align with door and trunk lid. Check side window opening (gauges are being prepared). Align upper front mating surface with an overlap. Shoulder one surface with a shoulder pliers and make cuts in edges.

Note

Make the cut in a manner, that as little alignment as possible will be required.

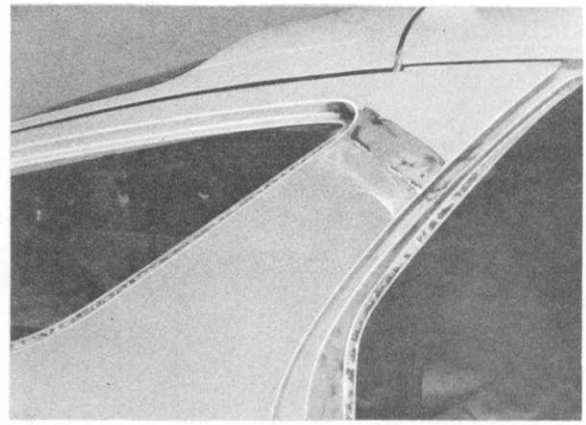
7. Clamp fender in position, check installed position with doors, lid, window opening and bumper panel, and tack weld.

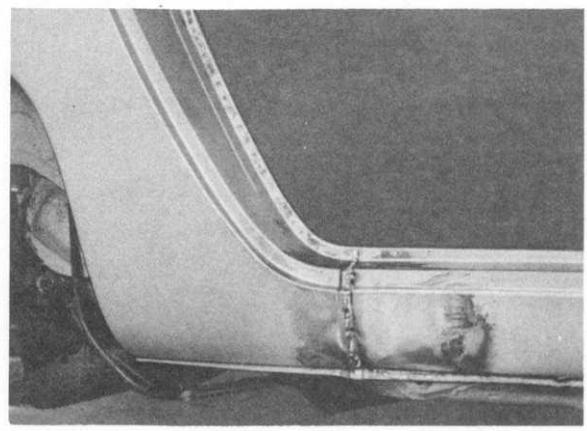




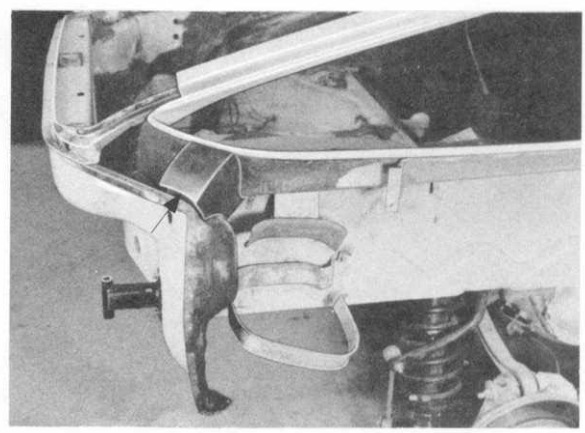
8. Spot weld fender flange all around and weld mating surfaces.

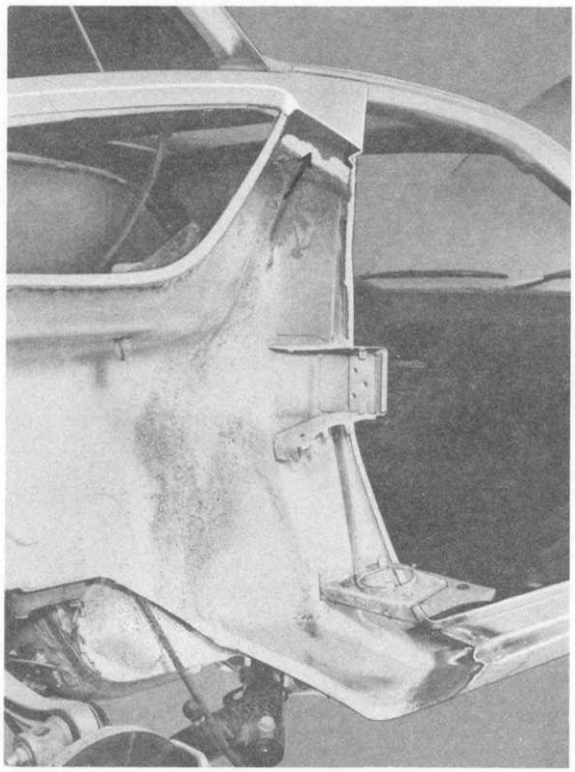
9. Straighten welded seams and flanges.





10. Paste pieces of foam rubber underneath fender on outside of tail panel and in top of door frame to provide a seal.





11. Solder welded seams on rail, door frame, lid frame and fender end section, and prepare them for painting.

12. Install lid and door locks. Check lid and door alignment, and correct if necessary.

13. Check fit of side window.

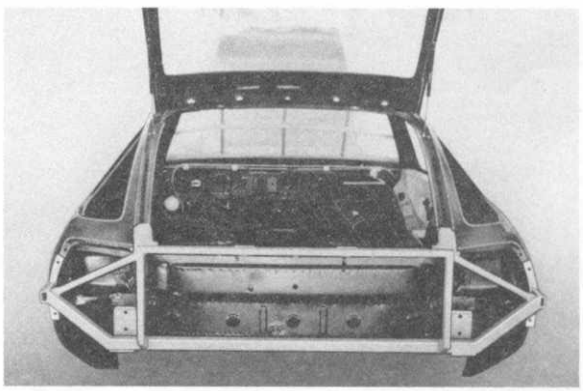
14. Fit bumper and panel, correct contour if necessary.

15. Seal spot welded flange in wheel house carefully and renew missing undercoat.

16. Prepare car for painting.

Note

Special Tool 9172 (template for rear side panels to PU trim) can be used to accurately locate the upper end points and outer bearing surfaces of rear side panels to the PU trim, starting from the threaded surfaces of the impact tubes and absorbers.



REPLACING FENDER END SECTION (OUTER SIDE PANEL)

Removing

Place car on a platform and take off wheels.
Disconnect battery wires.
Unscrew rear cover in wheel house and remove antenna.
Remove bumper panel, member and impact tubes (absorbers).
Remove side panel trim, side window, luggage compartment cover and insulation material to an extent as required.

Cutting

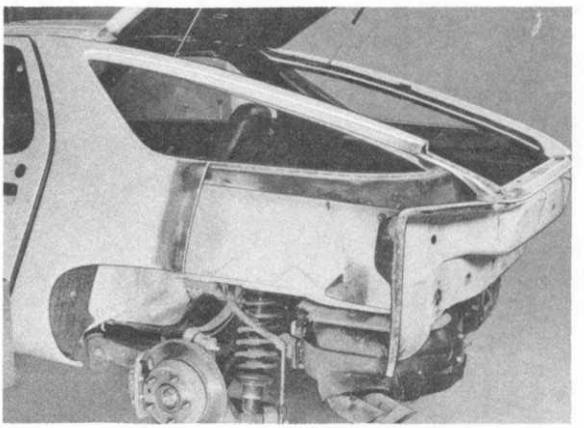
1. Cut off fender end section with a cutting wheel, pneumatic chisel etc. (determine cutting line to agree with extent of damage).

2. Pull or grind off scrap metal. Clean mating surfaces and flanges to remove undercoating and paint, and grind smooth.

3. Weld damaged spots.

Straightening and Assembling

1. Straighten tail panel and inner frame, and replace outer tail panel if necessary. Check installed position of impact tube mounts.



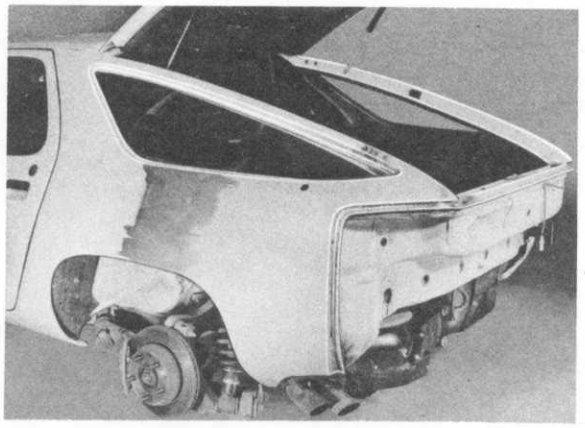
2. Straighten and grind spot welding flanges.

3. Fit and cut fender. Cut mating surface at wheel opening flush. Coat spot welding flanges with spot welding paint.

4. Tack weld fender with an oxyacetylene welder, align installed position with window opening (gauge or glass pane) and lower edge of lid.

5. Spot weld flanges and weld seams.

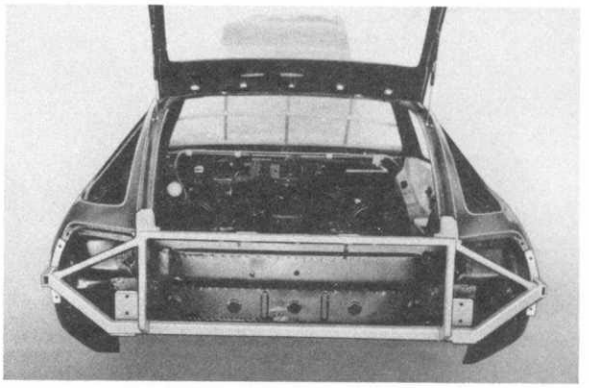
6. Straighten and tin welded seams.



7. Renew undercoat and prepare car for painting.

Note

Special Tool 9172 (template for rear side panels to PU trim) can be used to accurately locate the upper end points and outer bearing surfaces of rear side panels to the PU trim, starting from the threaded surfaces of the impact tubes and absorbers.



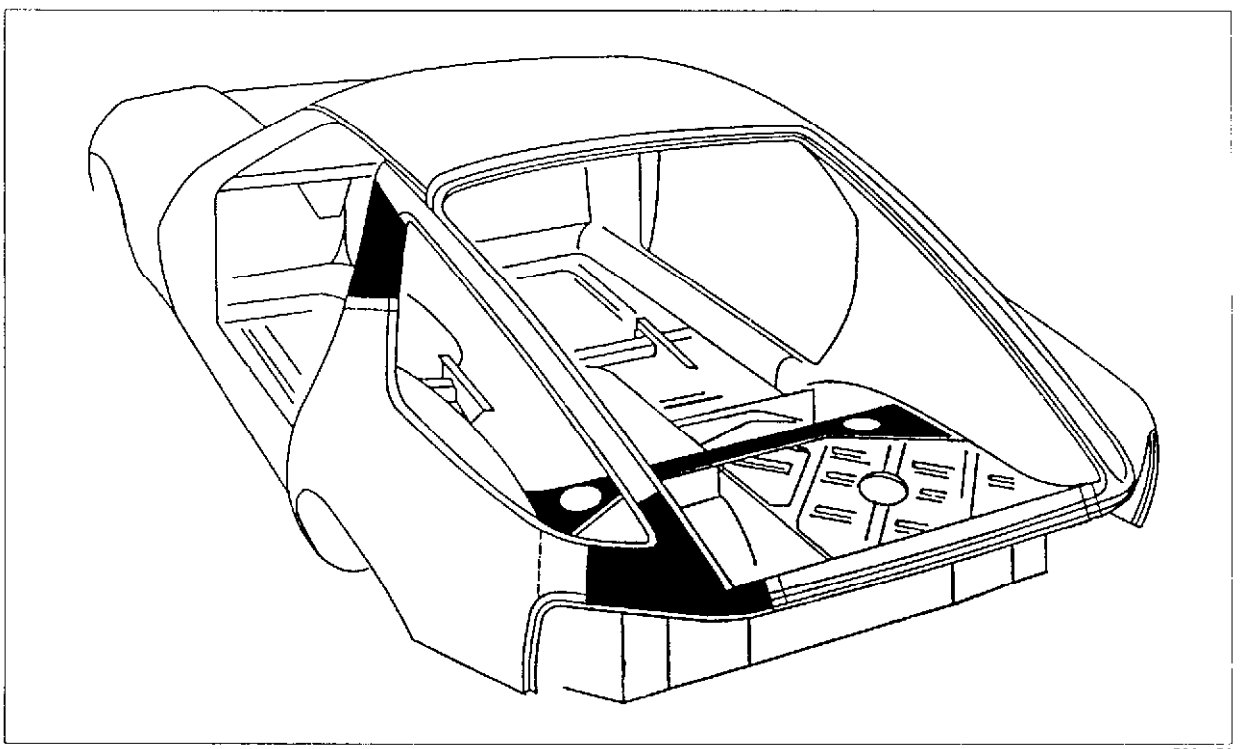
Body repairs to foam-filled cavities

Instructions for part-section repairs to body sections with foam-filled cavities to reduce running noise

Body construction work for production cars includes a number of carefully matched measures to reduce running noise. One of these measures is the injection of foam into certain body cavities in the following areas

- **Upper B post**
- **Complete cross-member**
- **Lower C post**
- **Inner rear side panel**
- **Center left and right reinforcement**

using a special PUR (polyurethane) moulding foam.



533 - 53

When carrying out body repairs in these areas, particularly when part-sections only are replaced, the damaged sheet metal parts must be detached by mechanical methods **(for instance by sawing, drilling and the use of suitable chisels)**, so that high temperatures are avoided. Before new parts are welded on or in, the synthetic foam must be removed, again by mechanical means such as **pulling off** followed by **brushing** with a wire brush, in the areas where welding is to take place.
Note that no new foam is applied in these areas.

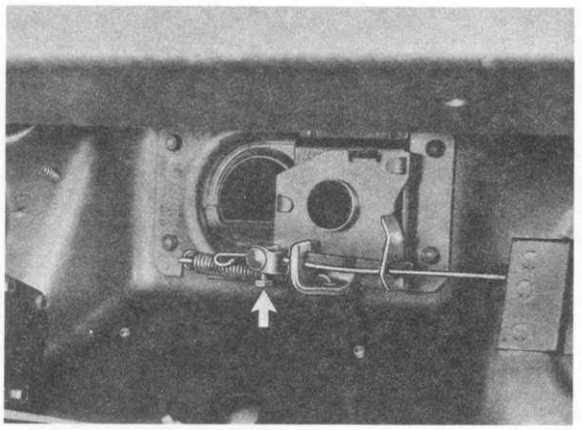
Printed in Germany – XXV, 1990

REMOVING AND INSTALLING ENGINE HOOD CABLE

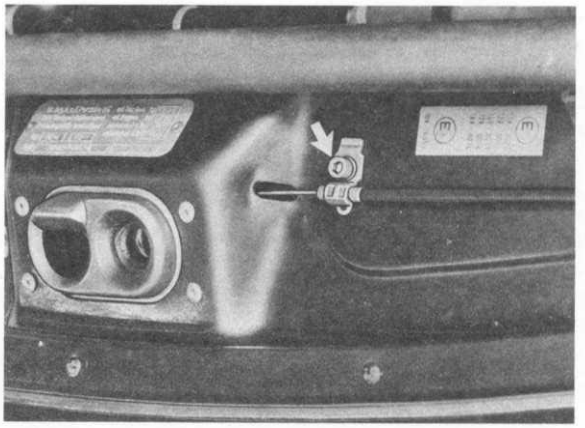
1. Remove left front wheel.
   Unscrew cover in wheel housing.

2. Unscrew air inlet grill.

3. Loosen screw on bottom of hood lock.

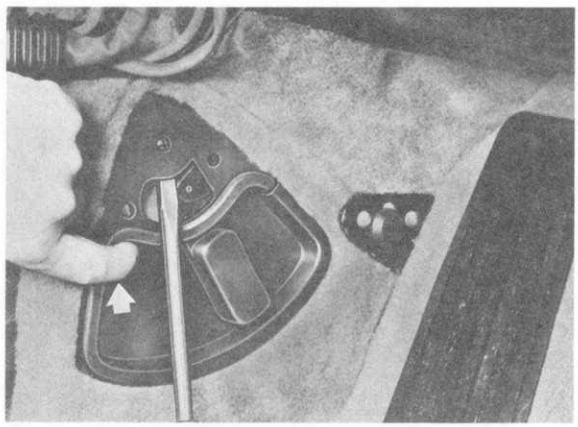


4. Unscrew clamp on lock cross member and pull hood cable out of lock.

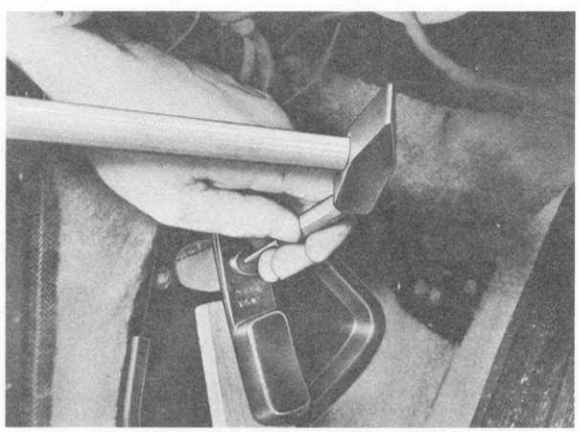


5. Detach hood cable in wheel housing.

6. Pull off carpet in footwell above hood cable grip. Use a screwdriver to lift cover at pivot point of grip and press up cover on left side.



7. Remove cable grip and lay aside. Drive out spiral pin and pull hood cable with protective sleeve forward out of the housing.



8. Pull out hood cable through grommet into footwell.

REPLACING LATCH ON REAR LID LOCK UPPER SECTION

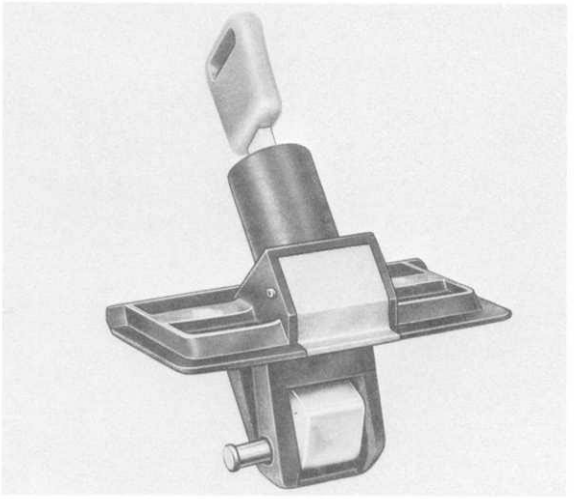
General

If the edge of the plastic latch in lock upper section is worn and this is impairing the lock's function, the latch of an installed lock upper section can be replaced.

Parts required:
Latch Part No. 928 512 161 02
Rivet pin Part No. 928 512 165 02

Removing and Installing

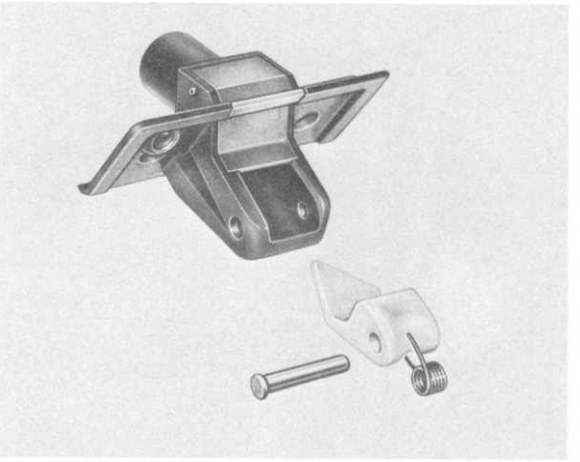
1. Drive rivet pin out of housing from the riveted side with a 3 to 4 mm dia. punch. Counter-hold the opposite side!



Note

If it is difficult to drive out the rivet pin, drill out rivet with a 5 to 6 mm dia. drill bit.

2. Remove plastic latch, making sure that the spring behind is not lost.



3. Install new latch with spring, pushing in the spring with a small screwdriver until the latch bore aligns with the housing.

4. Press in rivet pin and lock by punching. Rivet pin must not have lateral play.

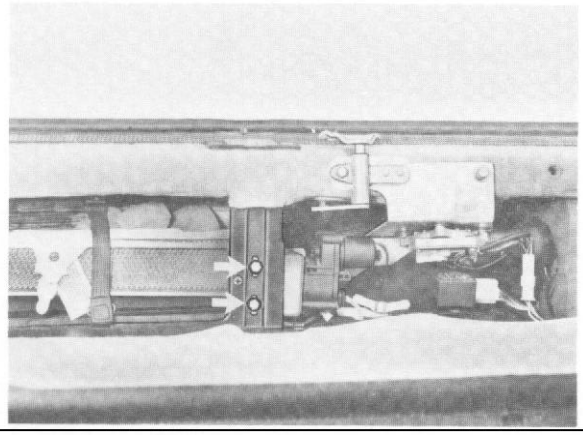
Note

If the lock cylinder has to be replaced, pull out pins on the side to be able to remove the cover.

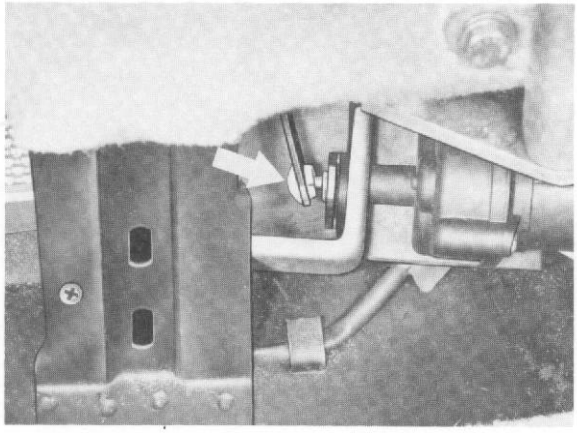
REMOVING AND INSTALLING REAR LID UNLOCKING DEVICE

Removing

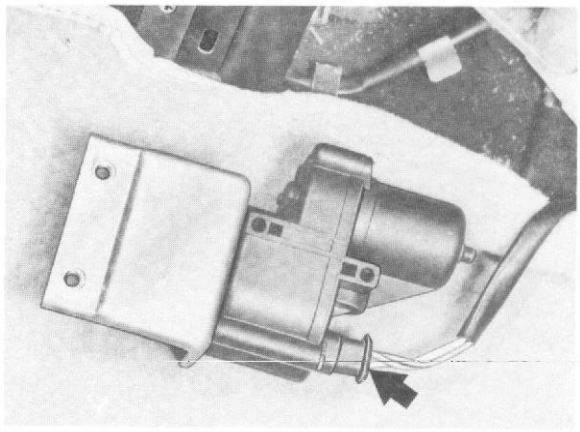
1. Loosen and remove tool plate. Remove mounting bolts of motor bracket.



2. Unclip operating rod on drive motor.



3. Disconnect plug on drive motor.

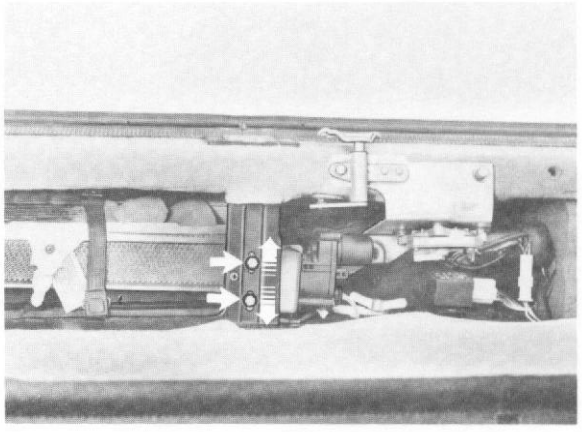


Installing

Installation is in reverse sequence.

Adjusting

Check lid lock upper and lower sections. Close lid, loosen bolts on bracket, pull motor down until unlocking cam rests on latch of lid lock upper section (slight resistance, do not press further in unlocking direction) and tighten bracket mounting bolts.



Note:

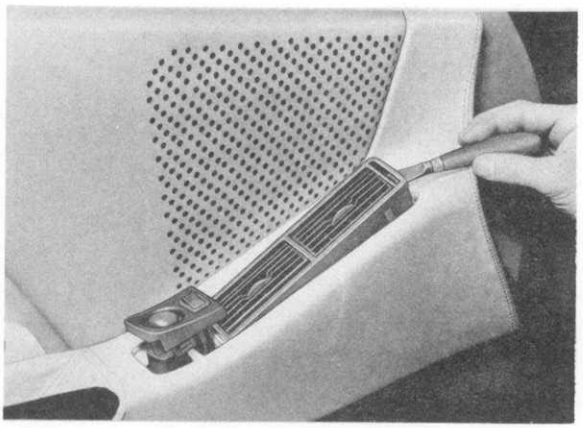
Adjustments are made from passenger compartment.

REMOVING AND INSTALLING DOOR

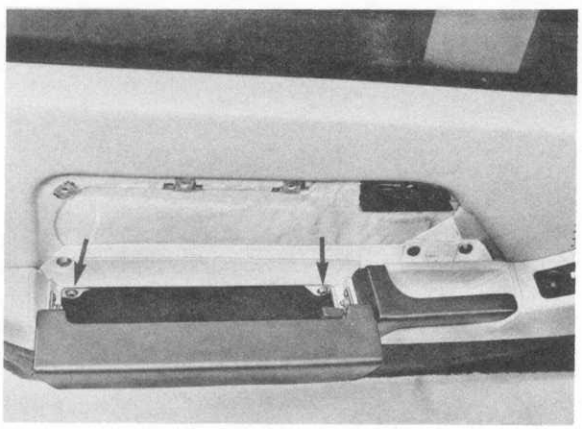
1. Pull off knob, unscrew knob liner and remove together with bearing shell.

2. Unscrew grip shell on inside grip. Remove door trim panel from clips.

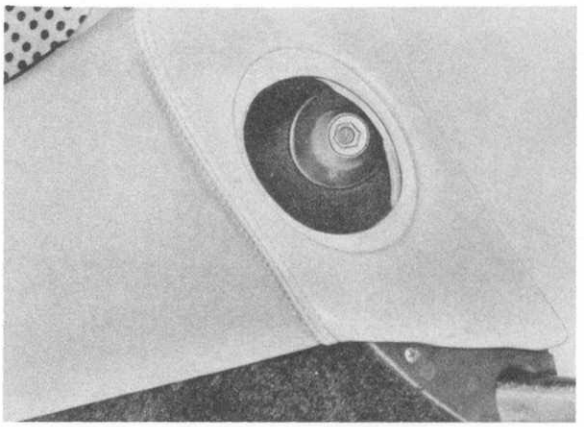
3. Remove side nozzle. Remove outside mirror switch. Note wire colors and pull off plugs.



4. Unscrew door trim panel screws, fold out armrest and unscrew screws covered with caps (see arrows).

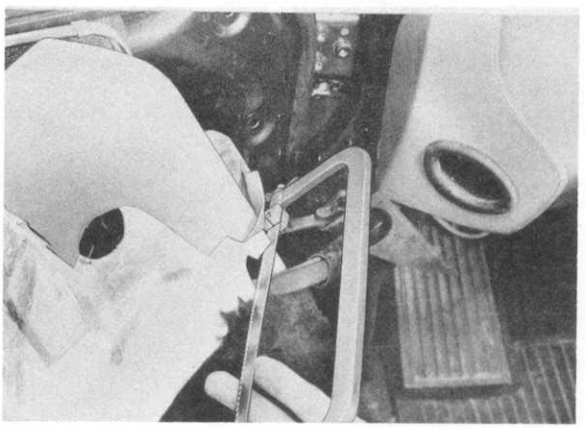


5. Remove door vent nozzle and unscrew bolt located behind latter. Detach cover on connecting tube.



6. Take off door trim panel from clips at bottom and remove with armrest.

7. Disconnect loudspeaker connections from door panel, pull off covering at narrowest opening point and saw through land, so that wire harness and vacuum hoses can be pulled through. Remove door panel.



8. Pull off inside window sealing rail. Unclip window frame trim at top carefully and remove.



9. Pull off door sealing sheet.

10. Detach door retainer and hinges, and take off door.

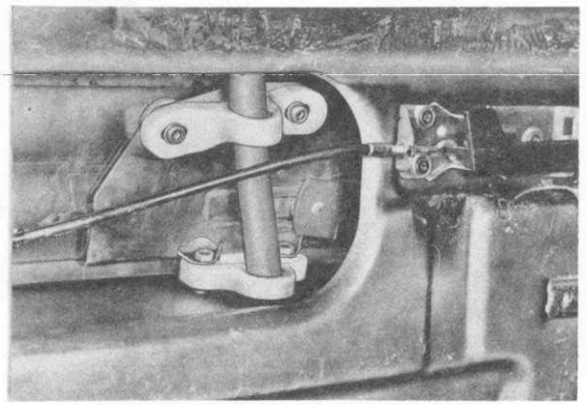
Note

If there is door retainer noise, spray door retainer and retaining rod with a sliding metal lubricant, e.g. Metal-lit from Bielefeld.

REMOVING AND INSTALLING DOOR WINDOW AND REGULATOR

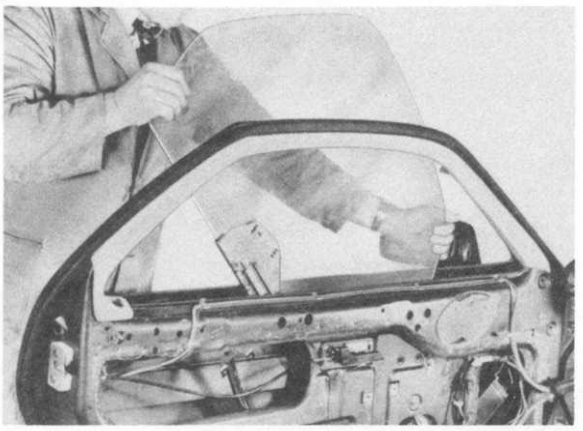
Removing

1. Adjust door window (door trim panel removed), that slides on guide tube are accessible.



2. Now unscrew slides and detach window lifting tube at top.

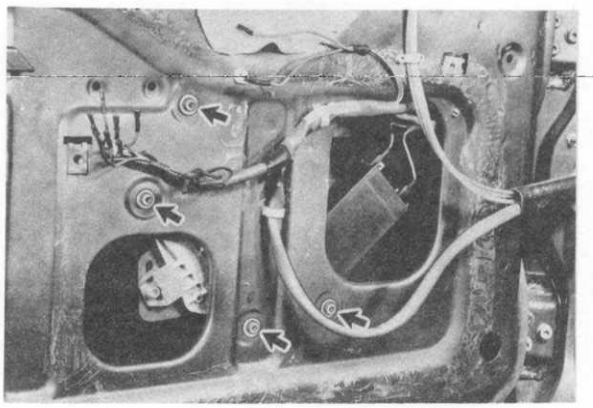
3. Pull off inside window recess seal, then tilt and remove door window glass.



Note

Unscrew or detach guides (arrow) in upper door recess to improve accessibility (see figure to right).

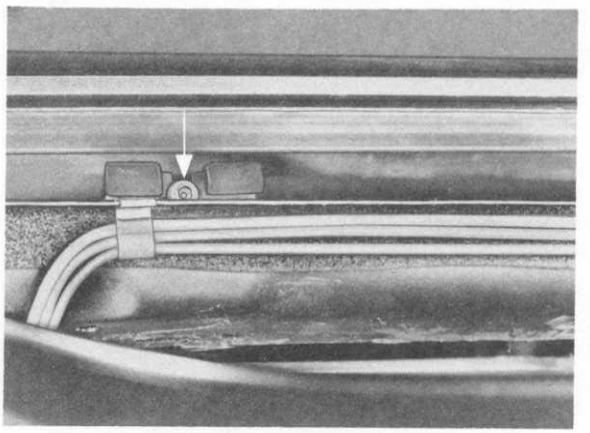
4. Unscrew window regulator from inside door panel (arrows), pull off electric wire plugs from motor and remove window regulator through large opening in inside door panel.



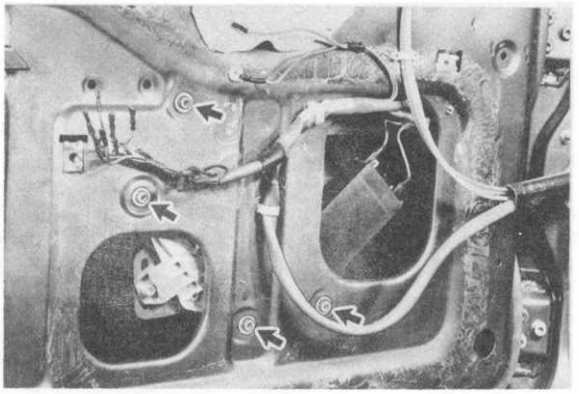
Installing

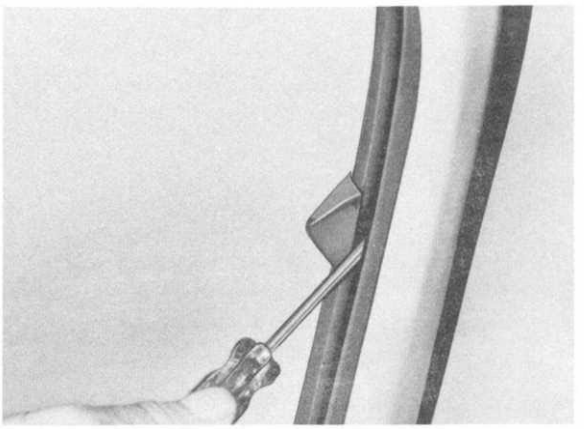
1. Place door window glass in door.

2. Install guides (position inward).



3. Guide in window regulator, connect it to lifting rail and bolt to inside door panel (arrows). Connect power supply plug.





Stop wedges must be installed only with countersunk metal screws.

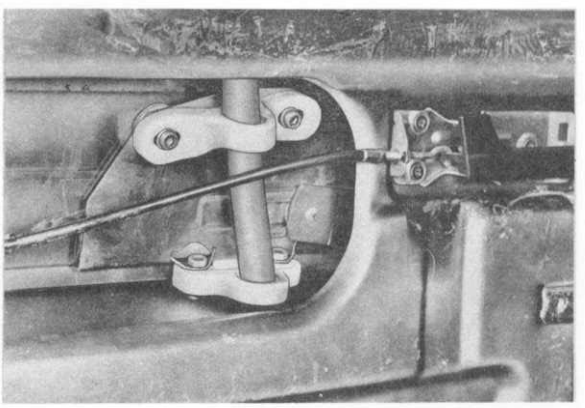
4. Install window recess seals, window guides and ornamental frame.



Note

Use a plastic hammer to install ornamental frame on edge of window opening. Coat rubber parts with petroleum, to facilitate pressing them into ornamental frame grooves. In the past a liner was mounted in the front curve with pop rivets, in the outer holes of which the ornamental strip corner was installed. The new corners are mounted with clips.

5. Set guide tube with mounted slides in center position and bolt to lifting rail.



Note

Make sure that wire harness is routed to outside mirror, so that it will not come in contact with glass.

Lubricate window lifting rails and guide tube with a multi-purpose grease.

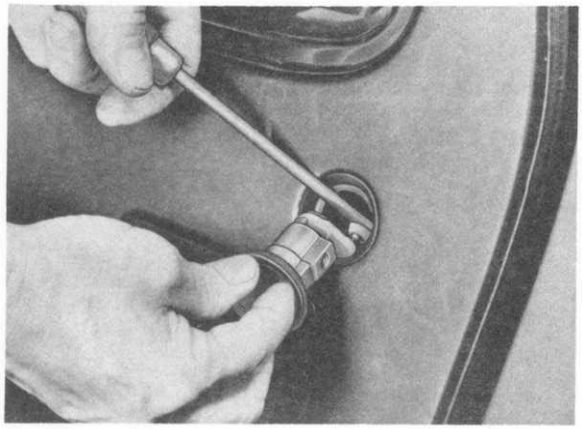
6. Run up window until it is completely in window frame, adjusting guide tube mountings if necessary.

7. Loosen both slides to relieve pressure on window glass and then tighten.

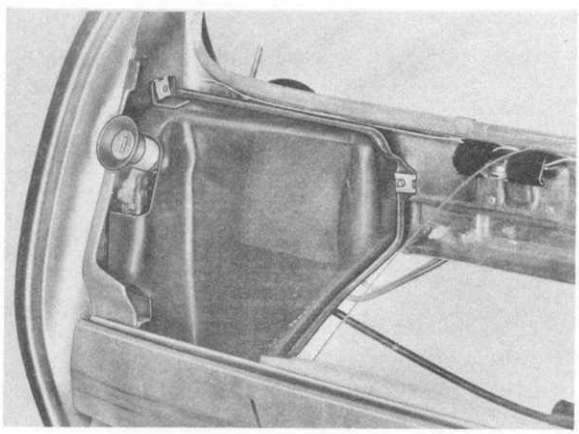
8. Lower window and measure distance to guide rail (5 to 6 mm) and adjust lower slide, that window glass runs in center of window frame. If necessary, loosen slides and tighten again after removing stress from window glass.

REMOVING AND INSTALLING DOOR LOCK

1. Remove grommet plug from door frame and unscrew socket head screw. Remove lock cylinder and detach connector from door lock.



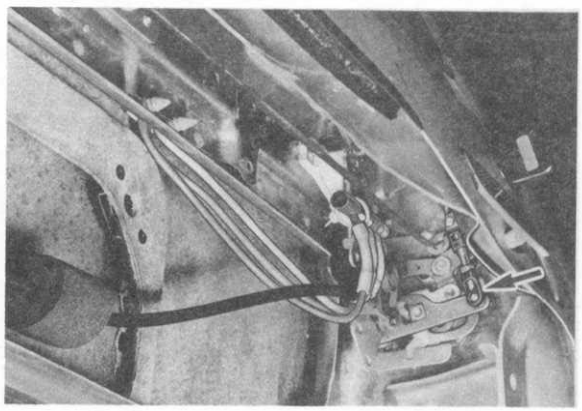
2. Unscrew and remove door lock cover.



Note

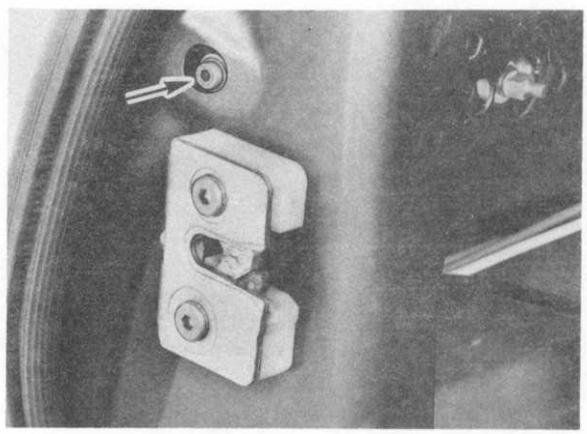
This lock cover was not used on the first cars manufactured.
The figure shows front passenger's door with a guide rail.

3. Detach connecting rod from outside door handle to lock. Unscrew and pull out outside door handle.



4. Pull off connecting hoses to control valve (driver's door) and vacuum control (passenger's door), and unscrew control parts.

5. Unscrew self-locking screws on lock outside section. Unscrew inside door control and remove with inside lock parts.



Note

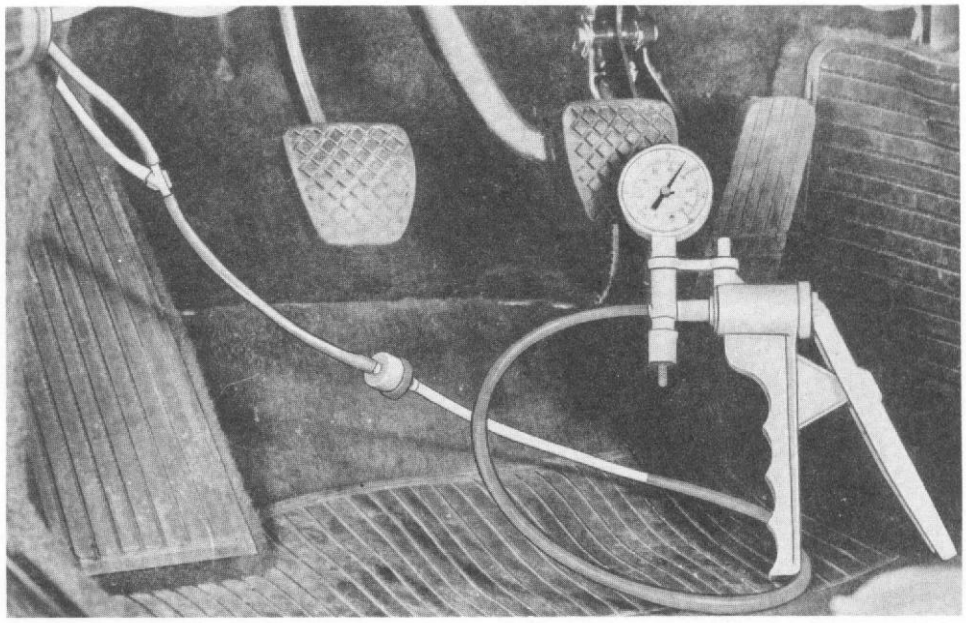
Hoses are connected on control valve in driver's door in red, blue and green as seen locking forward. In the passenger's door the red hose is connected on the vacuum switching part front inside and the green hose outside, so that locking will be simultaneous.

CHECKING DOOR CENTRAL LOCKING SYSTEM

The central locking system of the doors employs vacuum. A vacuum of at least 400 mbar is required to guarantee operation.

For testing, this vacuum can be provided by running engine for about 2 minutes or with a vacuum pump.

The necessary vacuum can be produced with just several pump actions by using Special Tool 9160 in a vacuum line, which is not connected with a vacuum tank. Pump would have to be operated about 50 times when a vacuum tank is involved.



Pump' s scale shows about 45 an = 450 mm on barometric column, which is equal to about 600 mbar vacuum.

If system is in good condition, the vacuum built up by engine will be sufficient for unlocking and locking even 2 days later.

If central locking system fails, first check control lines of driver's door for leaks.

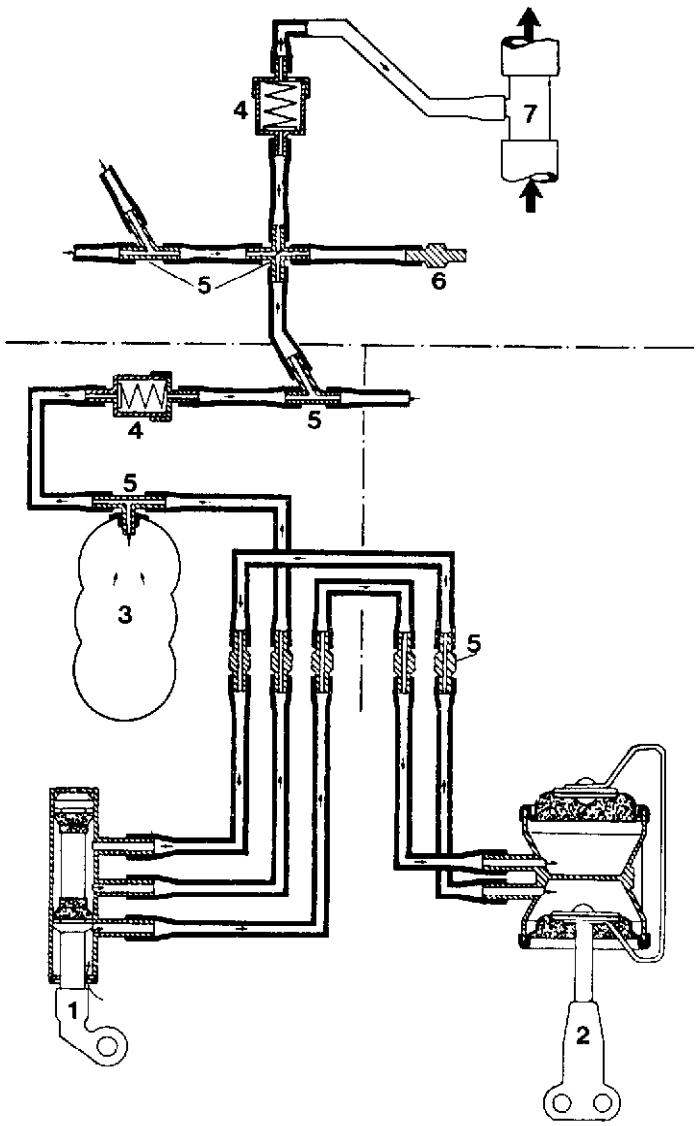
If vacuum drops obviously while testing with a vacuum pump and without operating the central locking system, the control system has a leak.

If unlocking and locking are not possible in spite of sufficient vacuum, the cause could be a mechanical defect, incorrect assembly or pinched hoses, impairing the control function.

When functioning correctly, the catch buttons of both doors must go up and down when unlocking and locking the driver's door with a key.

Doors can only be locked when doors or strikers are closed.

Layout of Central Locking System



1 = Control valve in driver's door
2 = Vacuum switch in passenger's door
3 = Vacuum tank in instrument panel
4 = Check valve
5 = Connector
6 = Plug
7 = Vacuum line to brake booster

Note

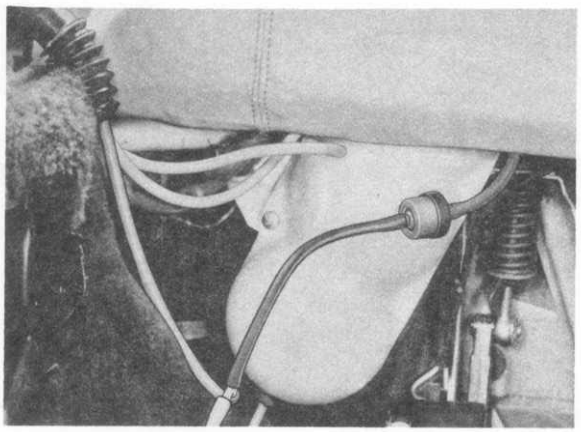
In order to be able to seal hose connection of vacuum pump with control lines, one each coupling must be installed in the lines.

When checking green line of driver's door with a vacuum pump, lock must lock. Red line = unlock.

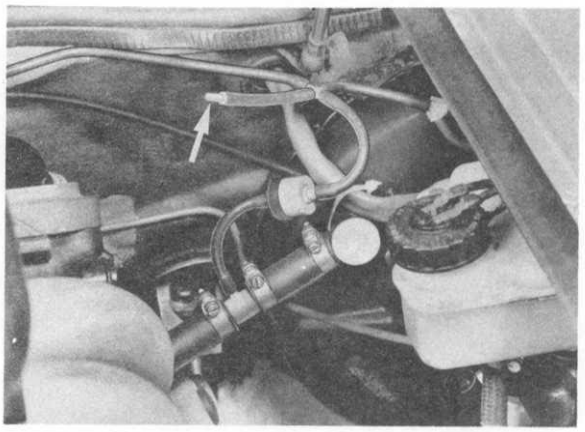
No vacuum will build up in other lock position.

From Chassis No. 928 810 0554
928 830 9521
928 820 0054
a special vacuum tank and check valve are installed underneath the instrument panel for the central locking system, therefore having a separate vacuum circuit from that of the heater and fresh air controls.

The first cars were fitted with rubber hoses. The introduction of hard plastic tubes has guaranteed free through flow even in tight points.

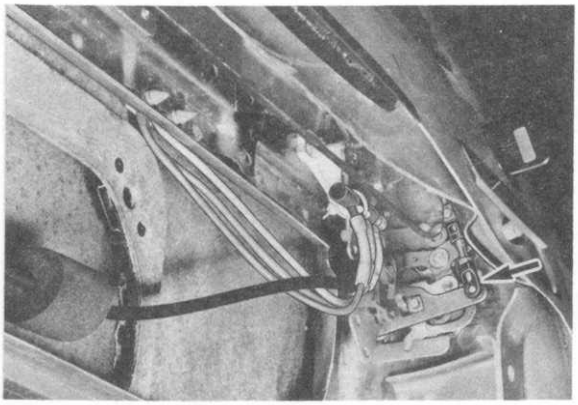


Vacuum tank underneath instrument panel

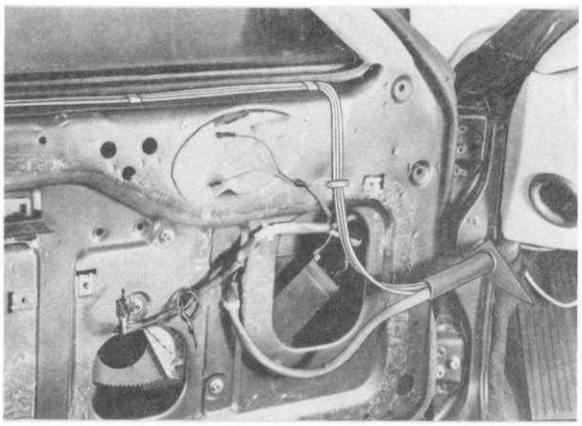


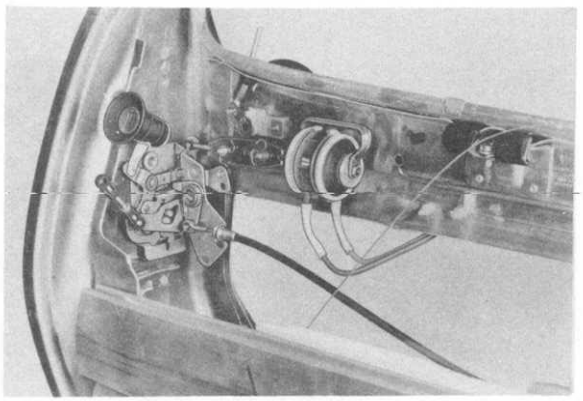
Test connection in engine compartment

As seen looking forward in car, vacuum lines on control valve of driver's door are red, blue and green. On vacuum switch in passenger's door green is connected at rear and red front inside.



Foam rubber strips must be used underneath plastic lines routed to the doors on the door inside panel. Lines are held with clamps, while downward leading lines are mounted with clips.



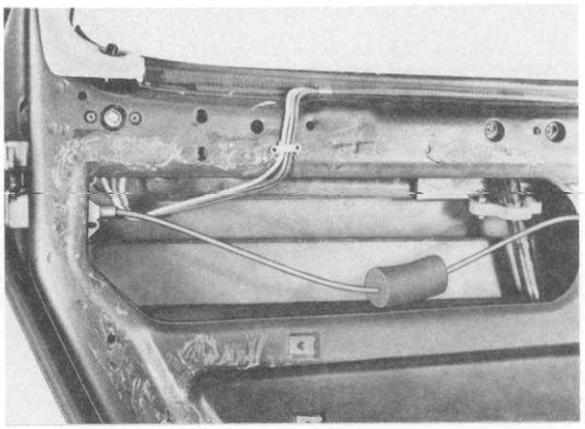


With this arrangement red lines are used to lock system and green for unlocking.

When testing the red or green line with a vacuum pump alternately, the locks of the doors must lock or unlock respectively.

Important

This test requires that the doors or strikers be closed!



When checking blue line leading to driver s door with a vacuum pump, there must be no drop in pressure without operation of locks. When locking and unlocking, pressure gauge could show up to approx. 20 mbar loss in each case.

TROUBLESHOOTING CENTRAL LOCKING SYSTEM

Unlock driver's door with key
Passenger's door is not unlocked

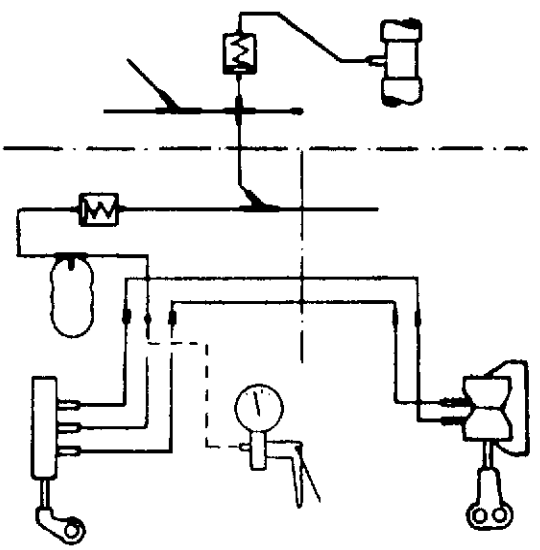
Car was not used for longer than 2 days (permissible vacuum loss).

Start engine briefly and then check lock action. If system is in good condition, it should be possible to operate lock about 10 times.

Vacuum Loss:

1. Troubleshooting - Supply Line

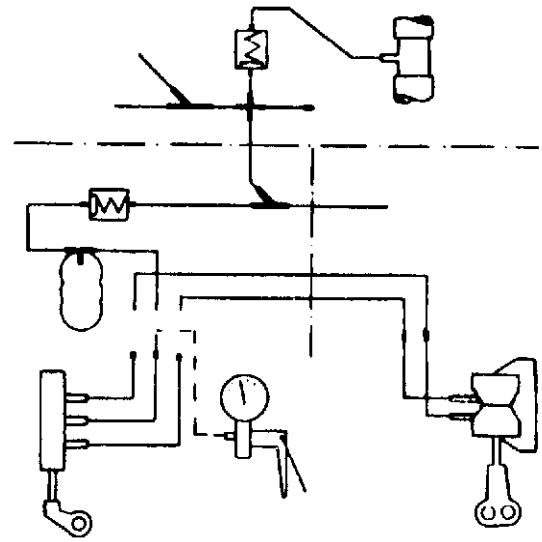
Disconnect blue control line in footwell on left side. Connect vacuum pump to blue hose leading to vacuum tank. Run engine briefly or build up 400 to 500 mbar with pump and observe pressure gauge. Gauge must remain constand without lock operation.



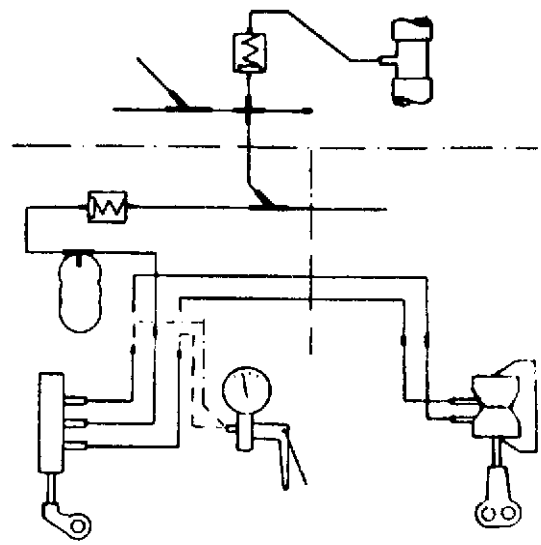
If pressure drops, check valve, vacuum tank or hoses have leaks.

2. Troubleshooting - Left Door

Connect vacuum pump on blue hose leading to door lock and produce vacuum. Operate door lock with key and observe vacuum. Leaks could be in hoses or control valve.



Remove door trim panel and replace damaged parts.



Connect green and red lines to vacuum pump alternately.

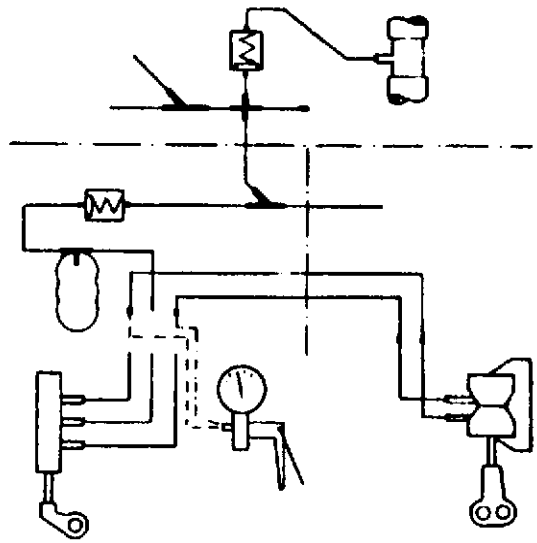
A line has been pinched. if lock does not function and there is no drop in vacuum.

Defect could be found at rubber hoses in door area or connecting tube to footwell.

If there is a loss in vacuum, control valve has a leak or there is a mechanical defect in lock mechanism.

3. Troubleshooting - Right Door

Connect vacuum pump at connecting point in footwell on left side, alternately, to red and green lines leading to right door. Vacuum built up in red line should lock and in green line unlock lock.



If pressure drops without operating of lock, connect vacuum pump at connecting points on right side of footwell. If locking system functions, the source of defect is located inbetween.

Vaccum available, but no locking action.

Control lines are pinched or vacuum switch is not positioned correctly.

Remove door trim panel, replace control lines if necessary or adjust position of vacuum switch in horizontal slots in inside door panel.

4. Troubleshooting - Lock Mechanism

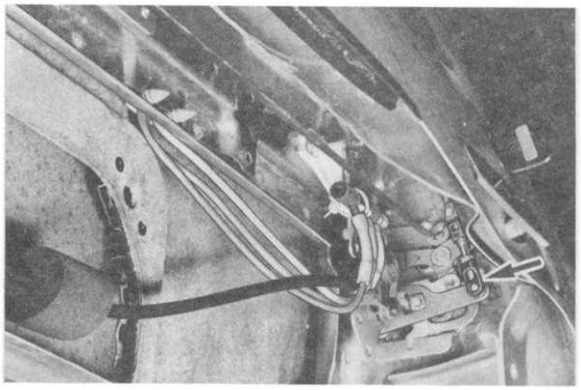
Possible Defects on Both Doors:

1. Defective lock cylinder.

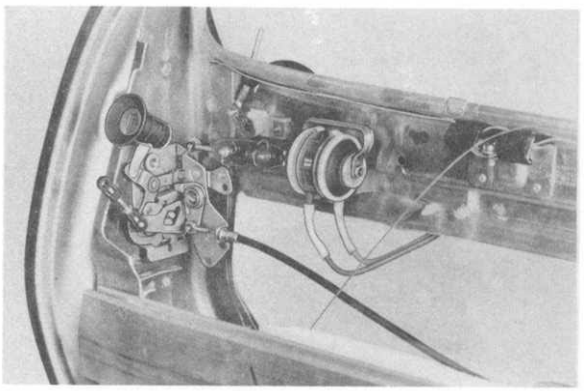
2. Broken drive dog on lock cylinder.

3. Detached connecting or locking rod.

4. Lock mechanism too tight or clamped.



Driver's door

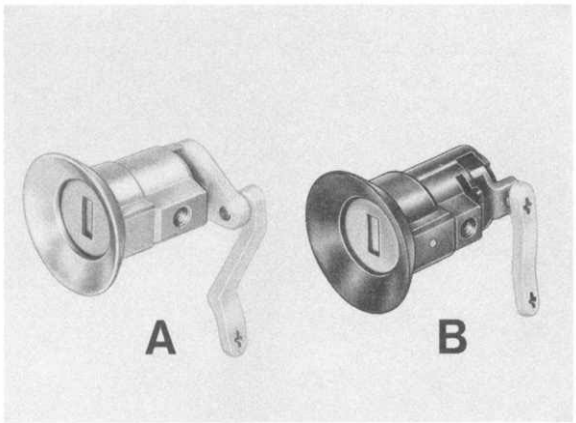


Passenger's door

REPLACING DOOR LOCK CYLINDERS

As from Chassis No. 928 810 2412
928 820 0884
928 920 9511
new door lock cylinders with a black escutcheon are installed in all models. The old lock cylinders with a chromeplated escutcheon are replaced by new lock cylinders, Part No. 928 537 901 02 with even codes or Part No. 928 537 903 02 with uneven codes.

If new lock cylinders are installed in cars prior to the above mentioned chassis numbers, old operating rod must also be exchanged against a new one having Part No. 928 537 111 03.

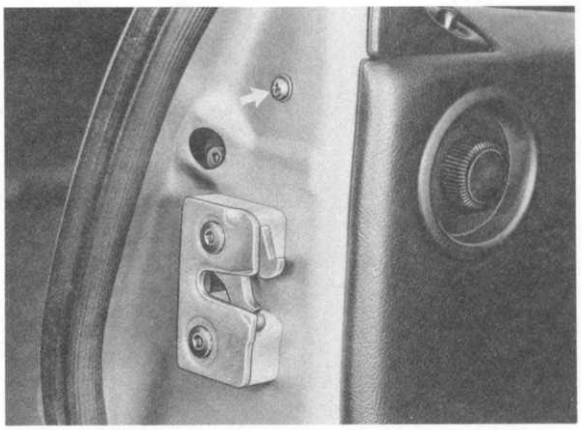


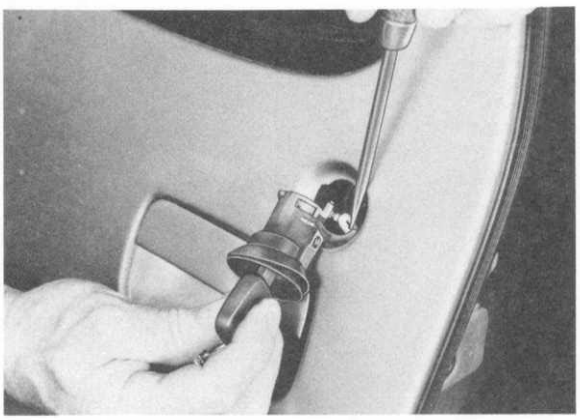
A - Old Version B - New Version

Removing and Installing

1. Pull off grommet from door frame and unscrew socket head screw.

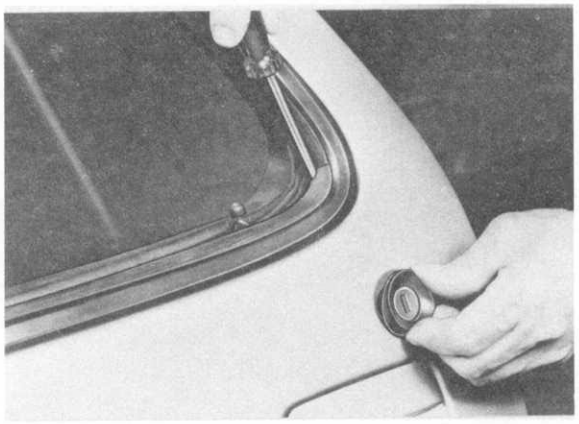
2. Loosen metal screw (arrow) and pull out lock cylinder far enough, that operating rod can be detached.





3. Detach operating rod from inner lock. Attach new operating rod on inner lock's ball pin and lock cylinder.

4. Press lock cover plate forward with a screwdriver, so that lock cylinder can be guided in all the way.



5. Install mounting screws for lock cylinder and lock cover, and press in grommet.

Note

Never use grease containing copper powder or other electrically conductive materials near the door lock cylinder contact switch of cars with an alarm system.

The alarm system could sound off on its own through the effects of moisture and electrically conductive grease.

MODIFICATION ON ROTARY KNOB LOCK

As from Chassis No. 928 810 1853
928 820 0661
928 820 9552
a modified rotary knob bearing is installed in all models.

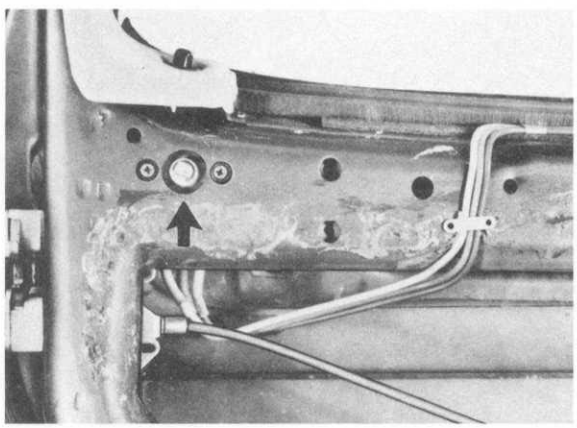
This modification covers:

1. Rotary knob bearing
   Driver's door Part No. 928 537 095 02
   Passenger's door Part No. 928 537 096 02
2. Bearing shell Part No. 928 537 585 02
3. Rotary knob Part No. 928 537 581 03
4. Cap Part No. 911 537 703 00

The former rotary knob bearing parts are unvalid and will be replaced by the new parts.

When installing in doors of cars prior to the above mentioned chassis numbers, the door trim must be removed and the plastic sheet pulled off partially.

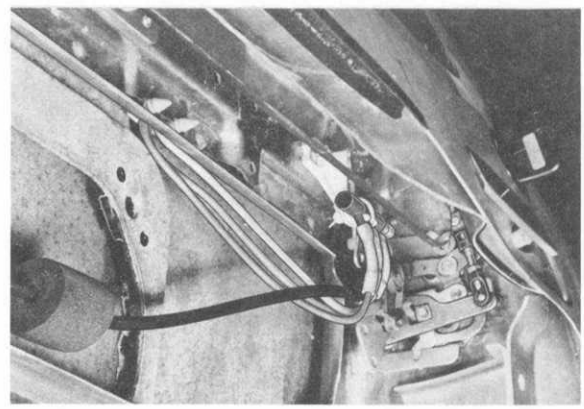
Open up opening in door inner panel for rotary knob bearing (arrow) to approx. 26 mm dia.



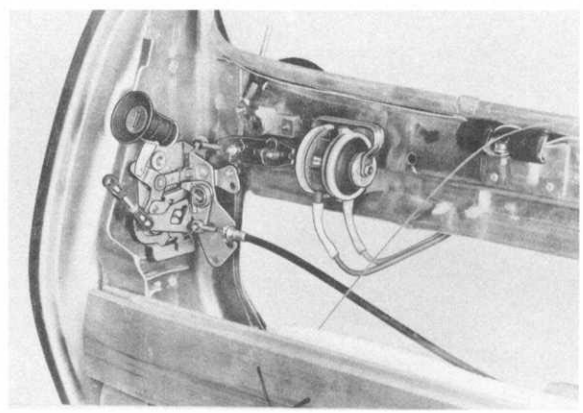
On driver's door fasten control valve with vacuum lines on rotary knob bearing at exact center with hose tape.

Installing

1. Insert rotary knob bearing. Attach safety rod on rotary knob bearing and inner lock, and mount rotary knob bearing.



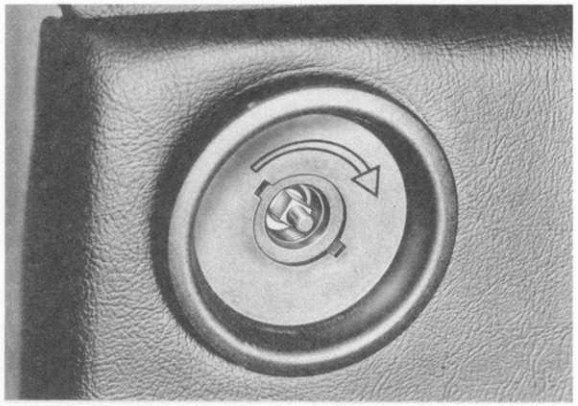
Driver's door



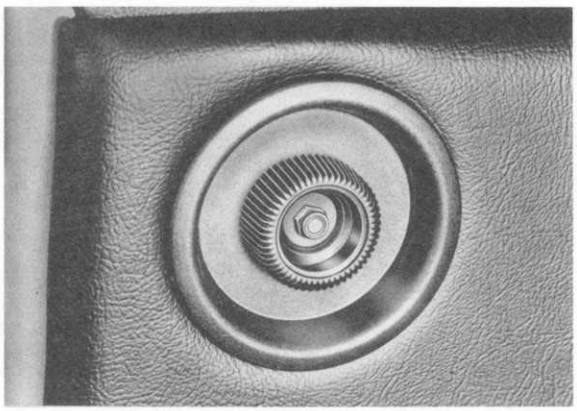
Passenger's door

2. Paste on plastic sheet and install door trim.

3. Turn up bearing shell to position on door trim.



4. Push on rotary knob and mount with washer and self-locking nut.

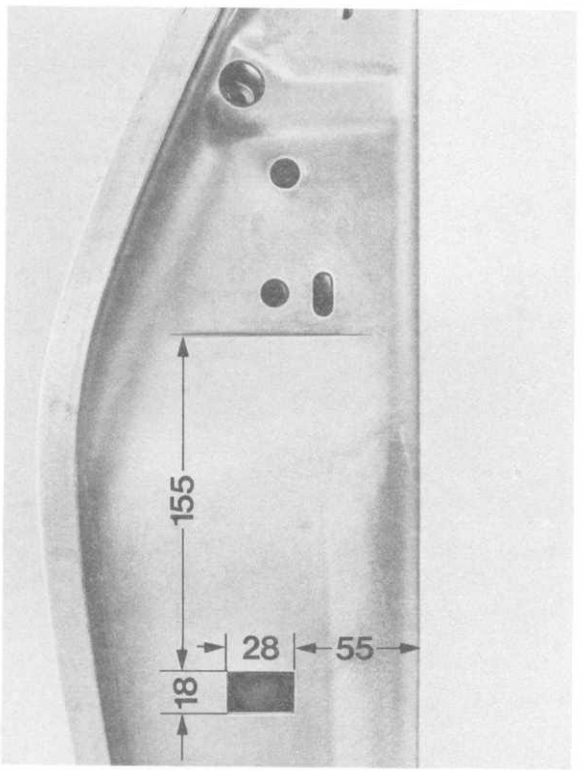


5. Press on cap.

MODIFICATION ON UNFINISHED DOOR SHELL

The opening for the door safety light must be made in spare doors at the door pillar as shown in the case of former version door shells for cars from 1980 models.

Dimensions in mm.



TROUBLESHOOTING CENTRAL LOCKING SYSTEM - From 1980 Models

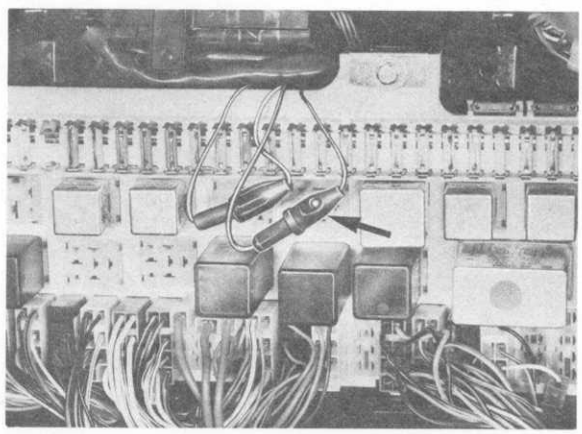
Checking Power Supply

Note

The central locking system only works with the ignition turned off. If the ignition is turned on, the window lifting relay will interrupt the power supply to the controls.

Check fuse no. 21 and both line fuses (0.4 A fine wire fuses) of left and right controls.

They are located in loose fuse holders behind the central electric board.

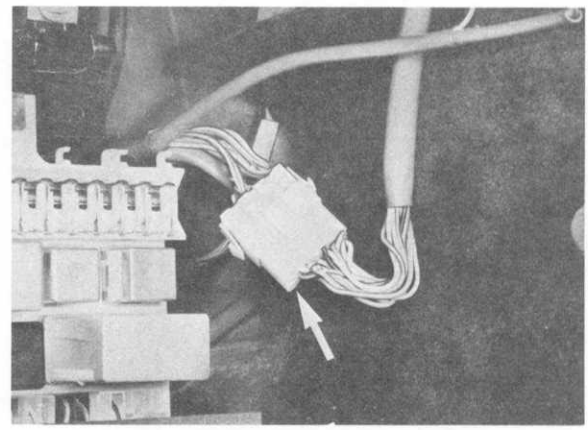


If fuses rated 0.25 A or others have been installed, replace them with 0.4 A fuses.

Finding Defective Side

Both controls are connected with each other electrically and could influence each other when defective.

To prevent this, disconnect the multiple pin plug of the wire harness in the passenger's door to the right hand side of the central electric board.



Check function of electric locking system on driver's side to find the defective side.

Note

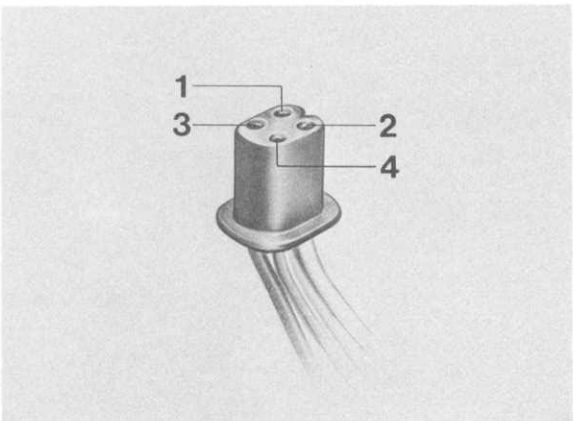
The central locking system can only function properly when the lock mechanism moves easily, does not seize and the lock cylinders are okay.

Removing Controls and Checking Function after Removal

1. Remove door trim panel.

   If still disconnected, connect multiple pin plug of wire harness for passenger's door.

2. Pull off plugs on control and check plug connections.



1 = green/black
2 = yellow
3 = brown
4 = red/white

3. There should be battery voltage between lines of red/white term. 4 and brown term. 3 (ignition turned off).

4. With the opposite side in unlocked position, the following voltage conditions should be prevailling at term. 1 and 2:

   Wire, yellow term. 2 - with voltage.
   Wire, green/black term. 1 - without voltage.

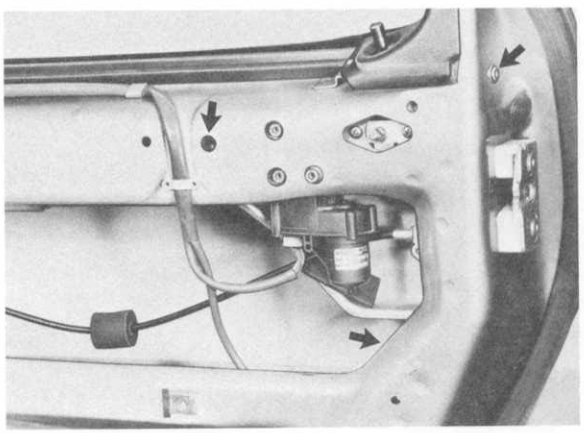
   Voltage should be opposite when in locked position.

   If voltage is not as described, replace control for opposite side or check wire harness.

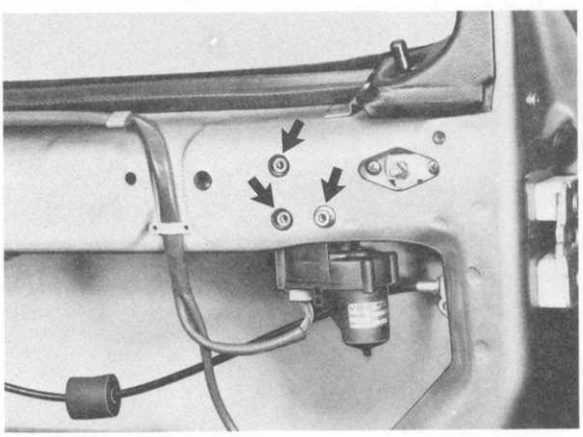
Note

If a test lamp is used to check the plugs, it could happen that the control will be switched on (power flow via test lamp).

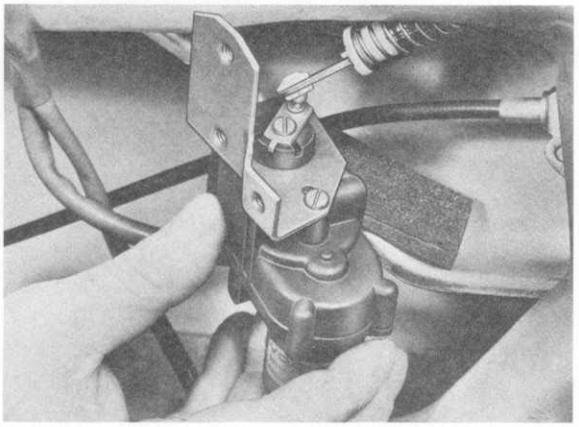
5. Remove lock cover.



6. Remove control.

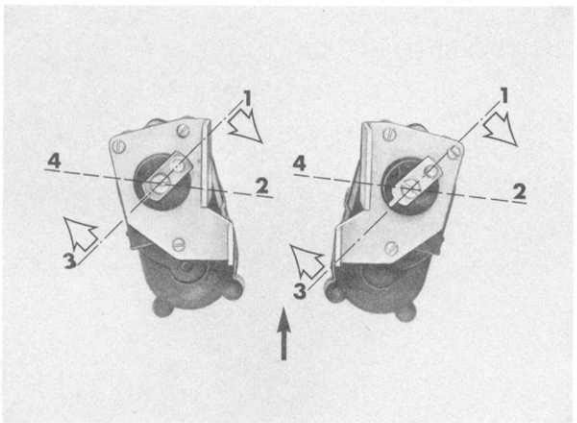


7. Disconnect transmitting linkage at winder.



Winder must turn easily from stop to stop. Replace the control when movement is hard.

8. Connect plugs on removed control (ignition turned off).



Turn winder clockwise from 1 to 2 by hand. Control should switch on in position 2 and continue turning to 3.
Turn winder further by hand about 45° (3 to 4). The control should turn further to initial point 1.

Replace control, if function is not correct.

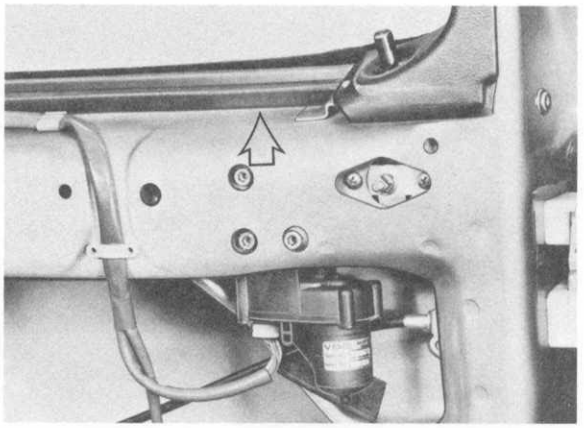
Installing and Adjusting Control

Note

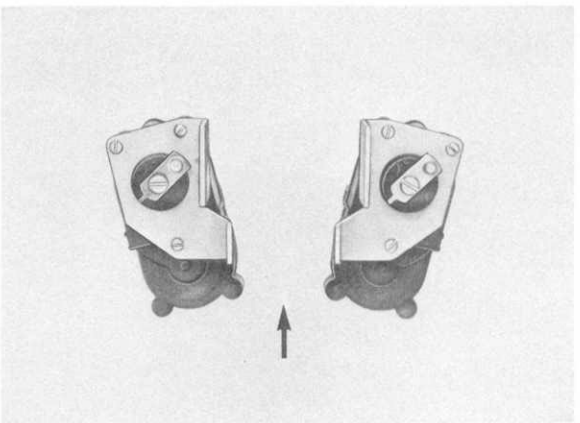
Mount control with the original M 6 x 8 bolts. Longer bolts would impair clearance of winder.

1. Install control.

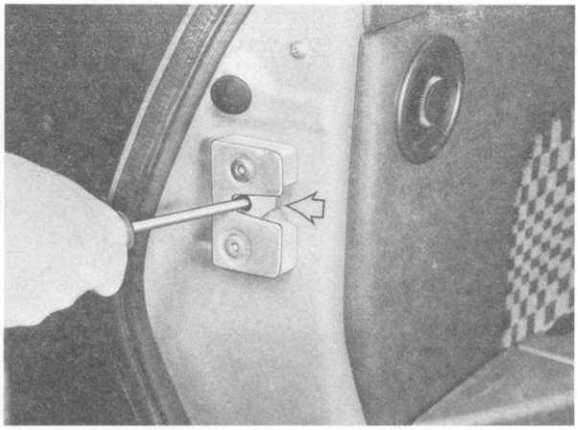
2. Pull up inner door recess seal above the control, so that position of winder to transmitting linkage can be observed from above after installation of control.



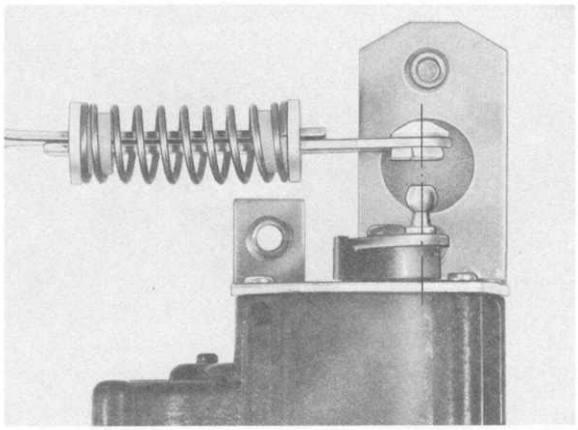
3. New controls are supplied in locked position; the winder faces right in installed position.



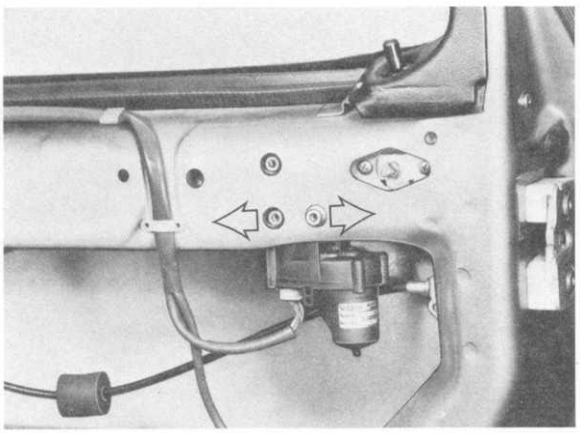
4. To adjust, move lock mechanism of opened door to "closed" position and push in locking button.



5. Hold winder of control in position 1 against stop.
   Ball socket on linkage must be aligned with ball head of winder.



If ball socket and ball head are not aligned, correct position of control in mounting bores or file slots, if necessary.



6. Unlock door and open the door lock by operating the inside or outside handle.

7. Check function of locks on both doors prior to final assembly.
   Locking buttons must be pushed in by at least 3 mm before the controls run.

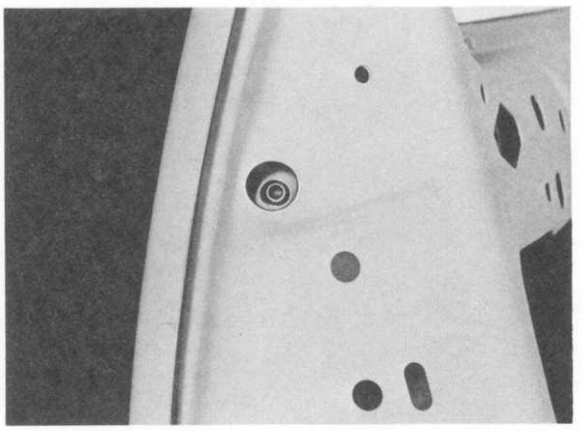
Note

Doors can only be locked when both doors are closed. If one door is open when locking the doors, the locking system will return to open state.

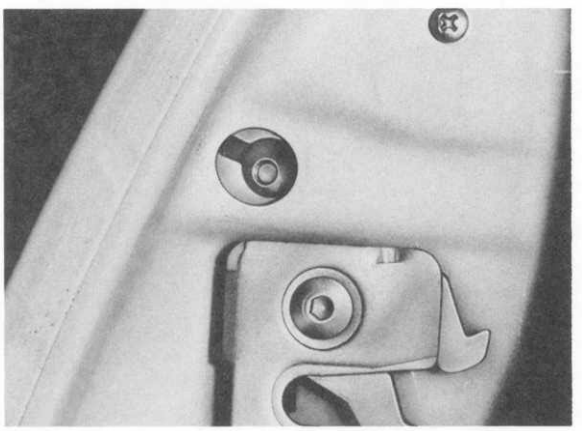
CHANGES ON DOORS AND DOOR LOCK CYLINDERS

The mounting points have been changed on doors and door lock cylinders.

Old Version Doors

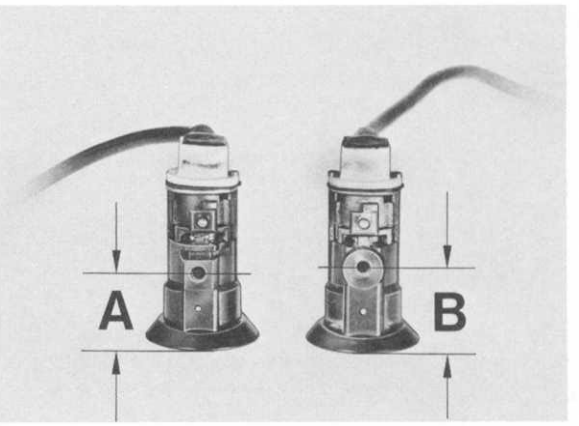


New Version Doors



Old Version Door Lock Cylinder –
A 26 mm

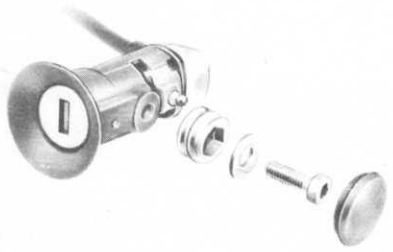
New Version Door Lock Cylinder –
B 29 mm



Since the old version doors still have the old mounting point, old or new door lock cylinders may be installed by filing the door mounting point.
A 6.4 mm dia. washer, a 6 mm dia. lock washer and a M 6 x 8 mm fillister head screw are required to mount the door lock cylinder.

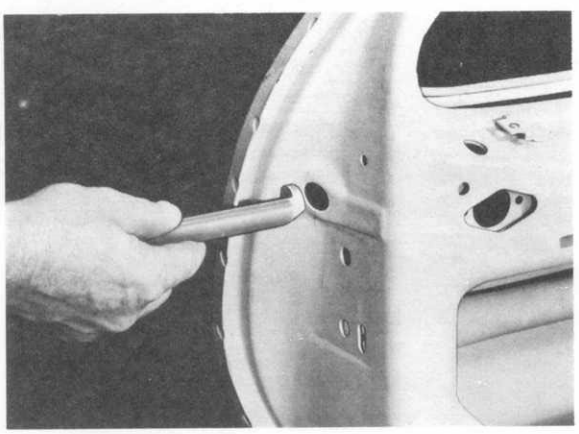


Doors with the new mounting point and new door lock cylinder require a spacer, 6.4 mm dia. washer, and a M 6 x 18 mm fillister head screw.

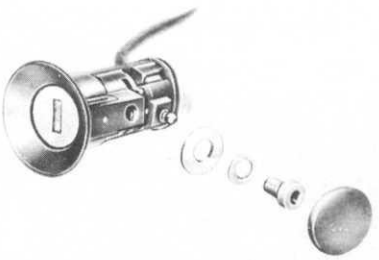


The following procedures are required to install an old door lock cylinder in doors with the new mounting point.

Fit in door lock cylinder. Check distance between mounting point and door lock cylinder. Change mounting point with the locally made tool in such a manner, that door lock cylinder and mounting point are in same level.



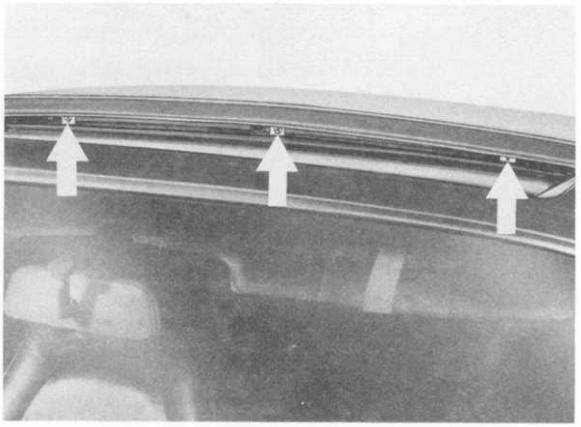
File mounting point if necessary. Installation of the door lock cylinder requires use of a 6.4 mm dia. washer, 6 mm dia. lock washer and a M 6 x 8 mm fillister head screw.



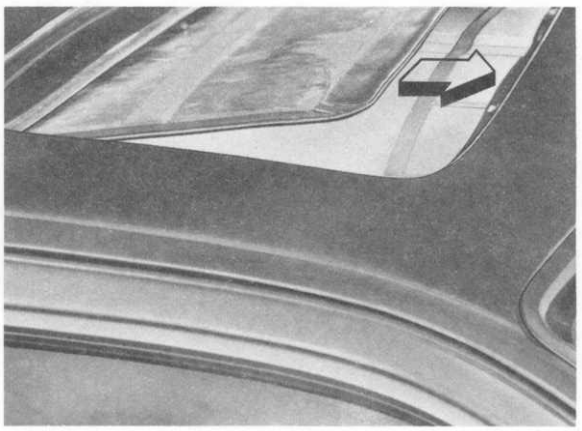
REMOVING AND INSTALLING POWER SUN ROOF (WITHOUT REMOVING GATES)

Removing

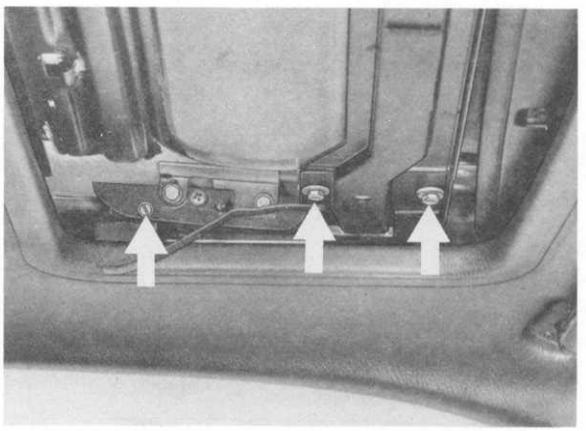
1. Open sun roof lid to rear end position. Unsrew sun roof liner mounting screws.



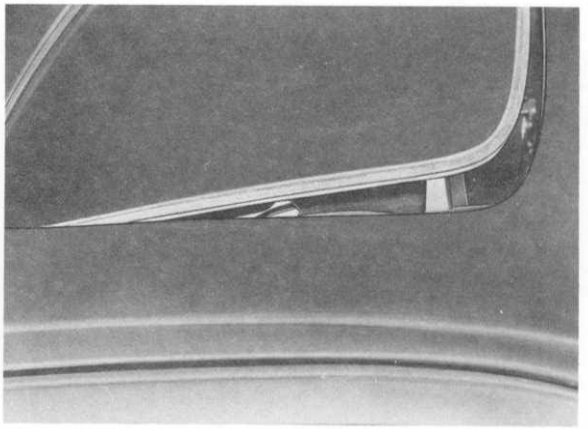
2. Pull out sun roof liner toward front.



3. Detach front guide and gates by loosening screws on sun roof.

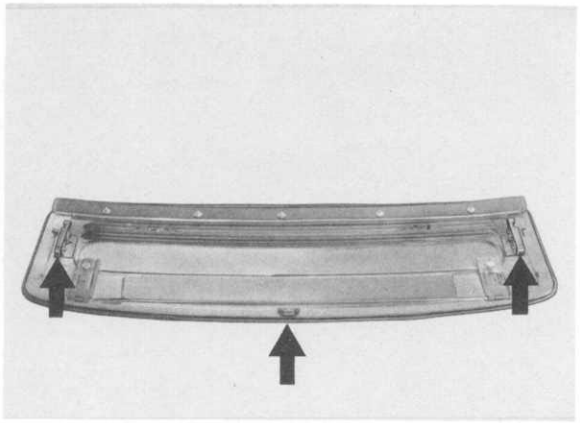


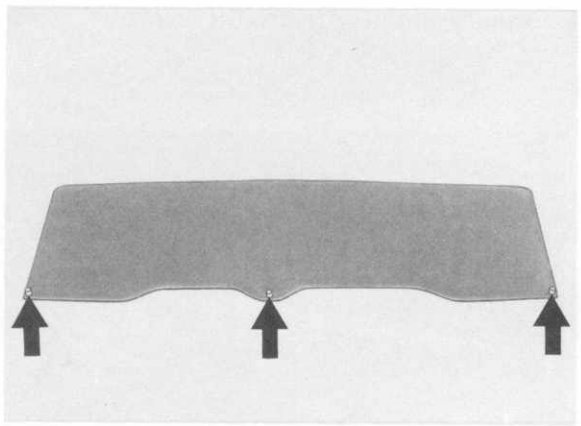
4. Close sun roof lid but for gap of approx. 10 mm. Lift front end of sun roof lid slightly, push back sun roof lid out of guides and lift off toward front.



Installing

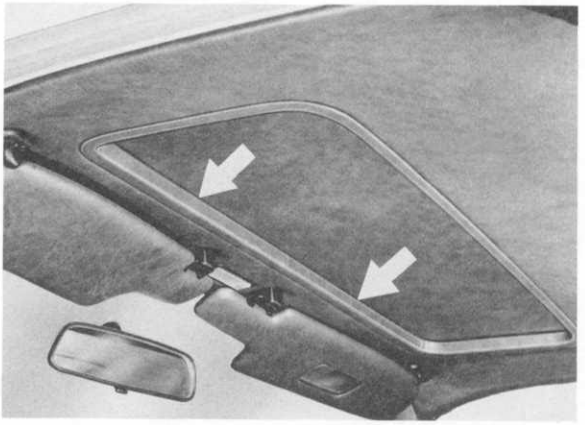
1. Check attachments before installing the sun roof lid (lid seals, gates and guides). Replace parts, if necessary.





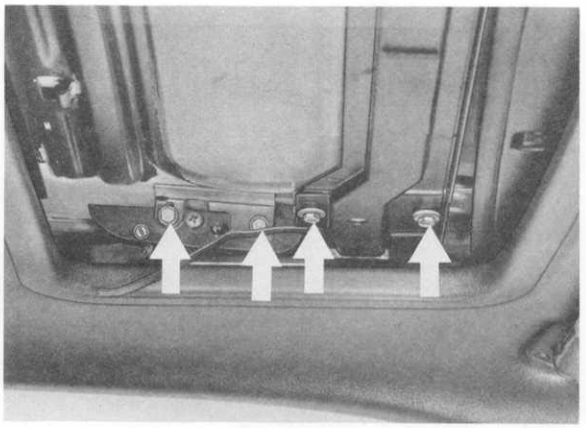
Installation is in reverse sequence.

2. Adjust sun roof liner that trim runs over roof frame without friction.

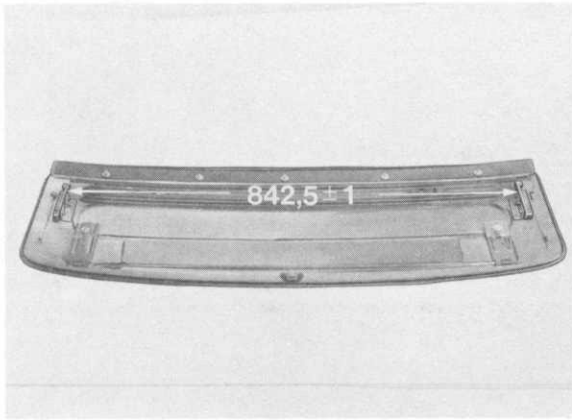


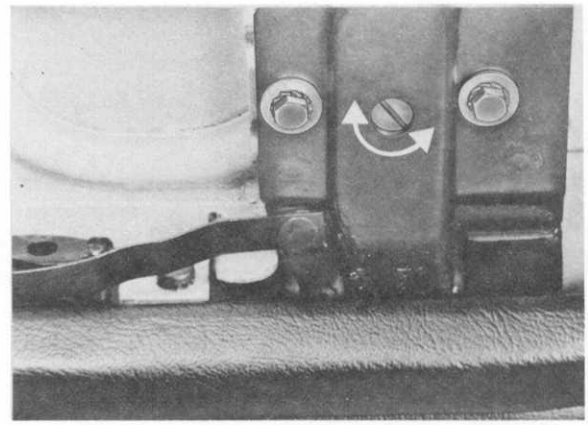
Note

Proceed as follows, if sun roof lid had been disconnected on the gate mounting screws or the gates had been replaced.

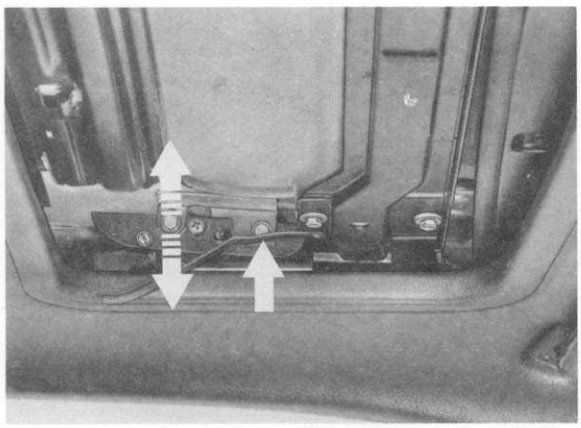


1. Correct the distance between gates, if necessary between brackets and gates, with washers.





2. After closing the sun roof lid, the rear end of the lid must be in same plane as the roof panel. Height can be corrected with the rear gate screws.

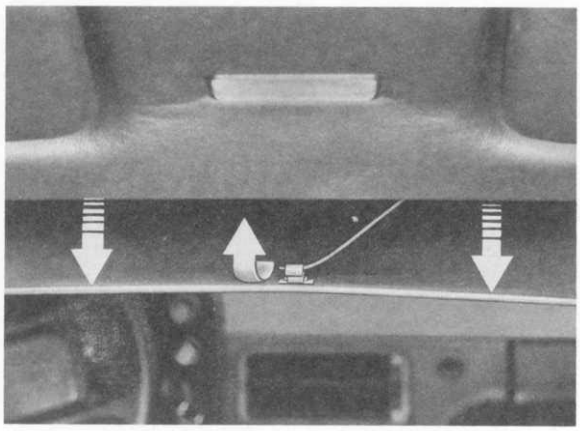


3. The lid's front edge can be adjusted to the roof plane with the recessed adjusting screws, whereby the mounting screws must be loosened first.

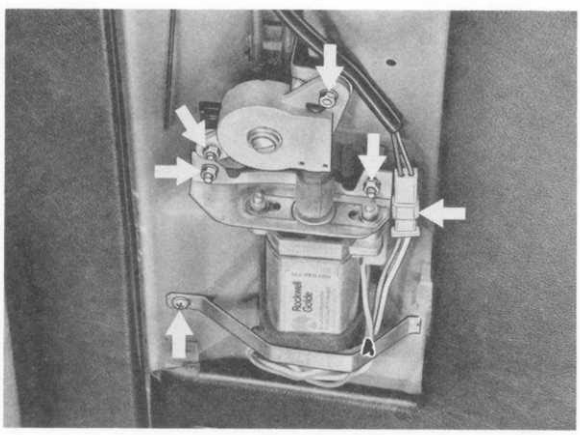
REMOVING AND INSTALLING DRIVE MOTOR AND GEARBOX FOR SUN ROOF

Removing

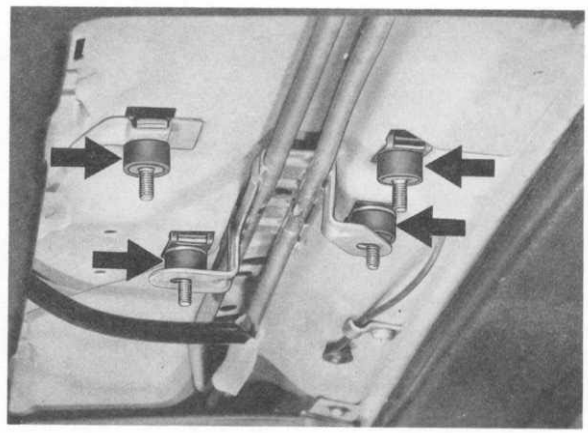
1. Pull down rear end of cover slightly, disconnect spring wire and take off cover toward rear.



2. Disconnect wire plugs. Unscrew mounting nuts and screw. Take off motor and gearbox.



3. Check rubber/metal mounts, replacing if necessary.



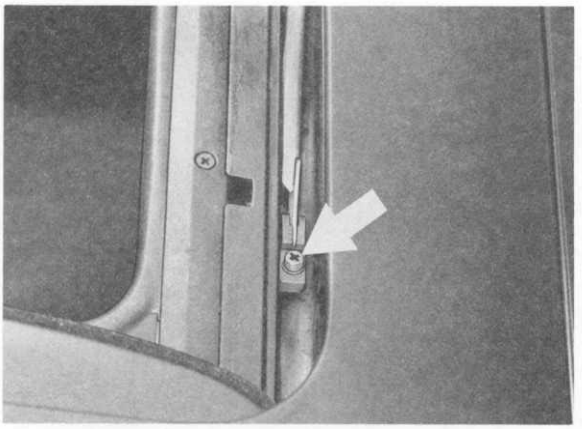
Installing

Check motor, gearbox and clutch for damage before installing, replacing if necessary. Installation is in reverse sequence.

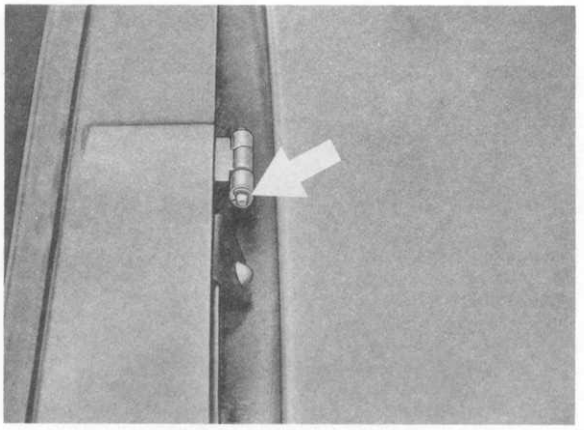
REMOVING AND INSTALLING WIND DEFLECTOR FOR SUN ROOF

Removing

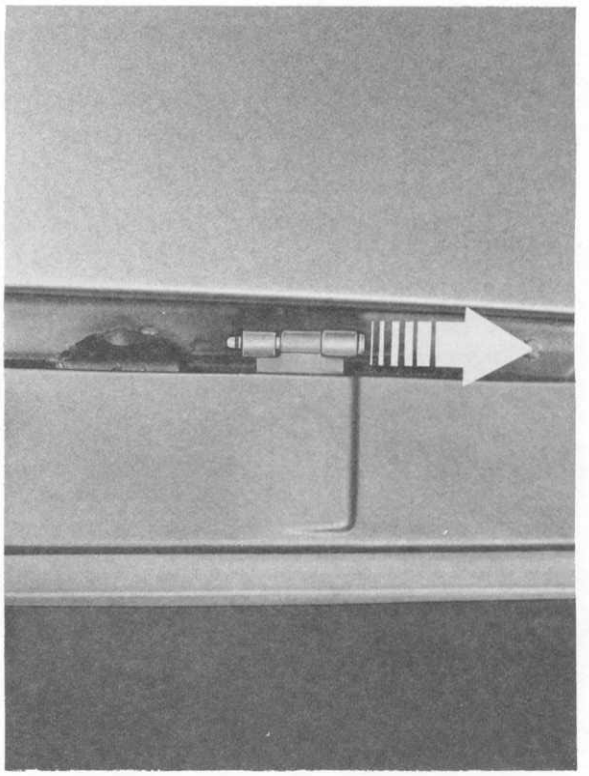
1. Open sun roof lid and unscrew deflector opener mounting screws.



2. Unclip locks on pins.

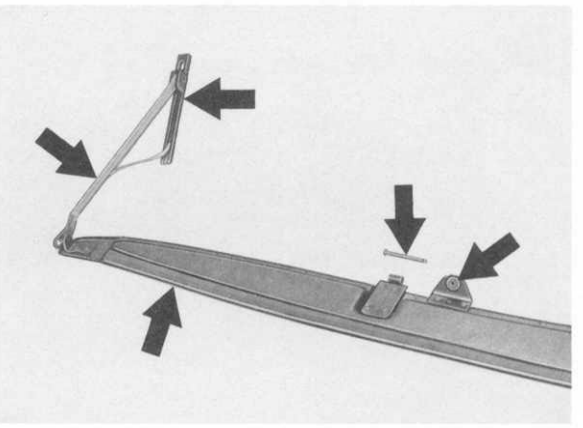


3. Press pins out of hinges and take wind deflector with opener out of car.



Installing

1. Inspect all parts (rubber pads, opener, pins, washers and locks), replacing parts when necessary, before installing the wind deflector.



2. Installation is in reverse sequence.

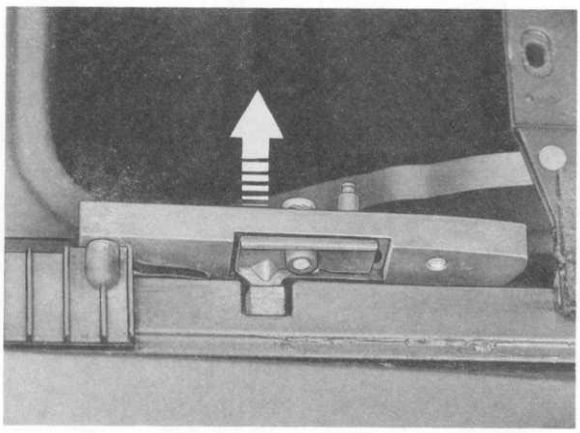
REMOVING AND INSTALLING GATES, GUIDE, CABLES AND GUIDE RAILS

Note

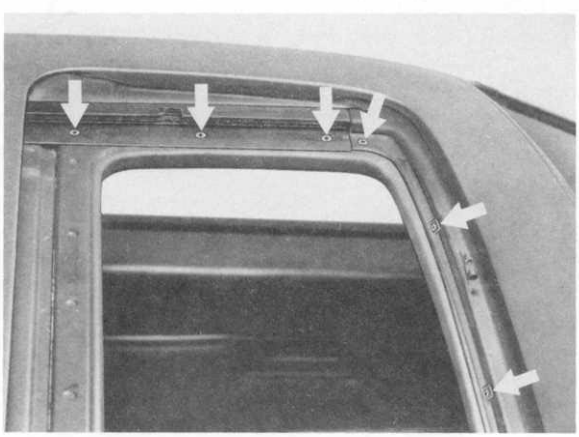
Sun roof gearbox is removed.

Removing

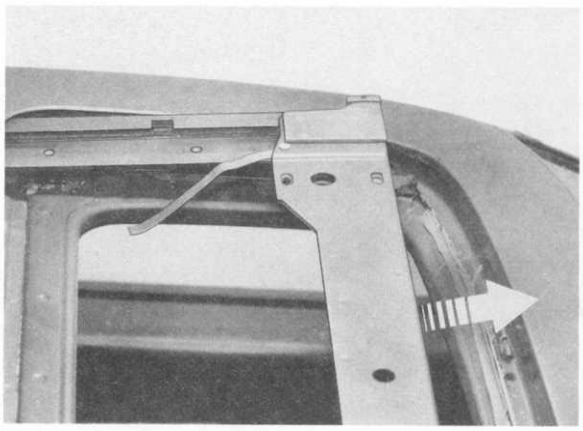
1. Take gates off of guide rails toward inside.



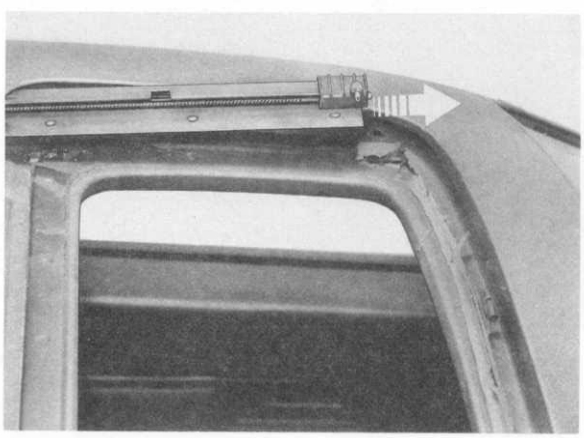
2. Push back front guide, unscrew mounting screws of front cover plate and guide rails, and lift off cover plate.



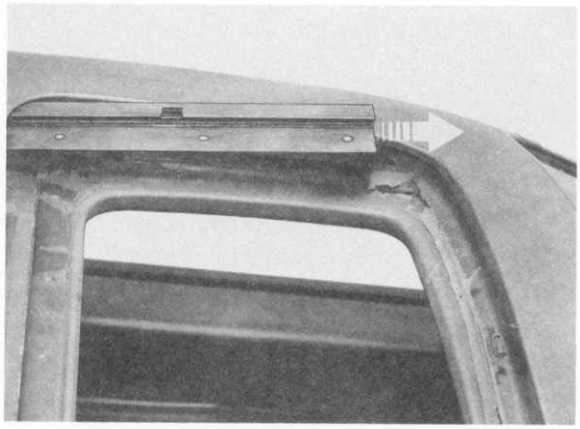
3. Lift front end of guide rails and push out guide toward front.

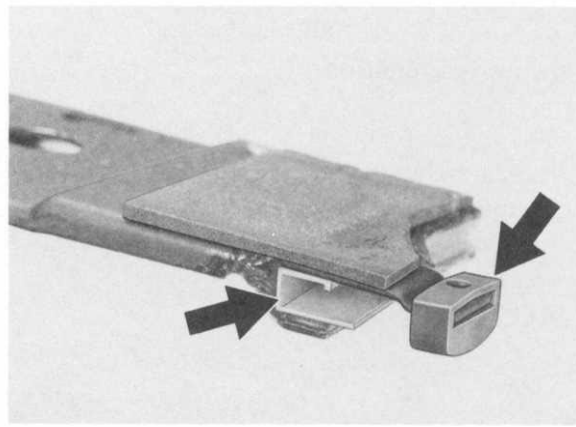


4. Pull out cables toward front (only possible after removal of gearbox).



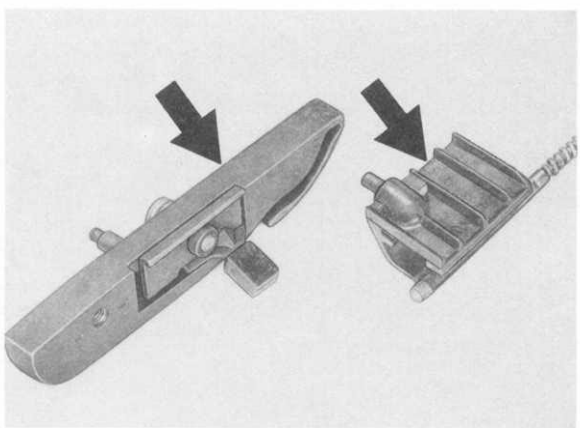
5. Pull guide rails out of spring clamps and remove toward front.





Installing

Inspect all parts for damage before installing, replacing parts if necessary.



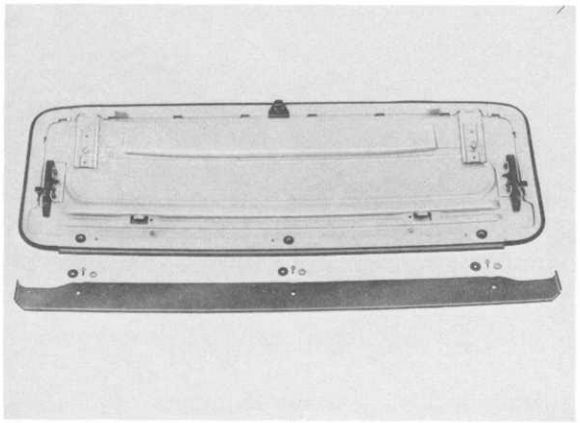
Lubricate all parts thoroughly with a special grease, e.g. Golde LS 2049 (application range from - 20° / 4° F + 90° C / 194° F).

Installation is in reverse sequence.

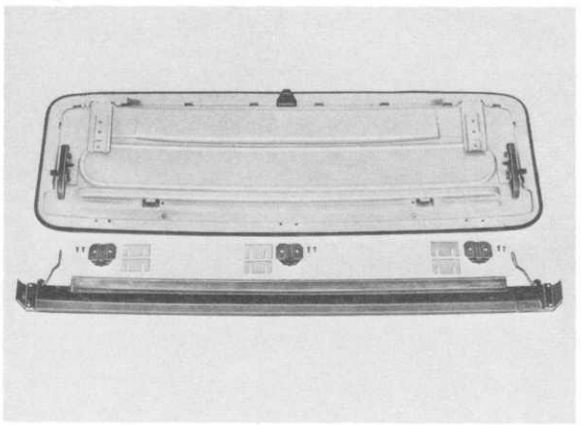
MODIFICATIONS ON SUN ROOF

Different modifications have been made on the sun roof since 1978 models to improve the function.

1. The rear cross guide with the connecting rods attached to the gates and stop plates bolted on the sun roof and shim plates have been omitted and replaced by a water drain plate, which is bolted direct to the sun roof lid at rear.



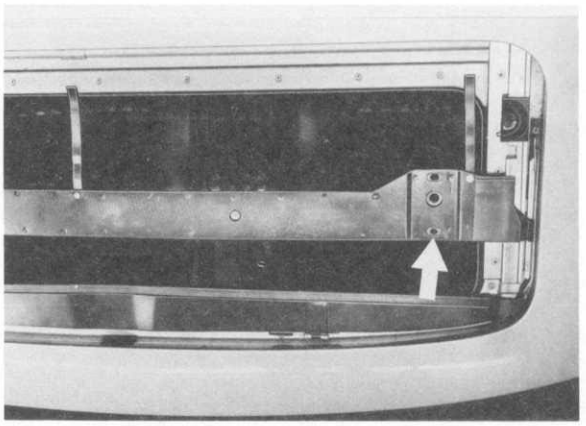
New Version



Old Version

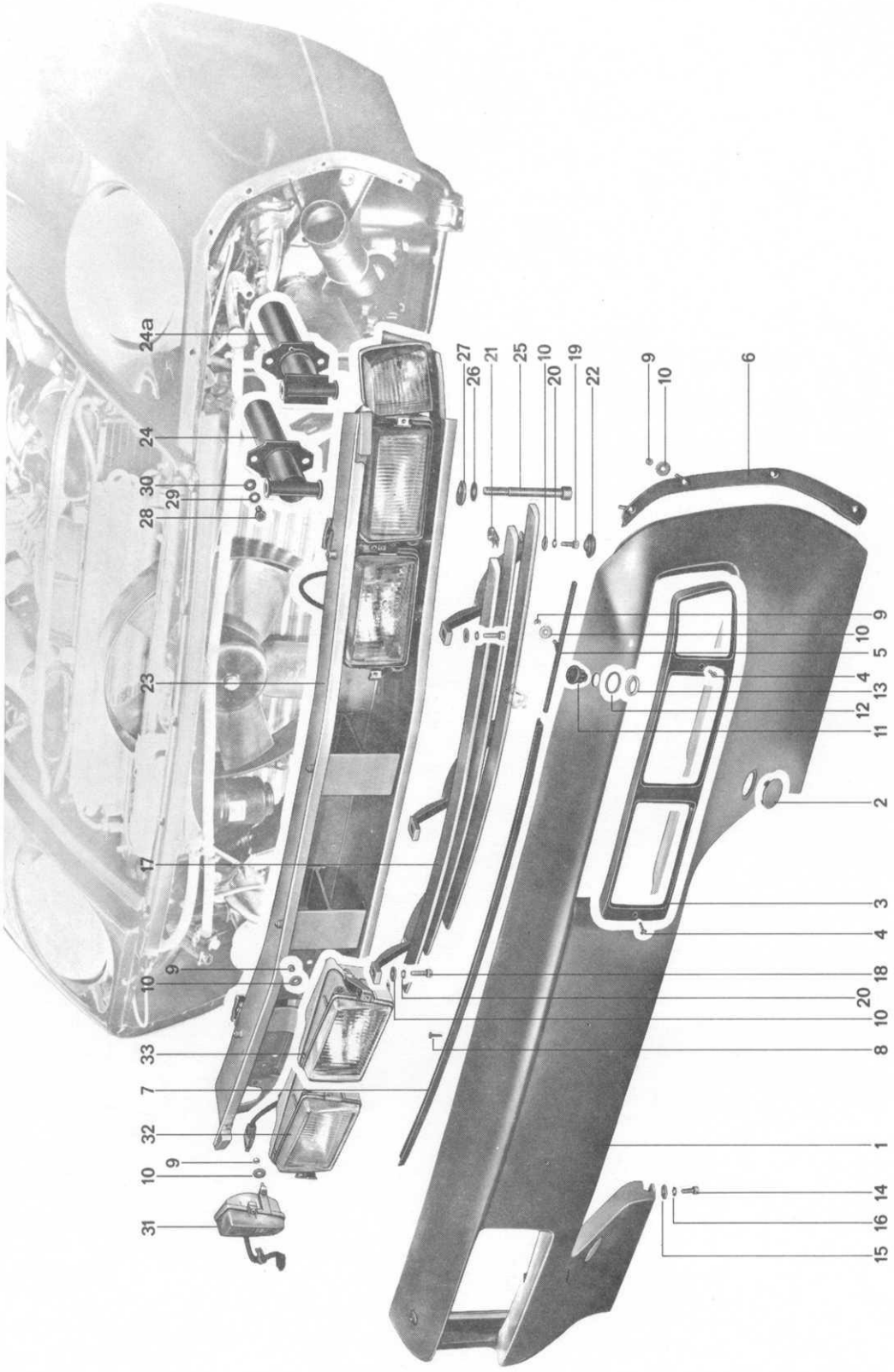
2. The velvet strip applied on the sun roof lid all around was replaced by a new part, which has an additionally flaked lip to prevent wind noise and improve sealing.

3. The front bolt holes in the front guide rails and lid hinge have been moved forward by 12 mm. In addition, in the middle of the new guide rail there is a third spring tongue resting against the sun roof head liner.



4. The height of the sun roof frame has been increased to improve clearance for lowering and returning.

REMOVING AND INSTALLING BUMPERS



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Panel	1	Detach at fender and top and bottom cross member, then pull forward a little and disconnect hose at spray jet	First fit panel on body, machine/grind off bearing surfaces. Rivet holding strips. Paint with PUR paint and install weatherstrip	
2	End cover	2			
3	Cover frame	2			
4	Metal screw	4			
5	Holding strip, upper	2	Replace, if necessary. Drill out rivets	Mount on panel with pop rivets	
6	Holding strip, side	2	Replace, if necessary. Drill out rivets	Mount on panel with pop rivets	
7	Cover rail	1	Replace, if necessary		
8	Metal screw	5			
9	Self-locking nut	30			
10	Washer	30			
11	Headlight spray jet	2	Open hose clip, detach hose	Aim at center of headlight with 9135	
12	Gasket	2			
13	Plastic nut	2			
14	Screw	2			
15	Washer	2			
16	Lockwasher	2			
17	Radiator grill	1	Replace, if necessary	Insert plugs in mounting holes on bottom cross member	
18	Screw	3			
19	Screw	3			
20	Lockwasher	6			
21	Cage nut	3			

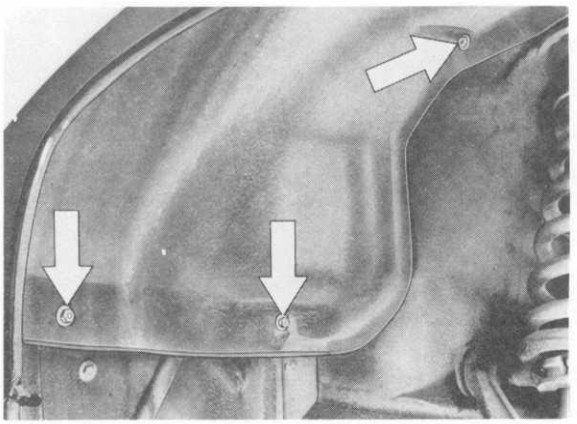
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
22	Rubber plug	3			
23	Carrier	1	Straighten only slight damage, otherwise replace		
24	Impact tube	2	Replace damaged parts	Bolt on carrier to fit body	
24a	Impact absorber	2	Replace damaged parts	Bolt on carrier to fit body	
25	Cyl. head bolt	2			
26	Washer	2			
27	Eccentric disc	2		Carrier can be offset depending on installed position	
28	Bolt	4			
29	Washer	4			
30	Washer	4			
31	Turn signal	2	Remove carrier, then disassemble	Mount on carrier before installation. Adjust on finished car. Fasten wires with clips	
32	High beam headlight	2			
33	Fog headlight	2			

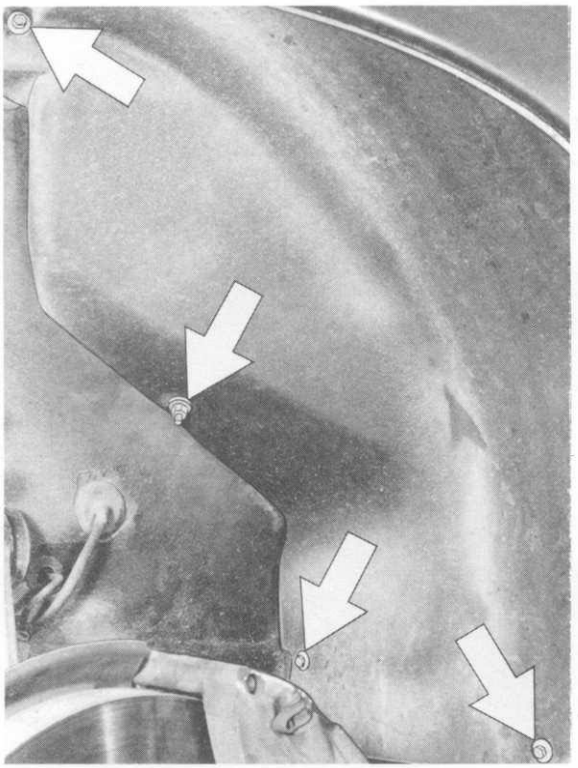
REMOVING AND INSTALLING NOSE PANEL, '87 MODELS ONWARD

Removing

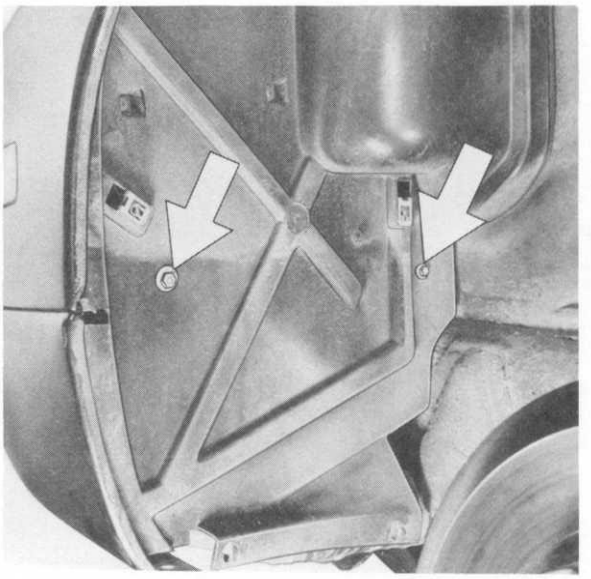
1. Remove wheels and front air dam.

2. Remove wheel-arch inner panel mounting bolts and remove wheel-arch inner panels from car.

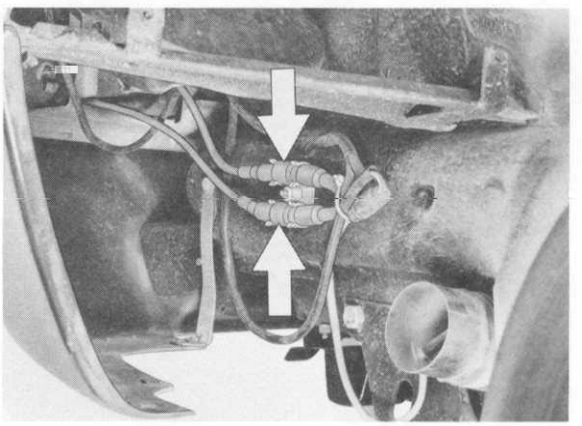




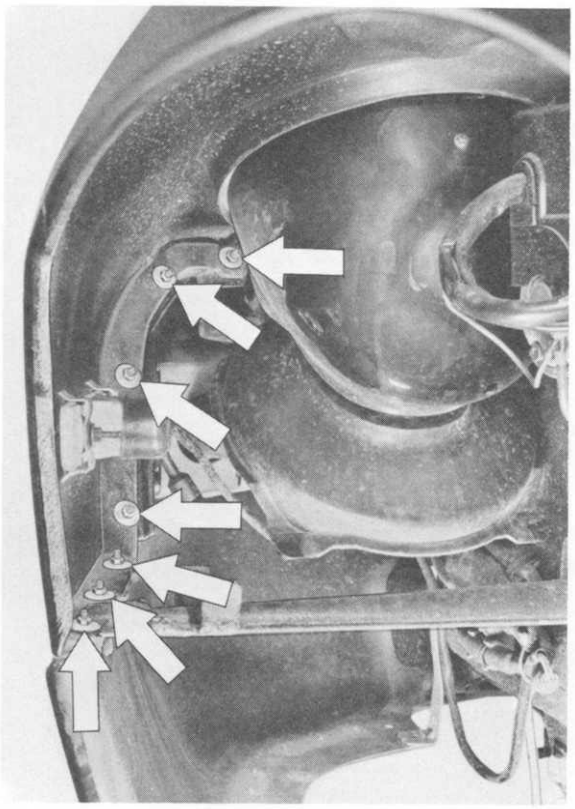
3. Remove wheel-well cover mounting bolts, disconnect air hose for outside-temperature sensor on left-hand side of car and remove wheel-well covers.

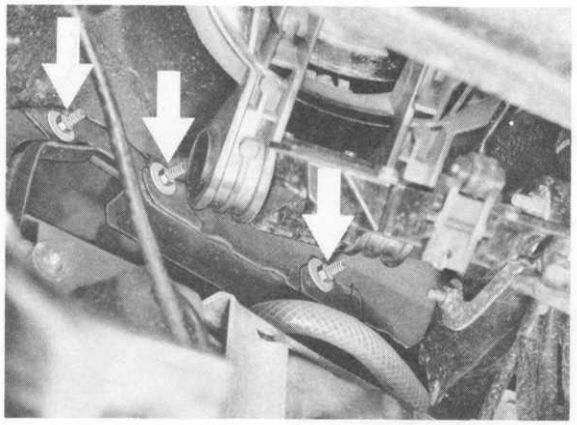


4. Unplug electrical connections.

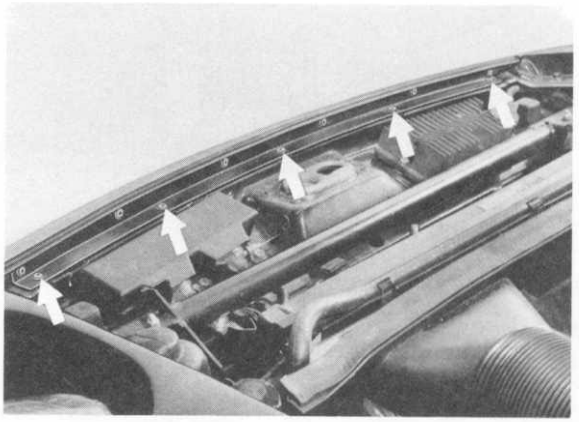


5. Remove bolts holding panel to front fenders.





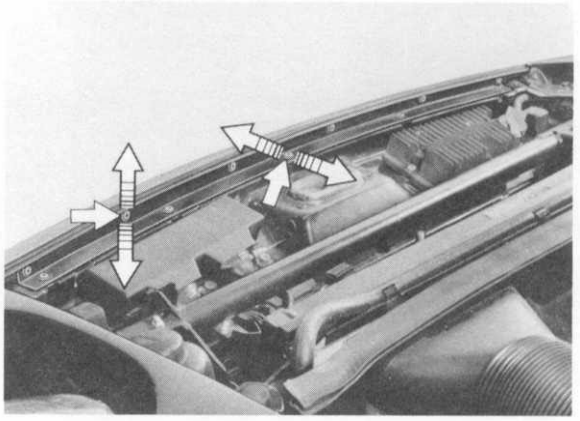
6. Remove cover-strip mounting bolts holding strip to front end section and remove panel from car.



Installing

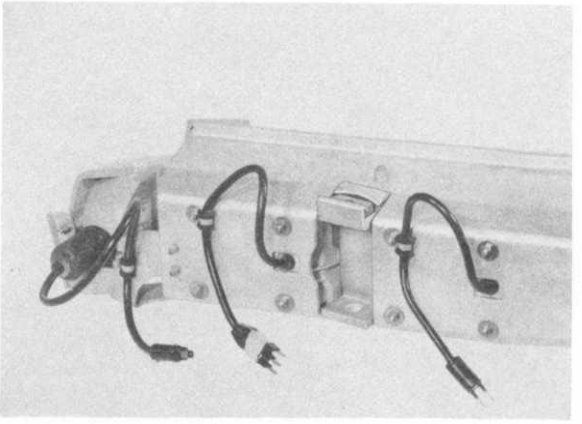
1. Before installation, check all mounting points and seals and replace seals if necessary.

2. When mounting the panel, check to ensure that the gaps between the lid and the fenders are equal and straight. Adjust at the mounting bolts of the cover strip.



DISASSEMBLING AND ASSEMBLING BUMPERS

The high beam and fog headlights as well as the turn signals are removed or installed with the carrier. Wires are fastened to the carrier with hose clips for protection.



The carrier and/or panel do not have to be removed to replace single parts.

Auxiliary headlights can be replaced after unscrewing the radiator grill and cover frame.

Single turn signal lamps and fog headlights can be replaced from underneath the fender.

Mark wires to prevent mixups!

Note

Until introduction of new PU trim, a weatherstrip is pasted along the entire mating surface to the body and fastened with clips. It is used to compensate for or cover up small irregularities in the body contour.

Painting

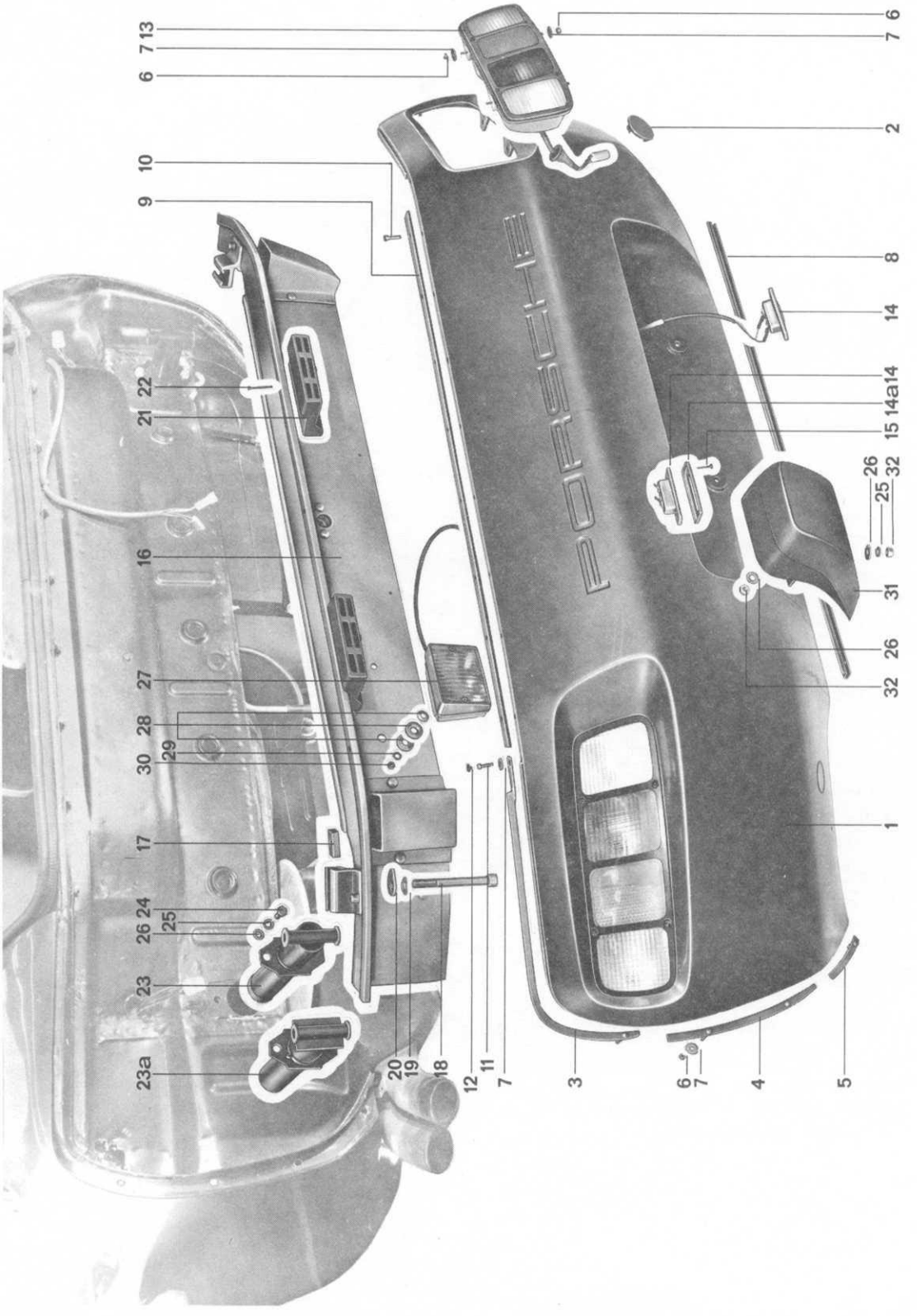
The panels are coated with a special polyurethane (PUR) paint, which is extremely elastic and scratch-proof.

New paint jobs or the painting of large areas require the use of this paint, whereby the entire part must be ground clean and sprayed.

Scratches and small damage areas can be touched up with normal body paints.

When placed in an oven for drying (max. 60° C) the panels should be placed on aluminum carriers or special stands to prevent permanent distortion.

REMOVING AND INSTALLING BUMPERS



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Panel	1	Detach panel on inside of fender and top center	Align panel with fender, grind as required, coat with PUR paint, rivet holding strips, install weatherstrip	
2	End cover	2	Pull out, now carrier mounting bolts are accessible		
3	Holding strip, upper	2	Replace, if damaged	Mount on panel with pop rivets	
4	Holding strip, center	2	Replace, if damaged	Mount on panel with pop rivets	
5	Holding strip, lower	2	Replace, if damaged	Mount on panel with pop rivets	
6	Self-locking nut	17			
7	Washer	17			
8	Reinforcement rail	1		Mount to bottom of panel with pop rivets	
9	Cover rail	1			
10	Countersunk screw	5			
11	Allen head screw	9	Replaced by positions 9 + 10		
12	Cap	9	Replaced by positions 9 + 10		
13	Tail light	2			
14	License plate light	2			
14a	Cover frame	2	Unscrew, pull out lamp, pull off wires		
15	Metal screw	4			
16	Carrier	1	Straighten only slight damage, otherwise replace		

No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
17	Threaded plate	2		Lock in guide	
18	Cyl. head bolt	2	Accessible after removal of end cover		
19	Washer	2			
20	Eccentric disc	2		Carrier will be offset depending on installed position	
21	Support	2			
22	Metal screw	2		Bolt support to carrier	
23	Impact tube	2	Replace damaged parts	Align installed position with carrier	
23a	Impact absorber	2	Replace damaged parts	Align installed position with carrier	
24	Bolt	4			
25	Lockwasher	8			
26	Washer	8			
27	Tail fog light	1	Pull off cover frame	Cut out opening in new panel with a knife. Install light on carrier and adjust	
28	Washer	3			
29	Lockwasher	1			
30	Nut	1			
31	Rubber pad (USA)	2	Detach from carrier	Cut out holder opening in new panel, measure hole and install	
32	Self-locking nut	4			

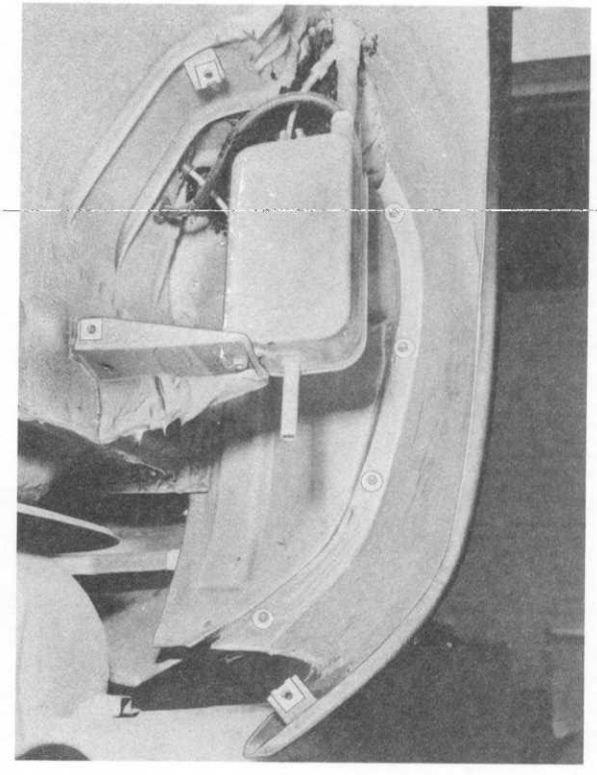
REMOVING AND INSTALLING BUMPER

1. The panel is bolted to fender with five bolts on the right side and four bolts on the left side. First remove plastic cover on left rear wheel house.



2. Until introduction of new PU panels, a weather-strip has to be pasted on the mating surfaces to the rear side panels and fastened with clips. In this manner small irregularities in the body contour can be equallized or covered up.

3. Tail lights can be removed with the panel, if rubber grommets are pulled out of tail panel and the then accessible plugs are disconnected.

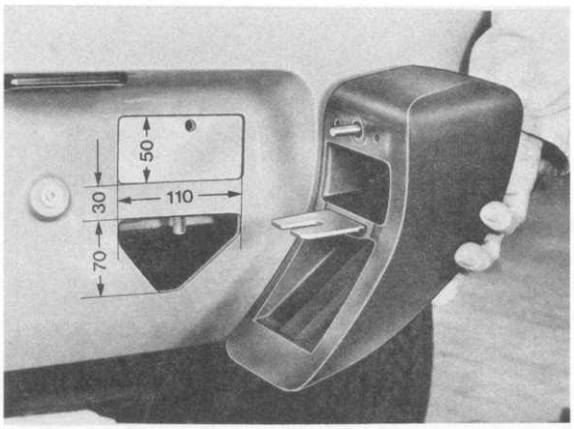


4. Tears or impressions in PU parts can be pasted and filled in with engineering adhesives from 3 M, Art. No. 8101 or 3535 B/A.

The mounting of rubber pads on the rear bumper has been changed for USA cars since the 1979 models.

Cut out the bumper trim in area of the rubber pads prior to installing.

Openings around the bolt and holder must be generous enough that the trim cannot be stressed or damaged when installing the rubber pads.



Note

It is recommended to make the openings with a piercing saw.
Dimensions in mm.

Painting

The PU panels are coated with a special polyurethane (PUR) paint, which is extremely elastic and scratchproof.

New paint jobs or the painting of large damaged areas require this paint, whereby the entire part must be ground clean and sprayed.

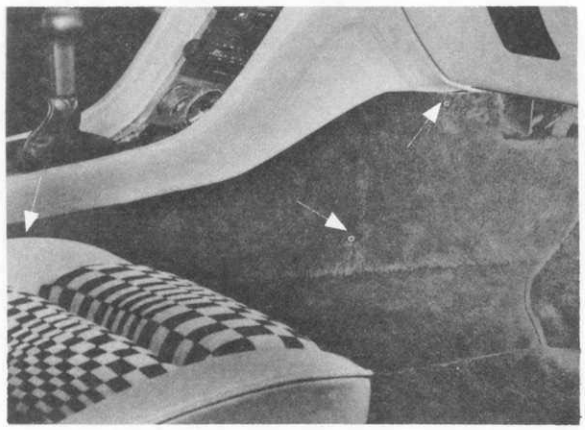
Only scratches or insignificant paint damage can be touched up with normal body paint.

Panels installed free of tension, no waves or distortion visible, do not have to be removed when car is placed in an oven for drying (max. object temperature 80° C).

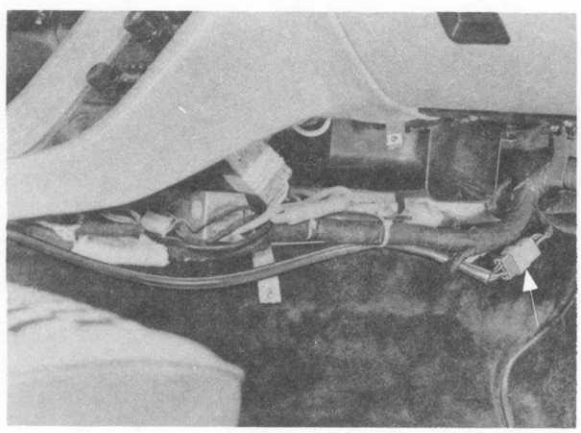
When drying panels in an oven (max. 60° C), make sure that outer surfaces are not loaded (e.g. place on styroper packing material or aluminum carriers). This will prevent permanent distortion.

REMOVING AND INSTALLING POWER WINDOW OPERATING SWITCH

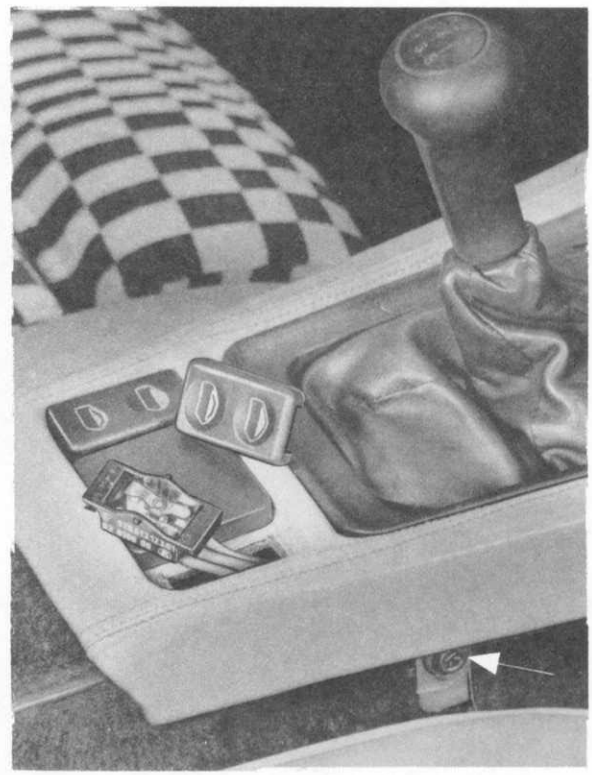
1. Unscrew side trim from center console (2 screws), pull off clip and press down trim.



2. Disconnect coupling on wire harness.



3. Loosen rear of center console, press up and press out switch.



INSTALLING ADHESIVE PLATE FOR INSIDE REAR VIEW MIRROR

An inside rear view mirror which has fallen off can be pasted again, if the adhesive plate (Part No. 477 845 043) and glass are not damaged.
Also applicable for the Sekuriflex-windshield.

Materials Required
Loctite 312, Part No. 000.043.051.00
Activator Loctite NF
Part No. 000.043.052.00

Installing Mirror Base



1. Mark installed position on outside of glass. Dimensions: 110 mm from roof edge to mirror base ca. 630 mm from A pillar to center of glass.

2. Remove all remainders of adhesive from windshield and adhesive plate and clean with fresh gasolin 80/110.

3. Spray a thin coat of Activator 312 NF on adhesive surface of windshield and allow to dry about 2 minutes.

4. Inject one drop of Loctite 312 on to adhesive plate and press on firmly. Turn adhesive plate, until some Loctite squeezes out on edges.



5. Position adhesive plate correctly, holding groove vertical, and press on for about 30 to 40 seconds.

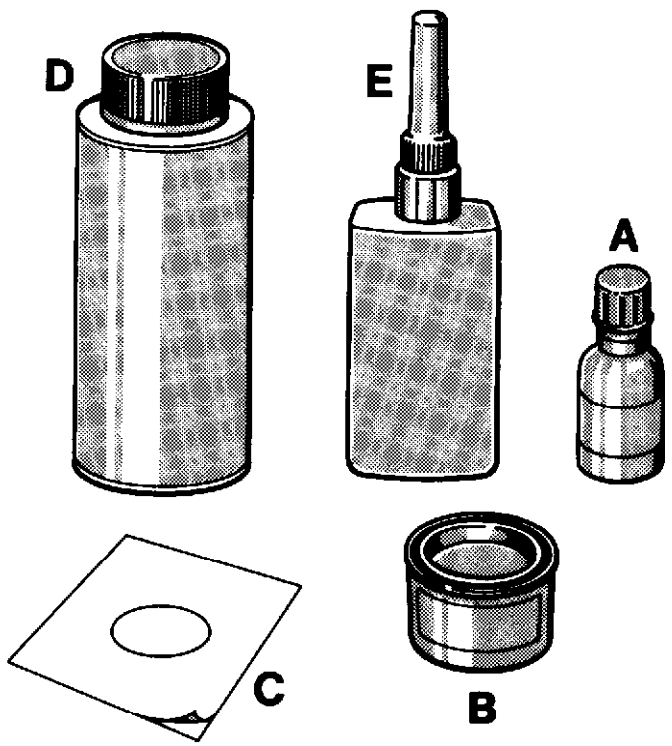
6. Install inside mirror carefully after waiting about 1 hour.

Note

After 1 hour approx. 60% and after 24 hours 100% of the adhesive strength has been reached.

Bonding the interior rearview mirror in place

The following materials are required for bonding of the complete interior rearview mirror:



752-64

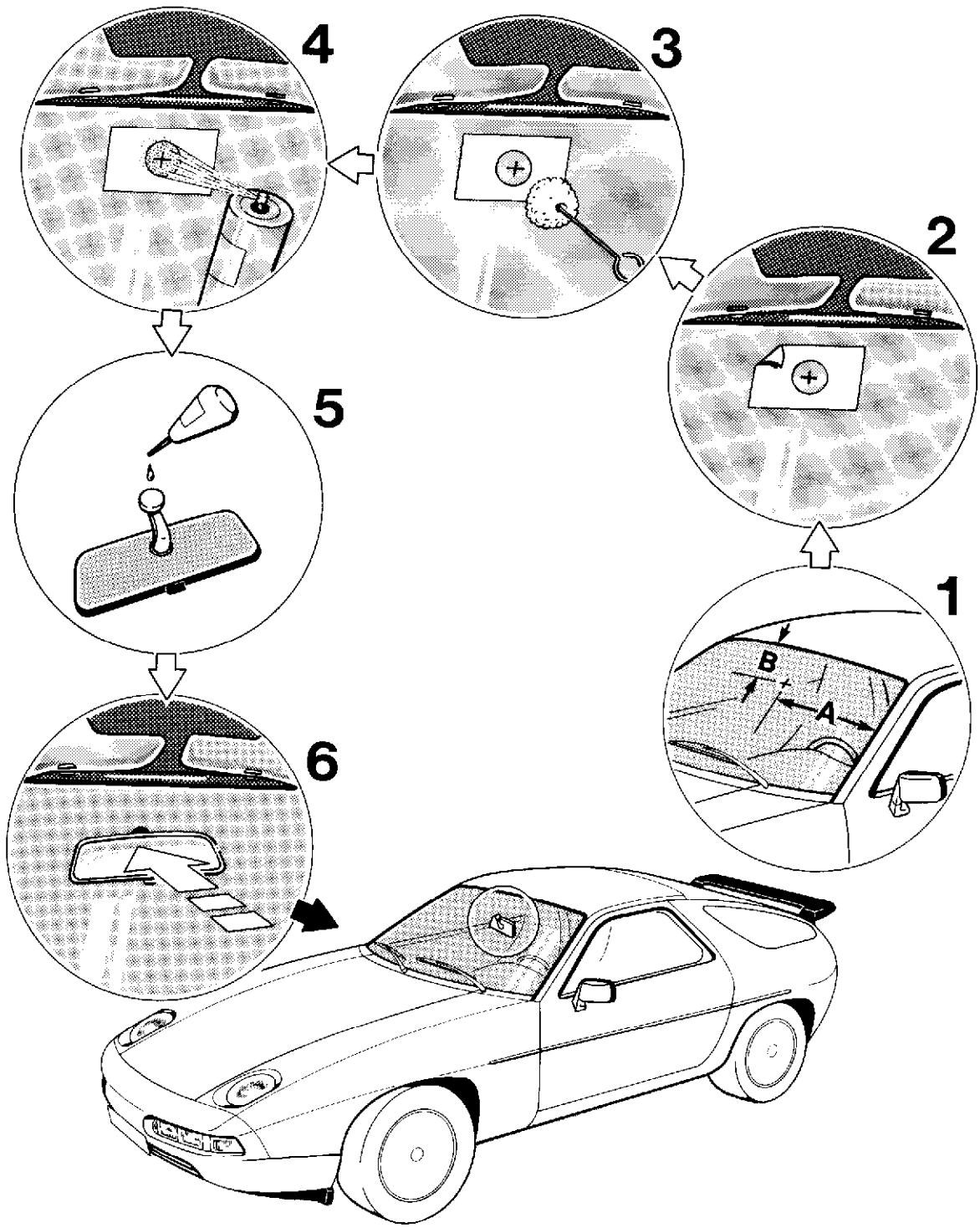
A	=	**Cleaning solution** (000.043.157.00)*
B	=	**Primer** (000.043.158.00)*
C	=	**Cover sheet** (000.043.177.00)*
D	=	**Activator** (000.043.052.00)*
E	=	**Adhesive** (000.043.051.00)*

* Porsche part no.

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Bonding the interior rearview mirror in place

Bonding the fully assembled interior mirror to the windshield



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Bonding the interior rearview mirror in place

Bonding the fully assembled interior mirror to the windshield

No.	Operation	Instructions
1	Mark position of interior rearview mirror	Mark position of adhesive plate on outside of windshield. **Dimension A = 630 mm** **Dimension B = 110 mm**
	Remove adhesive residue	Remove adhesive residue from windshield mechanically using a scraper. Remove adhesive residue from bonding plate of rearview mirror mechanically using a scraper.
	Roughen bonding plate of rearview mirror	Roughen bonding plate of rearview mirror mechanically using sanding paper.
	Clean bonding plate of rearview mirror	Clean bonding plate of rearview mirror using **cleaning solution** (A).
	Clean bonding area of windshield	Clean bonding area of windshield using **cleaning solution** (A).
2	Mask off bonding area of windshield	Mask off bonding area of windshield using **primer template** (cover sheet C). The position mark of the interior rearview mirror must be visible in the middle of the primer template.
3	Prime bonding area of windshield	Apply a thin coat of **primer** (B) to the masked bonding area of the windshield. **Caution: Allow a flash-off time of 15 to 20 minutes!**

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No.	Operation	Instructions
4	Activate bonding area of windshield	Spray activator (D) onto bonding area of the windshield. **Caution: Allow a flash-off time of 2 minutes!**
	Remove primer template	
5	Apply adhesive to bonding plate	Apply a drop of **adhesive** (E) to the bonding plate of the rearview mirror.
6	Bond rearview mirror in place	Press bonding plate of rearview mirror against primered and activated windshield area. **Note: Press mirror in place for approx. 40 – 50 sec.!**

Note:

Bonding strength
60 % after 1 hour
100 % after 24 hours

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REMOVING AND INSTALLING WINDSHIELD

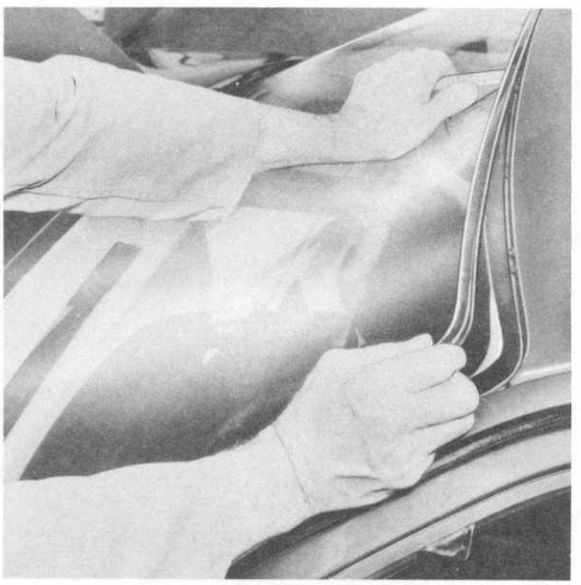
Removing

1. Lift off cap on windshield wiper and loosen screws. Set up wiper arm and move it back and forth, until the wiper arm can be removed.

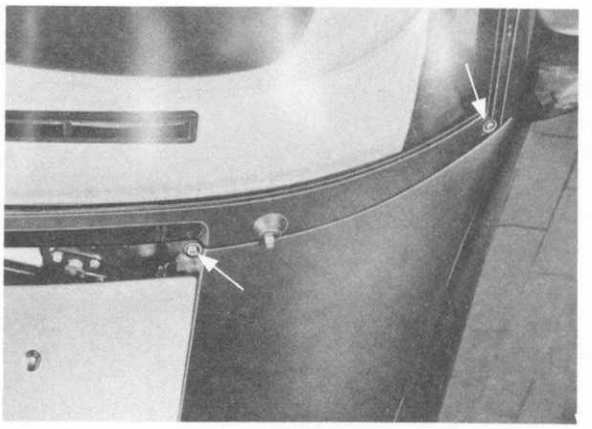
2. Knock side ornamental strips off of retaining rail with a wood wedge.



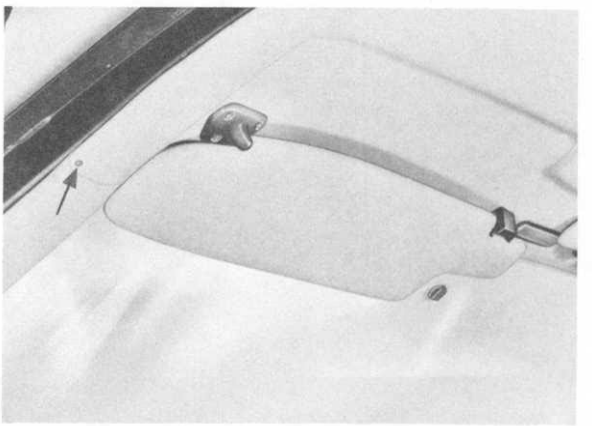
3. Pull out upper ornamental strip.



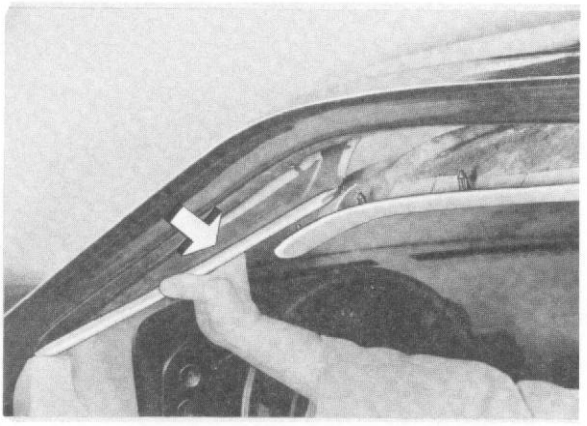
4. Open engine hood, unscrew and remove apron panel.



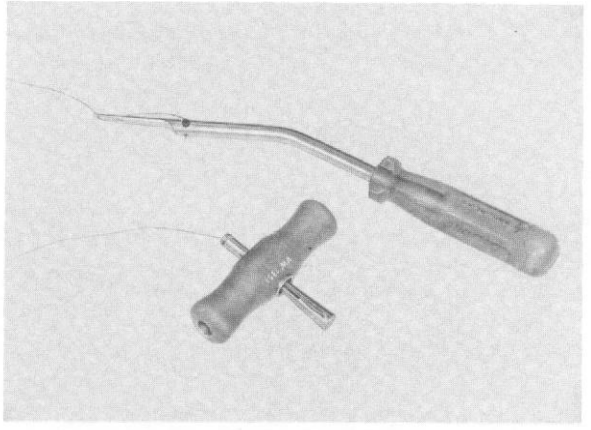
5. Unscrew sun visor mounts. Remove inside mirror by pressing up. Remove metal screw (see arrow) from A pillar. Pull down headliner on left and right sides far enough that the front clips can be disconnected.

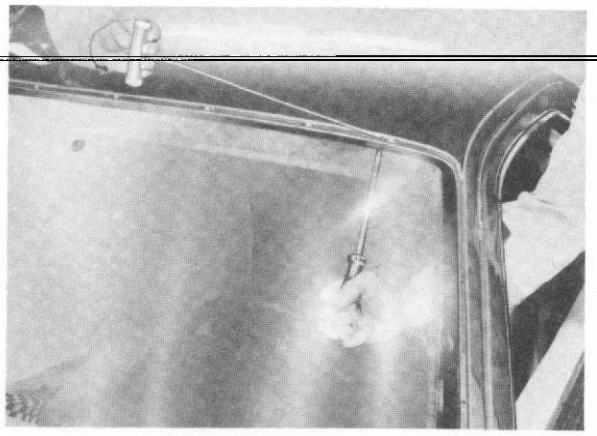


6. First press side pads up and in, and then pull them out.



7. Press the steel wire from Repair Kit 477 898 011 through windshield weatherstrip at an upper corner and secure it inside of Special Tool VW 1351 (similar to a screwdriver). Now pull the wire toward the inside and hold it on the weatherstrip with the special tool. Use the grip to pull the wire in up to this point. Repeat this procedure around entire windshield.





Note

To prevent the weatherstrip from sticking together again, press out the window glass carefully at the same time or place a small block underneath.

Broken windows can be pressed out and the weatherstrip cut through with a knife.

Cover inside of car to protect sensitive areas against glass splitters.

8. Remove remainders of adhesive from window and flange.

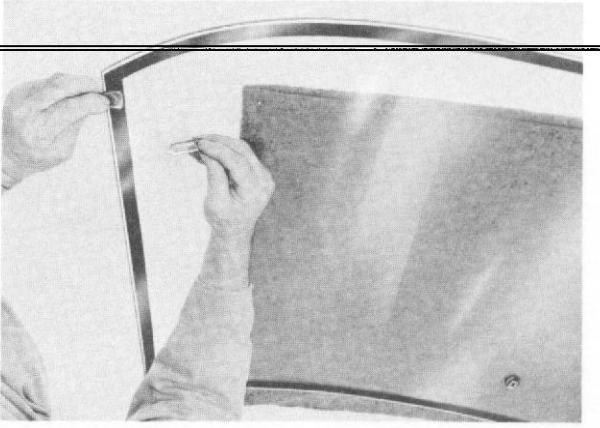
Note

Remainders of adhesive are best removed from window and flange by dabbing with a little sealant material.

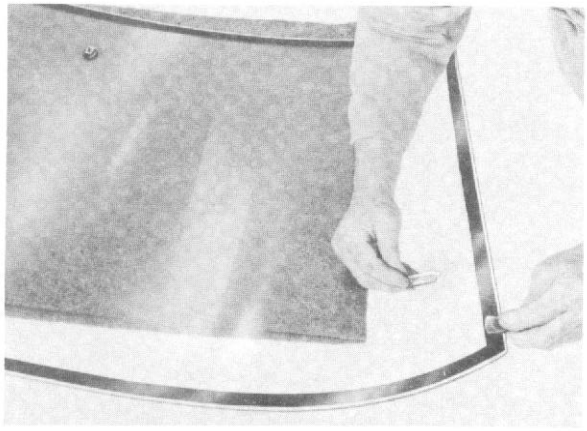
Installing

1. Place windshield in body, position and mark. Place spacer blocks on bottom window flange.

2. Clean edge of glass and flange with acetone.



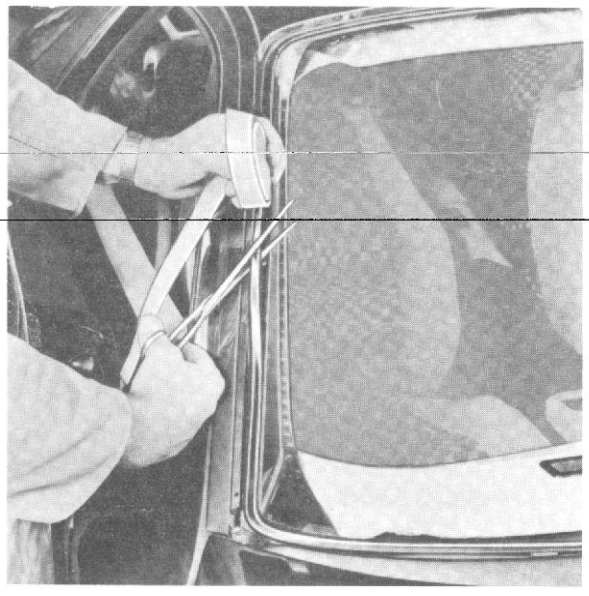
3. Apply a coat of primer to adhesive surfaces on window and flange.



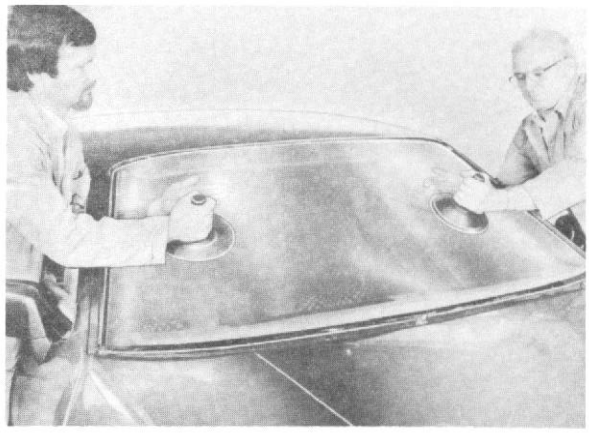
Note

Do not apply a second coat of priming solution after air-drying; this would impair adhesion.

4. Place cord seal in window opening and connect ends with a diagonal cut.



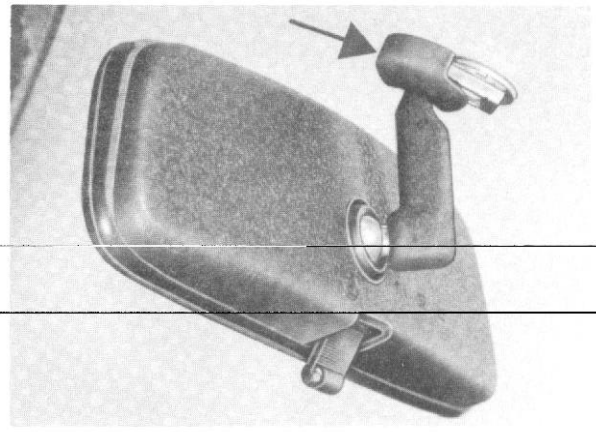
5. Install window glass with suction cups. Press on tight enough all around, that sealing cord fits well everywhere. Distance between flange and upper edge of glass should be 10.5 mm.



6. Install ornamental strips.

7. Install side pads, headliner and sun visors.

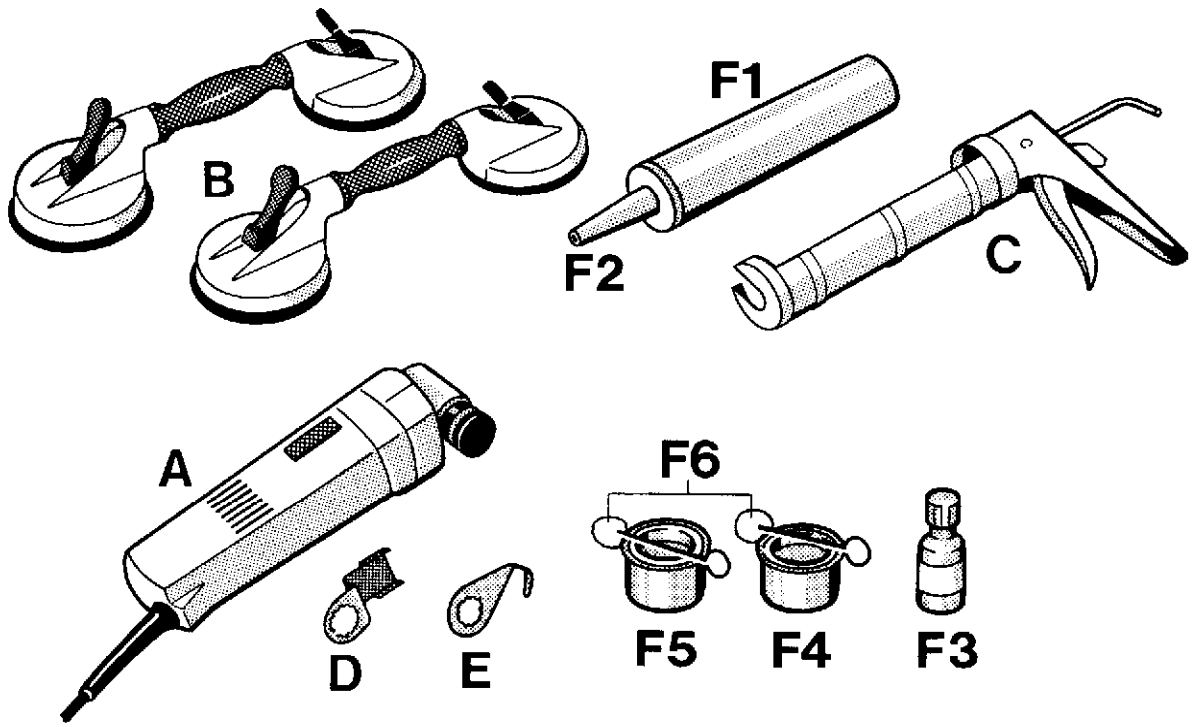
8. Install inside mirror.



9. Install apron panel and windshield wipers.

Removing and installing the bonded windshield

The following tools and materials are required for removal and installation of the bonded windshield:

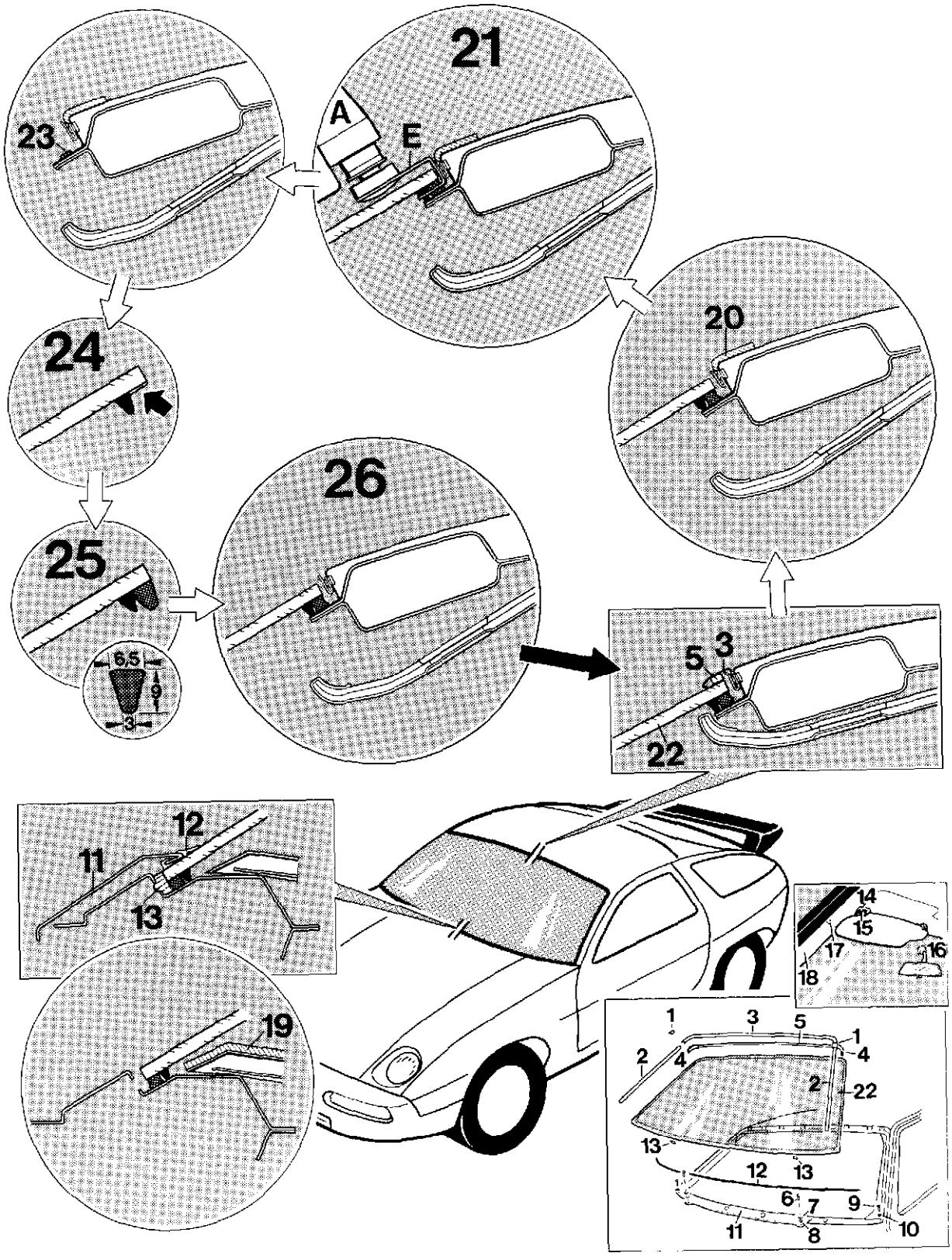


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A	Cutting device	VAG 1561	VW Werk AG
B	Double suction cup		VAG 1344CS equipment sales
C	Glue gun	VAG 1344/1	
D	Scrapping knife	6.39.03.113.02.2	e.g. C & E FEIN GmbH & Co. Postfach 172
E	Cutting knife U-shape	6.39.03.127.01.4	7000 Stuttgart 1
F	Adhesive set	000.043.038.01	Porsche Parts Service
F1	*- Adhesive sealing comp.*		
F2	*- Working nozzle*		
F3	*- Cleaning solution*		
F4	*- Body primer*		
F5	*- Glass primer*		
F6	*- Swab*		

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Removing and installing the bonded windshield



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Removing and installing the bonded windshield

No.	Work step	Instructions
	Remove the wipers	Unscrew the hexagon nuts, lift off washers and wipers.
1	*Move* sleeves	Separate transition from cover strips at top to water collection strip on right and left by moving the sleeves.
2	*Remove the water collection* strips	Drive the right and left water collection strips out of the holding rails by means of a wooden wedge.
	Remove the top cover strip	Remove the top cover strip from the plug-in clips using a plastic or wooden wedge. Remove the adhesive tape and sealing tapes.
3	- *Top cover strip*	
4	- *Sealing tapes*	
5	- *Adhesive tape*	
	Remove the cowl panels	Open lid. Unscrew hexagon sheet metal screws. Remove washers. Unscrew one sheet metal screw in each case at the right and left ends of the cowl panel, remove washers and remove cowl panel with seal.
6	- *Hexagon sheet metal screws*	
7	- *Washers*	
8	- *Sealing washers*	
9	- *Sheet metal screws*	
10	- *Washers*	
11	- *Cowl panel*	
12	- *Seal*	
13	*Remove spacer*blocks	Remove the spacer blocks at the bottom between the bodywork and windshield.
	Unscrew the sun visor bearing	Unscrew the slotted oval trim-head tapping screws and remove the sun visor bearing with sun visor.
14	- *Slotted oval trim-head tapping screws*	
15	- *Sun visor bearing*	
16	Lift off the inside mirror	Lift off the inside mirror upwards from the fixing plate parallel to the windshield.

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No.	Work step	Instructions
	Remove the A - column panels	Unscrew the sheet metal screw on the A-column. Unhook the front clips by pulling down the headlining on the right and left. Press the A-column panels inwards at the top and then pull out.
17	- *Sheet metal screw*	
18	- *A - column panel*	
19	*Attach a* cover to the Instrument panel	Cover the instrument panel to avoid soiling or damage.
	Open the door windows	Lower the door window panes. **Important:** The door windows must be closed again only after completion of the hardening time.
20	*Attach* adhesive tape to the bodywork	Mask the bodywork in the visible area of the window cut-out with adhesive tape to protect the paint work.
21	Cut out the windshield	Equip the cutting device (A) with a cranked knife (E). Sharpen the cutting knife with a whetting stone with the machine running. Insert the cutting knife between the bodywork and windshield and set the oscillation controller to step 4. Cut through the adhesive bonding between the windshield and bodywork all-round.
22	*Remove the* windshield	
23	*Remove the adhesive* sealing compound on the bodywork	Equip the cutting device (a) with a scraping knife (D) and remove theadhesive sealing compound on the bodywork so far that there is still a full covering of remaining adhesive.
	Clean the window cut-out in the bodywork	Clean the window cut-out in the bodywork thoroughly with cleaning solution (F3). **Important:** No cleaning solution residue must remain on the bodywork.

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No.	Work step	Instructions
	Prime damaged locations on the bodywork	Prime damage to the top coat in the invisible area of the window cut-out with body primer (F4).
	Remove the adhesive tape on the bodywork	
	Clean the windshield	Clean the area of the windshield to be glued thoroughly with cleaning solution (F3).
24	Apply a prime coat to the windshield	Apply glass primer (F5) all-round to the area of the windshield to be glued. **Important:** The glass primer requires a drying time of at least 15 minutes. No adhesive sealing compound must be applied before expiry of this time.
25	Apply adhesive sealing compound to the windshield	Using the glue gun, apply adhesive sealing compound (F1) all-round on the surface of the windshield to be glued in the form of a tapered bead (C). **Important:** The windshield must be installed in the vehicle within a maximum of 10 minutes after adhesive application.
	Position the double suction cups on the outer side of the windshield	
	Insert the spacer blocks	Insert the spacer blocks for positioning the windshield at the bottom in the bodywork (cowl).
26	Insert the windshield in the bodywork	Place the prepared windshield in the window cut-out of the bodywork, align and press on with the double suction cups (B). The windshield must rest on the spacer blocks at the bottom.

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No.	Work step	Instructions
	Clean the vision areas	Excess adhesive sealing compound must be removed immediately and the affected vision areas cleaned with cleaning solution (F3).
	Remove the cover on the instrument panel	
	Install the A-column panels	Inser the A-column panels, clip in the headlining again by pressing up and insert sheet metal screws.
	Fit the inside mirror	Push the inside mirror onto the fixing plate parallel to the windshield.
	Fit the sun visors	Secure the sun visor bearings with sun visors on the right and left with three slotted oval trim-head tapping screws in each case.
	Fit the cowl panel	Insert the cowl panel with seal and screw in the hexagon sheet metal screws with the corresponding washers. Secure the right and left ends of the cowl panel with one sheet metal screw and washer in each case.
	Fit the top cover strip	Attach the adhesive tape and sealing tapes. Secure the top cover strip to the plug-in clips with fitted sleeves.
	Install the water collection strip	Push the right and left water collection strips onto the holding rails. Produce a transition from the top cover strip to the right and left water collection strips by moving the sleeves.
	Fit the wipers	Slip on the wipers, put on washers and screw tight with hexagon nuts.

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Important:

In order to guarantee sufficient strength of the adhesive bond, the following parameter conditions must observed:

Hardening time	10 h	
Temperature	min.	15°C
Relative humidity	min. 40%	

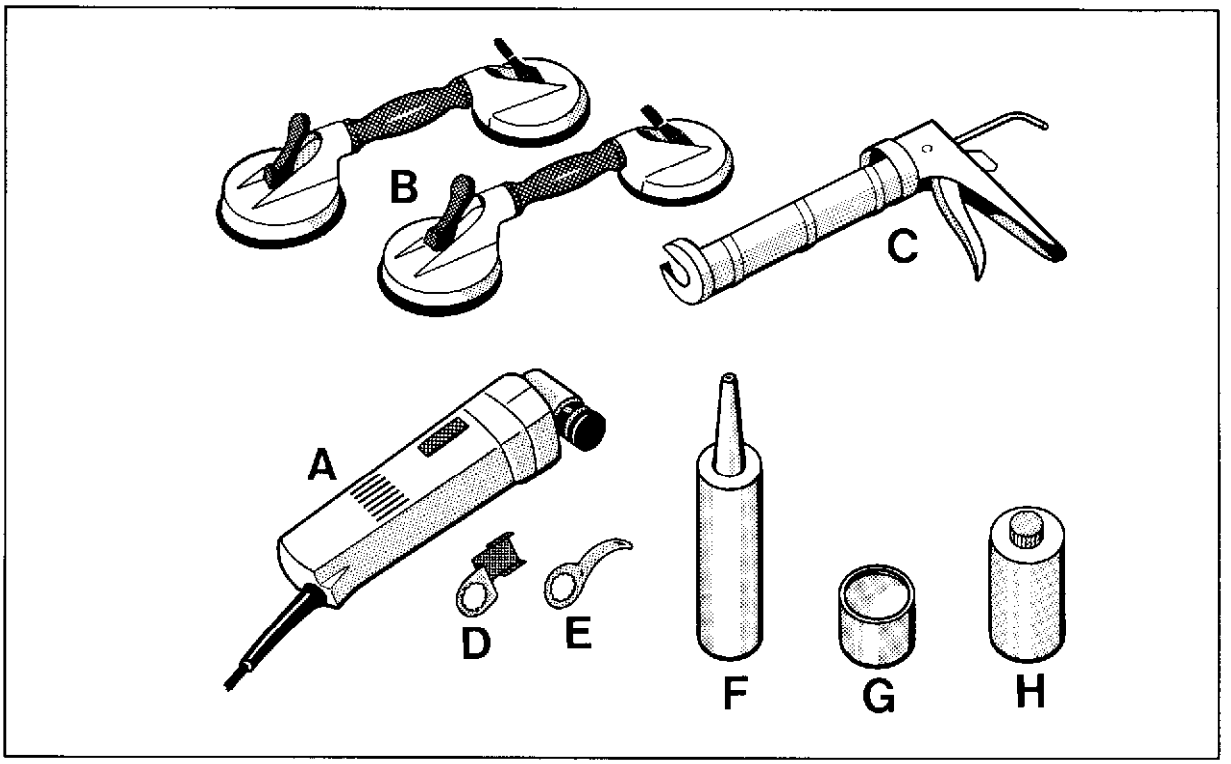
The hardening time is extended at lower temperatures and with a lower relative humidity.

The vehicle must not be put into operation before expiry of the hardening time!

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Removing and installing the bonded rear side window

The following tools and
materials are required for removal and installation of the bonded rear side windows:

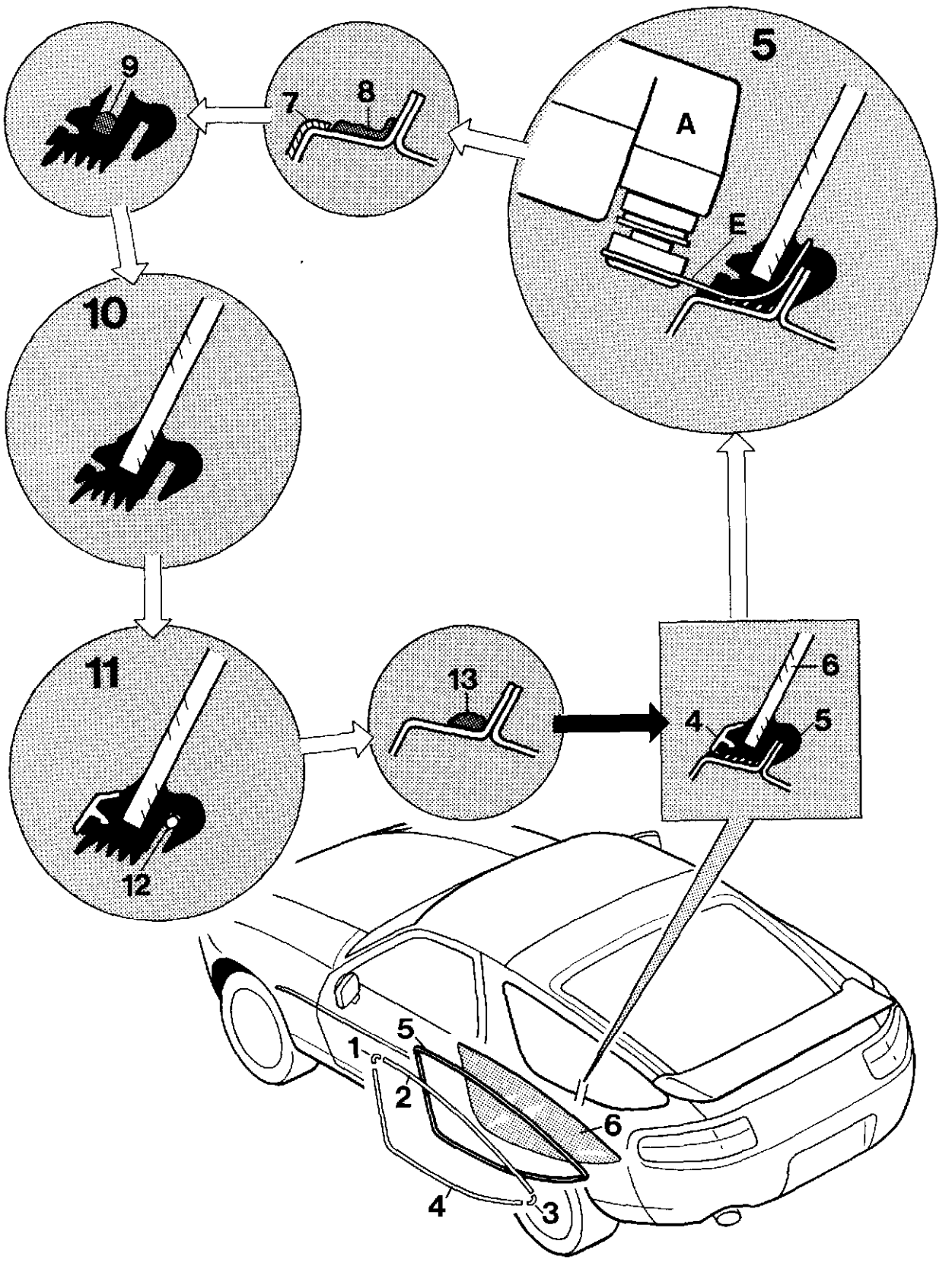


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A	Cutting device	VAG 1561	VW Werk AG
B	Double suction cups	VAG 1344	CS equipment sales
C	Glue gun	VAG 1344/1	
D	Scraping knife	6.39.03.113.02.2	e.g. C & E FEIN GmbH & Co. Postfach 172
E	Curved cutting knife	6.39.03.103.01.7	7000 Stuttgart 1
F	Adhesive sealing comp.	999.915.400.40	Porsche Parts Service
G	Body primer	999.915.487.40	
H	Cleaning solution	999.915.478.40	

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Removing and installing the bonded rear side window



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Removing and installing the bonded rear side window

No.	Work step	Instructions
1 2 3 4	Pull off the decorative frame - *Corner piece, top* - *Decorative frame part, top* - *Corner piece, bottom* - *Decorative frame part, bottom*	Carefully release the decorative frame from the rubber seal in the area of the top corner piece using a wooden or plastic spatula. Insert fabric cloths between the decorative frame and rubber seal and pull out the decorative frame by pulling the fabric cloth along the rubber seal.
5	*Cut through*the rubber seal	Equip the cutting device (A) with the curved knife (E). Sharpen the cutting knife with a whetting stone when the machine is running. Insert the cutting knife in the rubber seal, set the oscillation controller to step 6 and cut through the rubber seal all-round between the rear side window and body work.
6	*Remove the rear* side window	
	Pull the rubber seal residue off the bodywork	
7	*Attach* adhesive tape to the bodywork	Mask the bodywork in the visible area of the window cut-out with adhesive tape to protect the paint work.
8	*Remove the adhesive* sealing compound on the bodywork	Equip the cutting device (A) with the scraping knife (C) and remove the adhesive sealing compound on the bodywork so far so that there is still full coverage with adhesive residue.
	Clean the window cut-out in the bodywork	Thoroughly clean the window cut-out in the bodywork with cleaning solution (H). **Important:** No cleaning solution residue must remain on the bodywork.

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No.	Work step	Instructions
	Prime damaged locations on the bodywork	Prime damage to the top coat in the non-visible area of the window cut-out with body primer (G).
	Remove adhesive sealing compound on the rear side window	Carefully remove the adhesive sealing compound on the rear side window with a fixed knife. A full covering of adhesive residue may remain.
	Clean the rear side window	Thoroughly rub off the rear side window with cleaning solution (H). **Important:**: No cleaning solution residue must remain on the window.
	Clean the rubber seal	Clean the window channel of the rubber seal with cleaning solution (H). **Important:** No cleaning solution residue must remain in the window channel.
9	*Apply adhesive sealing compound* in the window channel of the rubber seal	Insert a cartridge of adhesive sealing compound (F) in the glue gun (C) and glue the window channel of the rubber seal all-round. **Important:** The rear side window must be installed in the vehicle within a maximum of 4 hours after adhesive application.
10	Place the rubber seal on the rear side window	
11	Complete the rubber seal with the decorative frame	Press the top decorative frame part (2) into the rubber seal. Assemble the bottom decorative frame part (4) with the top corner piece (1) and bottom corner piece (3), press into the rubber seal, connect with the top decorative frame part (2) and press the assembled decorative frame completely into the rubber seal.

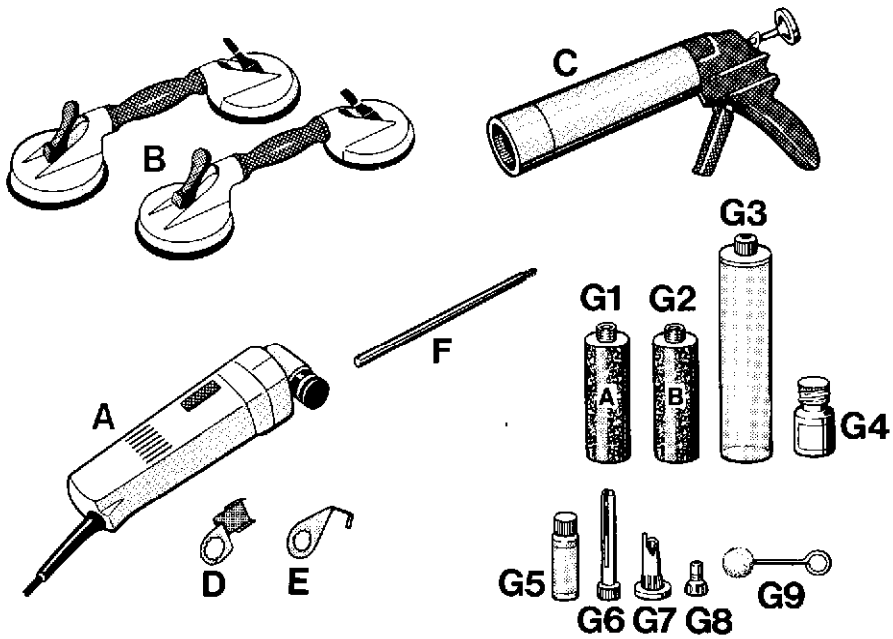
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No.	Work step	Instructions
12	*Place the assembly cord* in the rubber seal	Place the assembly cord for pulling in the rear side window in the rubber seal. The cord ends must cross approximately in the center of the C-column area.
	Remove the adhesive tape from the bodywork	
13	*Apply adhesive sealing compound* to the bodywork	Apply adhesive sealing compound (F) all-round in the area of the window cut-out on the bodywork with the glue gun (C).
	Fit the rear side window in the bodywork	Place the assembled and prepared rear side window in the window cut-out of the bodywork, align and press on. From the passenger compartment, pull the rubber seal onto the bodywork bead by pulling out the assembly cord.
	Clean the vision areas	Excess adhesive sealing compound must be removed immediately and the affected vision areas must be cleaned with cleaning solution (H).

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Removing and installing windshield – 2-pack adhesive

The following tools and materials are required for removal and installation of the windshield:



924 - 64

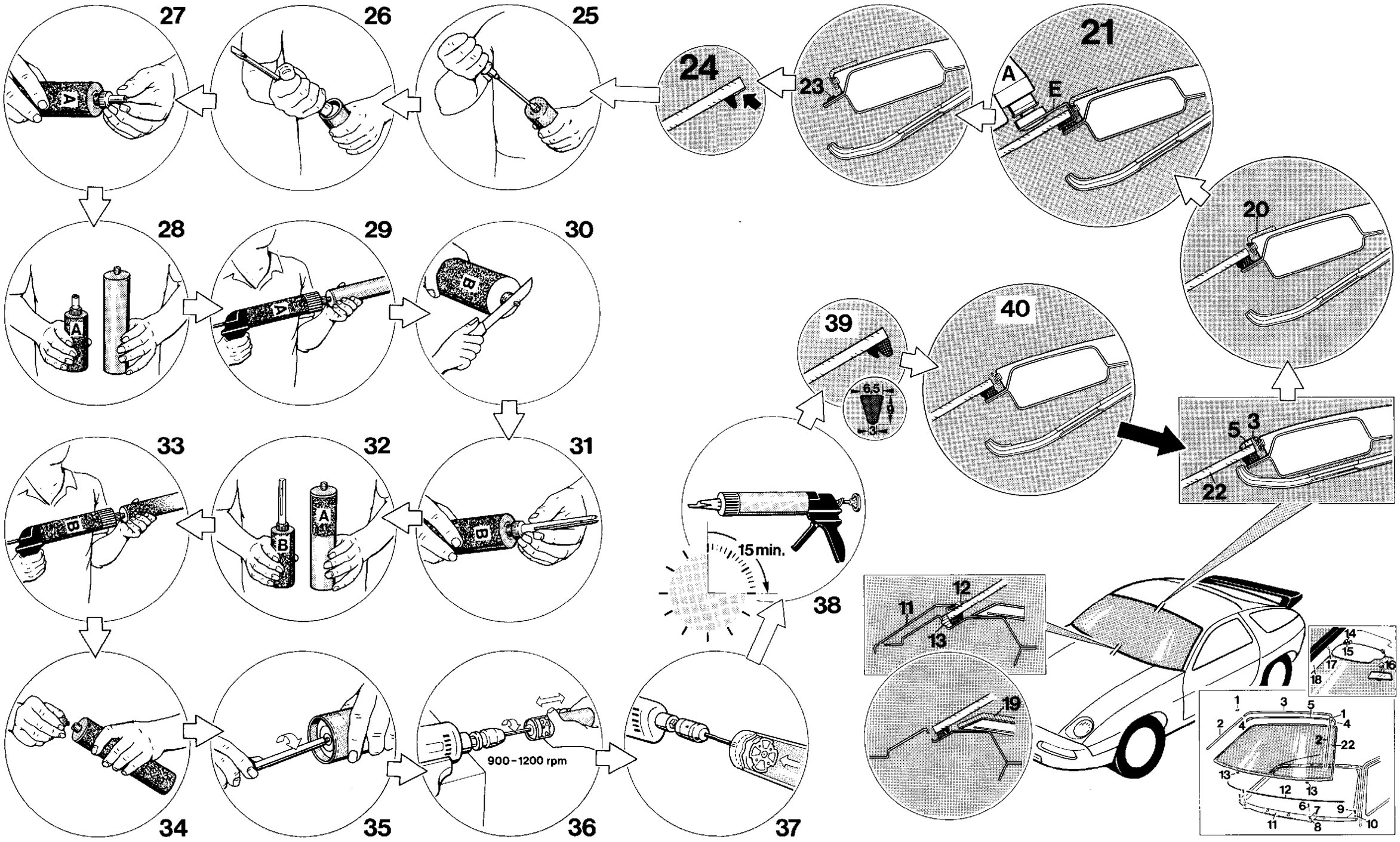
A	Cutter	VAG 1561	VW Werk AG
B	Twin-cup suction puller	VAG 1344	Service equipment supply
C	Bonding gun	VAG 1344/1	
D	Flashing knife	639.031.130.22	e.g. C & E FEIN GmbH & Co.
E	Cutting knife, U-type	639.031.270.14	P.O. Box 172 ; D-7000 Stuttgart 1
F	Mixing rod 9528	000.721.952.80	Porsche Parts Service
G	Adhesive set	000.043.038.01	
G1	*- Cartridge component A*		
G2	*- Cartridge component B*		
G3	*- Mixing cartridge*		
G4	*- Primer*		
G5	*- Cleaning solution*		
G6	*- Injector nozzle*		
G7	*- Application nozzle*		
G8	*- Filling nozzle*		
G9	*- Touch-in tool*		

Printed in Germany – XXVII,1991

Removing and installing windshield – 2-pack adhesive

Printed in Germany – XXVII,1991

Removing and installing windshield — 2-pack adhesive



Printed in Germany - XXVII, 1991

Removing and installing windshield – 2-pack adhesive

Removing windshield:

No.	Operation	Instructions
	Remove windshield wipers	Undo hexagon nuts, lift off washers and wipers.
1	Relocate *sleeves*	Shift sleeves to separate junction between upper cover molding and RH and LH drip molding.
2	Remove *drip moldings*	Using a wooden wedge, separate RH and LH drip moldingsfrom the retaining rails.
	Remove upper cover molding	Using a plastic or wooden wedge, separate upper cover molding from the locating clamps. Remove adhesive tape and sealing tapes.
3	- *upper cover molding*	
4	- *sealing strips*	
5	- *adhesive tape*	
	Remove cowl panel	Open cover. Remove hexagon head sheetmetal screws. Remove washers. Remove one sheetmetal screw each on right and left-hand side of cowl panel, remove washers and take out cowl panel complete with weatherstrip.
6	- *Hex head sheetmetal screws*	
7	- *Washers*	
8	- *Sealing washers*	
9	- *Sheetmetal screws*	
10	- *Washers*	
11	- *Cowl panel*	
12	- *Seal*	
13	Remove *spacer blocks*	Remove spacer blocks between body and lower windshield side.
	Unscrew sun visor support	Remove raised countersunk sheetmetal screws and sun visor support complete with sun visor.
14	- *Raised countersunk sheetmetal screws*	
15	- *Sun visor support*	

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No.	Operation	Instructions
16	Lift off interior rearview mirror	Lift rearview mirror off the subplate, following a line parallel to the windshield.
17 18	Remove A-pillar linings - *Sheetmetal screw* - *A-post lining*	Unscrew sheetmetal screw from A-pillar. Unclip front clips by pulling down right and left-hand sides of headlining. Press top of A-pillar linings to the inside and pull out.
19	Spread *cover* over instrument panel	Cover instrument panel to avoid staining or damaging the panel.
	Open door windows	Lower door windows. **Attention:** The door windows must not be closed before the curing time has elapsed.
20	Attach *adhesive tape* to the body	Cover body in visible area of windshield aperture with adhesive tape to protect the paintwork.
21	Cut out windshield	Insert cranked knife (E) into cutter (A). With equipment running, sharpen cutter with grindstone. Place cutting knife between body and windshield and set vibration regulator to stage 4. Cut bonding between windshield and body in a continuous line.
22	Lift out *windshield*	
23	Remove *adhesive sealant* from body	Insert flashing knife (D) into cutter (A) and remove adhesive sealant from body only to the extent that the remaining adhesive covers the whole area in a uniform manner.

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No.	Operation	Instructions
	Clean windshield aperture of body	Clean windshield aperture of body thoroughly using cleaning solution (G5). **Attention:** Make sure no cleaning solution residues remain on the body.
	Apply primer to damaged areas of body	Use primer (G4) to coat damaged areas in non-visible section of windshield aperture.
	Remove adhesive tape from body	
	Clean windshield	Clean bonding area of windshield thoroughly using cleaning solution (G5).
24	Apply primer to windshield	Apply primer (G4) to the bonding area of the windshield in a continuous bead. **Attention:** Drying time of the primer is at least 15 minutes. No windshield adhesive must be applied until this time has elapsed.

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Preparing the adhesive cartridge for application of adhesive

No.	Operation	Instructions
25	Open nozzle fitting of cartridge containing component A	Use a screwdriver to pierce the diaphragm in the nozzle fitting of the cartridge containing component A (H1).
26	Open flanged cover of cartridge containingcomponent A	Use the screwdriver handle to pierce the flanged cover at the end of the cartridge containing component A (H1).
27	Screw filling nozzle onto cartridge containing component A	Screw filling nozzle (H9) onto cartridge containing component A (H1).
28	Place cartridge containing component A into bonding gun	Place cartridge containing component A (H1) into bonding gun (C). Remove screw-on cap from mixing cartridge (H3).
29	Press component A into mixing cartridge	Insert filling nozzle (H9) of cartridge containing component A (H1) into mixing cartridge. Press component A into mixing cartridge (H3) using the bonding gun.
30	Open screw-on fitting of cartridge containing component B	Use a knife to cut off the tip of the nozzle fitting of the cartridge containing component B (H2).
31	Screw injector nozzle onto cartridge cont. component B	Screw injector nozzle (H7) onto cartridge containing component B (H2).
32	Place cartridge containing component B into bonding gun	Place cartridge containing component B (H2) into bonding gun (C).

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No.	Operation	Instructions
33	Press component B into mixing cartridge containing component A	Introduce injector nozzle (H7) of cartridge containing component B (H2) into mixing cartridge (H3). Use the bonding gun (C) to press component B (H2) into mixing cartridge (H3) containing component A.
34	Close mixing cartridge	Pull injector nozzle (H7) out of mixing cartridge (H3) and close mixing cartridge with screw-on cap.
35	Screw mixing rod into mixing cartridge	Screw mixing rod (G) manually into internal thread of mixing disc in the mixing cartridge (H3). Clamp other end of mixing rod into a drill chuck. Fit the drill into a suitable clamping device.
36	Mix component A and component B	Switch on drill (900 to 1200 rpm) and rotate mixing cartridge 25 times from stop to stop. Perform all 25 double strokes fairly rapidly.
37	Engage mixing disc into piston	Pull back mixing cartridge until a rattling sensation is felt. Switch off drill and screw mixing rod out of mixing cartridge. The mixing disc will then engage into the piston of the mixing cartridge.
38	Place mixing cartridge into bonding gun	Insert mixing cartridge with mixed 2-pack windshield adhesive into bonding gun. Screw application nozzle (H8) onto mixing cartridge.

Caution: Open time is 15 minutes!

Open time is the time available for application of the adhesive and for installing the windshield into the aperture in the body.

Printed in Germany – XXVII, 1991

Installing the windshield:

No.	Operation	Instructions
39	Apply windshield adhesive to the windshield	Using the bonding gun (C), apply a trapezoidal continuous bead of windshield adhesive to the bonding area of the windshield.
	Position twin-cup suction pullers on outside of windshield	
	Insert spacer blocks	Insert spacer blocks for positioning of bottom of windshield into body (cowl panel).
40	Insert windshield into body aperture	Place prepared windshield into aperture in body, align and press into place using the twin-cup suction pullers (B). Make sure the bottom of the windshield rests on the spacer blocks.
	Clean visible areas	Remove adhesive that has squeezed out immediately and clean the affected visible areas using cleaning solution (G5).
	Remove cover from the instrument panel	
	Install A-pillar linings	Install A-pillar linings, clip headlining into place by pressing up and fit sheetmetal screws.
	Fit interior rearview mirror	Push interior rearview mirror onto subplate, following a line parallel to the windshield.
	Fit sun visors	Using three raised countersunk sheetmetal screws per side, install sun visor support with RH and LH sun visors.

Printed in Germany – XXVII,1991

No.	Operation	Instructions
	Fit cowl panel	Put cowl panel complete with weatherstripping into place and screw in hex sheetmetal screws with washers. Tighten right-hand and left-hand sides of cowl panel with one sheetmetal screw and washer each.
	Fit upper cover molding	Attach adhesive strips and sealing strips. Install upper cover molding complete with sleeves to the locating clamps.
	Fit drip molding	Push RH and LH drip moldings onto the retaining rails. Push sleeves into place to ensure smooth transition of upper cover molding to RH and LH drip moldings.
	Fit windshield wipers	Position windshield wipers, put washers into place and tighten using hexagon nuts.

Note:

The bonding does not immediately reach its full strength. In order to ensure sufficient bonding strength, the following conditions must be adhered to:

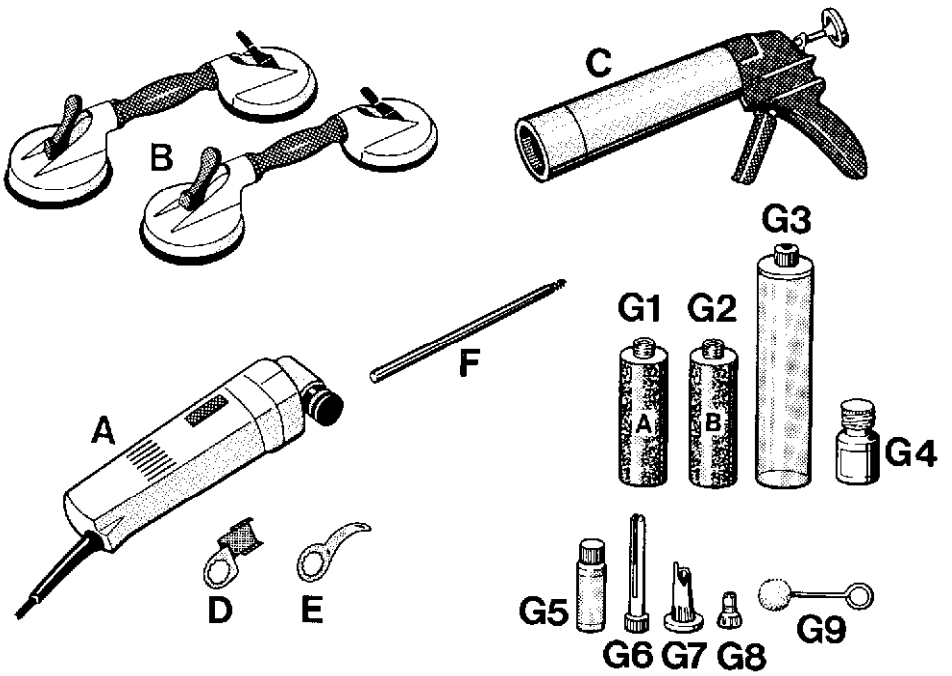
Curing time	3 hours
Temperature	min. 5°C

Do not operate the vehicle before the curing time has elapsed!

Printed in Germany – XXVII,1991

Removing and installing bonded rear side window – 2-pack adhesive

The following tools and materials are required for removal and installation of the bonded rear side window:



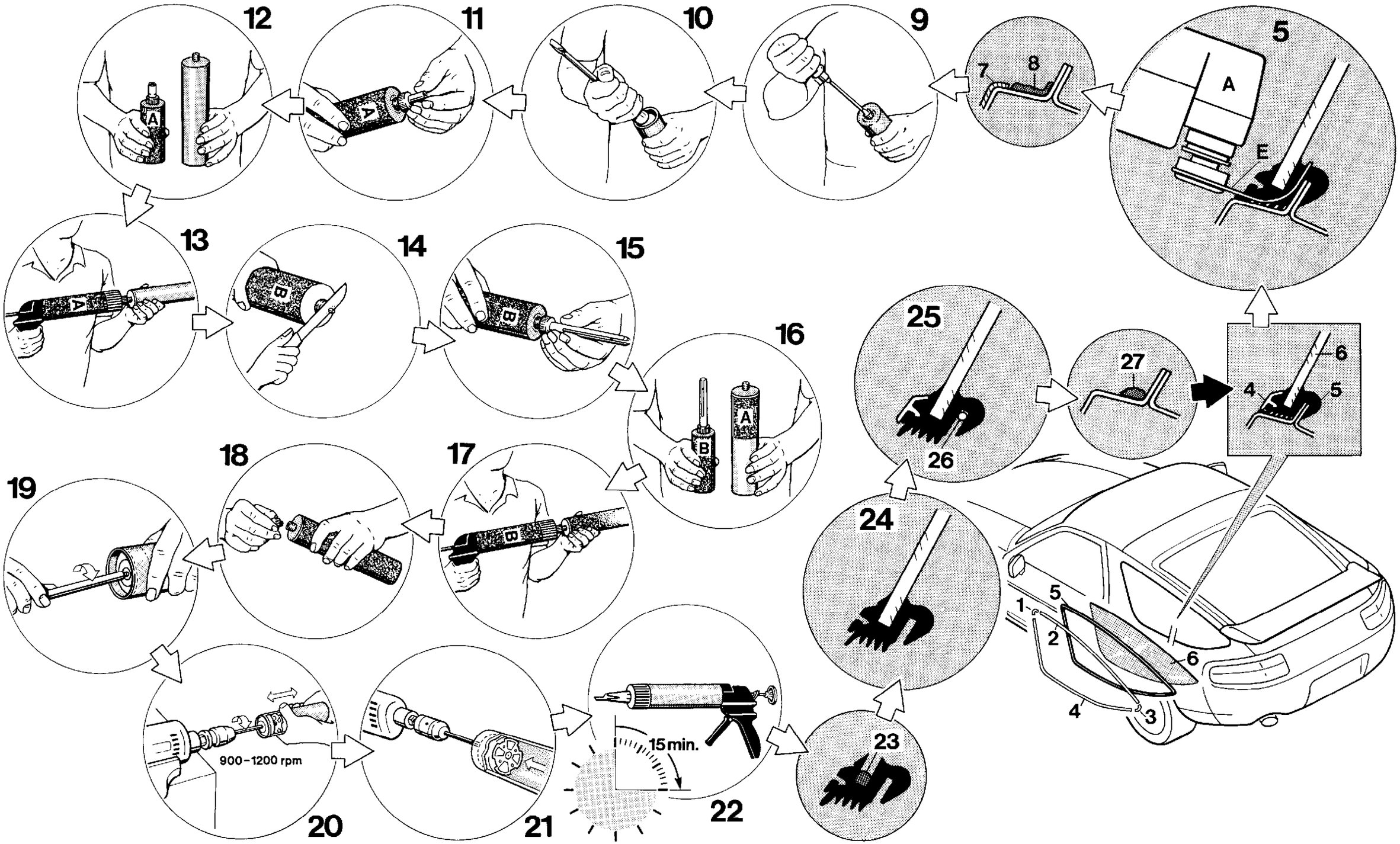
A	Cutter	VAG 1561	VW Werk AG
B	Twin-cup suction puller	VAG 1344	Service equipment supply
C	Bonding gun	VAG 1344/1	
D	Flashing knife	639.031.130.22	e.g. C & E FEIN GmbH & Co.
E	Cutting knife, cranked	639.031.030.17	P.O. Box 172 ; D-7000 Stuttgart 1
F	Mixing cartridge 9528	000.721.952.80	Porsche Parts Service
G	Adhesive set	000.043.038.01	
G1	*- Cartridge component A*		
G2	*- Cartridge component B*		
G3	*- Mixing cartridge*		
G4	*- Primer*		
G5	*- Cleaning solution*		
G6	*- Injector nozzle*		
G7	*- Application nozzle*		
G8	*- Filling nozzle*		
G9	*- Touch-in tool*		

Printed in Germany – XXVII,1991

Removing and installing bonded rear side window – 2-pack adhesive

Printed in Germany – XXVII,1991

Removing and installing bonded rear side window – 2-pack adhesive



Removing and installing bonded rear quarter window – 2-pack adhesive

Printed in Germany – XXVII,1991

Removing and installing bonded rear side window – 2-pack adhesive

Removing the rear side window:

No.	Operation	Instructions
1 2 3 4	Pull away trim molding - *upper corner section* - *upper trim section* - *lower corner section* - *lower trim section*	Using a wooden or plastic spatula, carefully lift trim molding out of the window rubber, starting in the corner section area. Place a rag between trim molding and rubber seal and pull out molding by pulling the rag along the rubber seal.
5	Cut through *rubber seal*	Insert cranked knife (E) into cutter (A). Using a grindstone, sharpen the cutting knife with the equipment running. Engage cutting knife into rubber seal, set vibration regulator to stage 6 and cut rubber seal in a continuous line between rear side window and body.
6	Lift out *rear side window*	
	Lift remains of rubber seal off the body	
7	Attach *adhesive tape* to body	Cover body in visible area of window aperture with adhesive tape to protect the paintwork.
8	Remove *adhesive sealant* from body	Insert flashing knife (D) into cutter (A) and remove adhesive only to the extent that the remaining adhesive covers the whole area in a uniform manner.

Printed in Germany – XXVII,1991

No.	Operation	Instructions
	Clean window aperture in body	Clean window aperture of body thoroughly using cleaning solution (G5). **Attention:** Make sure no cleaning solution residues remain on the bodywork.
	Apply primer to damaged areas of body	Use primer (G4) to coat damaged paintwork areas in non-visible section of window aperture.
	Remove adhesive sealant from rear side window	Using a fixed knife, remove adhesive residue carefully from rear side window. A thin coating of adhesive covering the bonding surface in a uniform manner may remain.
	Clean rear side window	Clean rear side window thoroughly using cleaning solution (G5). **Attention**: Make sure no cleaning solution residue remains on the window.
	Clean rubber seal	Clean window channel of rubber strip using cleaning solution (G5). **Attention:** Make sure no cleaning solution residue remains in the window channel.

Printed in Germany – XXVII,1991

Preparing the adhesive cartridge for application of adhesive

No.	Operation	Instructions
9	Open nozzle fitting of cartridge containing component A	Use a screwdriver to pierce the diaphragm in the nozzle fitting of the cartridge containing component A (H1).
10	Open flanged cover of cartridge containingcomponent A	Use the screwdriver handle to pierce the flanged cover at the end of the cartridge containing component A (H1).
11	Screw filling nozzle onto cartridge containing component A	Screw filling nozzle (H9) onto cartridge containing component A (H1).
12	Place cartridge containing component A into bonding gun	Place cartridge containing component A (H1) into bonding gun (C). Remove screw-on cap from mixing cartridge (H3).
13	Press component A into mixing cartridge	Insert filling nozzle (H9) of cartridge containing component A (H1) into mixing cartridge. Press component A into mixing cartridge (H3) using the bonding gun.
14	Open screw-on fitting of cartridge containing component B	Use a knife to cut off the tip of the nozzle fitting of the cartridge containing component B (H2).
15	Screw injector nozzle onto cartridge cont. component B	Screw injector nozzle (H7) onto cartridge containing component B (H2).
16	Place cartridge containing component B into bonding gun	Place cartridge containing component B (H2) into bonding gun (C).
17	Press component B into mixing cartridge containing component A	Introduce injector nozzle (H7) of cartridge containing component B (H2) into mixing cartridge (H3). Use the bonding gun (C) to press component B (H2) into mixing cartridge (H3) containing component A.

Printed in Germany – XXVII, 1991

No.	Operation	Instructions
18	Close mixing cartridge	Pull injector nozzle (H7) out of mixing cartridge (H3) and close mixing cartridge with screw-on cap.
19	Screw mixing rod into mixing cartridge	Screw mixing rod (G) manually into internal thread of mixing disc in the mixing cartridge (H3). Clamp other end of mixing rod into a drill chuck. Fit the drill into a suitable clamping device.
20	Mix component A and component B	Switch on drill (900 to 1200 rpm) and rotate mixing cartridge 25 times from stop to stop. Perform all 25 double strokes fairly rapidly.
21	Engage mixing disc into piston	Pull back mixing cartridge until a rattling sensation is felt. Switch off drill and screw mixing rod out of mixing cartridge. The mixing disc will then engage into the piston of the mixing cartridge.
22	Place mixing cartridge into bonding gun	Insert mixing cartridge with mixed 2-pack windshield adhesive into bonding gun. Screw application nozzle (H8) onto mixing cartridge.

Caution: Open time is 15 minutes!

Open time is the time available for application of the adhesive and for installing the windshield into the aperture in the body.

Printed in Germany – XXVII, 1991

Installing the rear quarter window:

No.	Operation	Instructions
23	Apply *window adhesive* to the window channel of the rubber seal	Place cartridge with window adhesive into bonding gun (C) and apply a continuous bead of adhesive to the window channel of the rubber seal.
24	Place rubber seal onto rear side window	
25	Assemble trim molding to rubber seal	Press upper trim section (2) into rubber seal. Assemble lower trim section (4) to upper corner section (1) and lower corner section (3), press into rubber seal, assemble to upper trim section (2) and press fully assembled trim molding fully into rubber seal.
26	Place *assembly cord into rubber seal*	Place assembly cord for fitting of the rear side window into the rubber seal. The ends of the cord must cross each other near the middle of the C-pillar area.
	Remove adhesive tape from body	
27	Apply *window adhesive* to the body	Using the bonding gun (C), apply a continuous bead of window adhesive to the window aperture area to the body.
	Fit rear side window to body	Place assembled and prepared rear side window into the window aperture, align and press into place. Working from passenger compartment side, slowly pull out the assembly cord to align the rubber seal to the body flange.

Printed in Germany – XXVII,1991

No.	Operation	Instructions
	Clean visible areas	Remove adhesive that has squeezed out immediately and clean the visible areas affected using cleaning solution (G5).

Printed in Germany – XXVII,1991

PAINT COLORS – 1978

Standard:		Special:	
india red	027	oak green metallic	265
talbot yellow	106	silver green metallic	266
continental orange	107	lint green metallic	275
fern green	273	minerva blue metallic	304
olive green	274	petrol blue metallic	376
albert blue	387	brown copper metallic	443
cockney brown	408	silver metallic	936
mocca black	451		
cashmire beige	502		
black	700		
grand prix white	908		

PAINT COLORS – 1979

Standard:		Special:	
india red	027	oak green metallic	265
talbot yellow	106	lint green metallic	275
olive green	274	light blue metallic	30 T
arrow blue	305	minerva blue metallic	304
cockney brown	408	petrol blue metallic	376
mocca black	451	brown copper metallic	443
cashmire beige	502	opal metallic	463
lilac	601	tobacco metallic	464
black	700	black metallic	708
grand prix white	908	silver metallic	936

PAINT COLORS – 1980

Standard:		Special:	
india red	027	oak green metallic	265
talbot yellow	106	lint green metallic	275
olive green	274	light blue metallic	30 T
arrow blue	305	minerva blue metallic	304
cockney brown	408	petrol blue metallic	376
mocca black	451	brown copper metallic	443
cashmire beige	502	opal metallic	463
lilac	601	tabacco metallic	464
black	700	black metallic	708
grand prix white	908	silver metallic	936

PAINT COLORS – 1981

Standard:		Special:	
india red	027	light blue metallic	30 T
arrow blue	305	minerva blue metallic	304
mocca black	451	black metallic	708
black	700	tin metallic	956
chiffon white	182	platinum metallic	655
bamboo beige	523	pacific blue metallic	31 G
burnus brown	524	palisander metallic	474
mint green	20 A	moss green metallic	20 C
grand prix white	908	wine red metallic	895

RANGE OF BODY PAINT COLORS AS FROM 1982 MODELS

Standard Colors:		Special Colors:	
guards red	027	met. light blue	30T
royal blue	305	met. minerva blue	304
mocha brown	451	met. black	708
black	700	met. pewter	956
chiffon white	182	met. platinum	655
bamboo beige	523	met. pacific blue	31G
caramel brown	524	met. rosewood	474
mint green	20A	met. moss green	20C
grand prix white	908	met. wine red	895
		met. meteor grey	961
		met. light bronze	966

RANGE OF BODY PAINT COLORS AS FROM 1983 MODELS

Standard Colors:		Special Colors:	
guards red	027	met. pewter	956
black	700	met. platinum	655
grand prix white	908	met. moss green	20C
glacier blue	32Z	met. slate blue	661
		met. quartz gray	662
		met. kiln red	811
		met. ruby red	810
		met. light bronze	966

RANGE OF BODY PAINT COLORS AS FROM 1984 MODELS

Standard Colors:		Special Colors:	
india red	027	met. pewter	956
black	700	met. platinum	655
grand prix white	908	met. moss green	20 C
glacier blue	32Z	met. slate blue	661
chiffon white	182	met. quartz gray	662
		met. kiln red	811
		met. ruby red	810
		met. light bronze	966

RANGE OF BODY PAINT COLORS AS FROM 1985 MODELS

Standard Colors:	
guards red	027
black	700
grand prix white	908
pastel beige	536
marble gray	673

Special Colors:	
met. nutmeg brown	492
met. garnet red	822
met. iridescent blue	33P
met. saphire blue	33X
met. crystal green	33N
met. white gold	539
met. silver	936
met. moss green	20C
met. meteor gray	961

RANGE OF BODY PAINT COLORS, 1986 MODELS ONWARD

Standard Colors:		Special Colors:	
pastel beige	536	nutmeg brown - metallic	492
marble gray	673	garnet red - metallic	822
india red	027	iris blue - metallic	33P
grand prix white	908	prussian blue - metallic	33X
black	700	cristal green - metallic	33N
dark blue	347	white gold - metallic	539
		silver - metallic	936
		moss green - metallic	20C
		meteor - metallic	961

Body paint colors model 1987 onward

Standard:		Special:	
Grand prix white	908	Silver - metallic	980
Black	700	Lagoon green - metallic	35Y
Dark blue	347	Rock green - metallic	699
Cherry red	80F	Nougat brown - metallic	40B
Lemon yellow	10W	Diamond blue - metallic	697
Ceramic beige	499	Espresso brown - metallic	40D
Turquoise	21M	Marine blue - metallic	35V
Guards red	80K	Venice blue - metallic	(36P) 35U
		Cassis red - metallic	80D

Body paint colors model 1988 onward

Standard:		Special:	
Grand prix white	908	Silver - metallic	980
Black	700	Lagoon green - metallic	35Y
Dark blue	347	Rock green - metallic	699
Cherry red	80F	Nougat brown - metallic	40B
Lemon yellow	10W	Diamond blue - metallic	697
Ceramic beige	499	Espresso brown - metallic	40D
Turquoise	21M	Marine blue - metallic	35V
Guards red	80K	Venice blue - metallic	36P
		Cassis red - metallic	80D

Printed in Germany – XXIV, 1989

Body paint colors model 1989 onward

Standard:		Special:	
Grand prix white	908	Silver - metallic	980
Black	700	Diamond-blue metallic	697
Dark blue	347	Dove-blue metallic	37B
Guards red	80K	Stone-grey metallic	693
Linen	60M	Slate metallic	22D
Apricot-beige	548	Valvet-red metallic	81L
Murano green	22C	Linen metallic	550
		Pine-green metallic	22E
		Cognac-brown metallic	40L
		Salmon-silver metallic	81K

Printed in Germany - XXIV, 1989

Body paint colors model 1990 onward

Standard:		Special:	
Grand prix white	908	Silver metallic	980
Black	700	Diamond-blue metallic	697
Dark blue	347	Dove-blue metallic	37B
India red	80K	Pepple-grey metallic	693
Linen	60 M	Slate metallic	22D
Apricot-beige	548	Velvet-red metallic	81L
Murano green	22 C	Linen metallic	550
		Pine-green metallic	22E
		Cognac-brown metallic	40L
		Salmon-silver metallic	81K

Printed in Germany - XXV, 1990

Body Paint Colors Beginning With 1991 Models

Standard Colors:	
Grand Prix white	908
Black	700
Maritime blue	38B
Indian red	80K
Signal green	22S
Mint green	22R
Rubystone red	82N

Special Colors:	
Polar silver metallic	92 E
Polar silver metallic	92 M*
Horizon blue metallic	37 X
Cobalt blue metallic	37 U
Oakgreen metallic	22 L
Slate gray metallic	22 D
Slate grey metallic	23 F*
Coral red metallic	82 H
Black pearl effect	738
Midnight blue metallic	37 W
Midnight blue pearl effect	39 C*
Amethyst pearl effect	38 A
Amethyst pearl effect	83 K*
Amazon green pearl effect	37 Z
Amazon green pearl effect	39 A

* = Water-base paints

Water base paints are applied exclusively by the manufacturer during production spraying. For repair of watwer-base paints, conventional respray paints matching the color of the original paint are used. I.e. the only prerequisite for resprays is that the correct respray paint is used (refer to Paint Manual, page L3 - 25). Color differences due to paint application do no occur.

Printed in Germany – XXVII, 1991

Body Paint Colors Beginning With 1992 Models

Standard Colors:	
Grand Prix white	908
Black	700
Maritime blue	38B
Indian red	80K
Signal green	22S
Mint green	22R
Rubystone red	82N

Special Colors:	
Polar silver metallic	92 E
Polar silver metallic	92 M*
Horizon blue metallic	37 X
Cobalt blue metallic	37 U
Oakgreen metallic	22 L
Slate gray metallic	22 D
Slate grey metallic	23 F*
Coral red metallic	82 H
Black pearl effect	738
Midnight blue metallic	37 W*
Amethyst pearl effect	38 A
Amethyst pearl effect	83 K*
Amazon green pearl effect	39 A

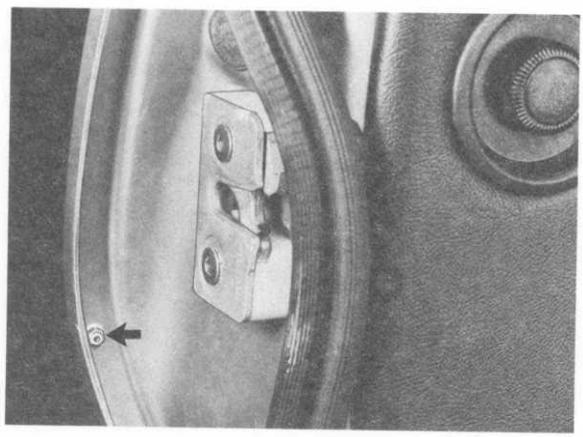
* = Water-base paints

Printed in Germany – XXVII, 1991

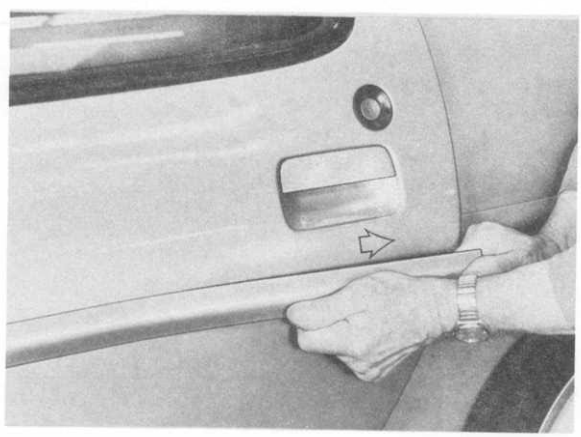
REMOVING AND INSTALLING SIDE GUARD STRIPS

Removing

1. Pull off rubber door weatherstrip at rear in area of lock and loosen nuts of moulding strip. All other mountings are by pins in sockets and adhesive strips.



2. Loosen strips at one end, pull out pins and then detach strips by pulling at a sharp angle. Do not bend off toward the outside, since this would deform the steel insert in the strip and the strip could no longer be used. Press out pins on other end of strip carefully.



3. Used side guard strips can be used again, if the old adhesive strips are pulled off and new double-sided adhesive foam rubber strips are installed (3 M, Art. No. 4262, 19 mm wide). The primed adhesive surface of the strip must not be washed!

4. Replace damaged sockets and make sure that tongues engage behind the metal edge.

Installing

1. Clean body in working area thoroughly, with alcohol and clean cellulose. Ambient and object temperature must be at least + 20° C.

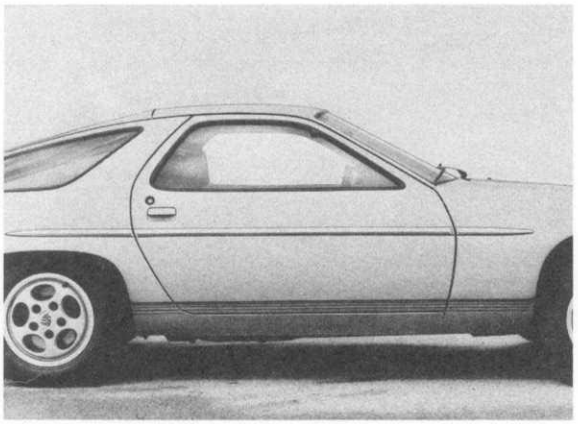
2. Press sockets into the 10 mm dia. holes.

3. Position side guard strips for the different sections and heat the strips to about 60° C to improve the adhesive force.

4. Peel off paper backing from adhesive surface and do not touch the adhesive surface.

5. First install the door's side guard strip. Guide the strip into the socket or hole with help from another person, without letting the adhesive surface make contact, so that the strip can be aligned. Press on strip firmly with a rubber roller or soft cloth (pressure about 70 - 80 N/ 7 - 8 kp). Install a washer and nut on the threaded pin and press in the rubber door weatherstrip.

6. Align front and rear mating strips with door's strip and press on as for door's strip.



SERVICE INSTALLING SIDE GUARD STRIPS

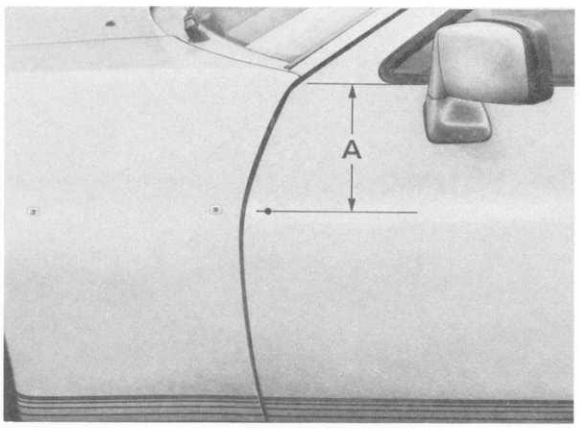
When service installing these strips, first draw the door' s strip on the door according to specified dimensions and then align and drill holes for the fender' s strips.

Drill 10 mm dia. holes for the sockets and one 6.5 mm dia. door hole at rear.

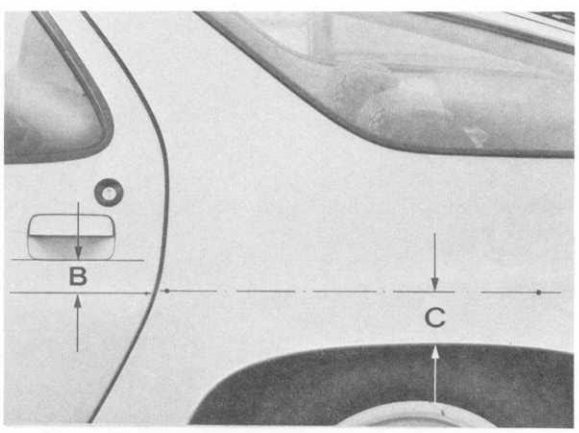
In longitudinal direction drill holes that rear door hole is at center of seal recess and all strips begin about 3 to 4 mm behind the door or fender edge.

Height distances:

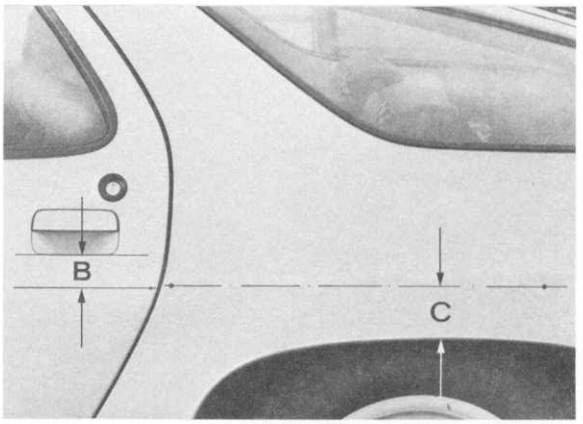
Distance A = 200 mm
(outer edge of door shoulder to center of strip)



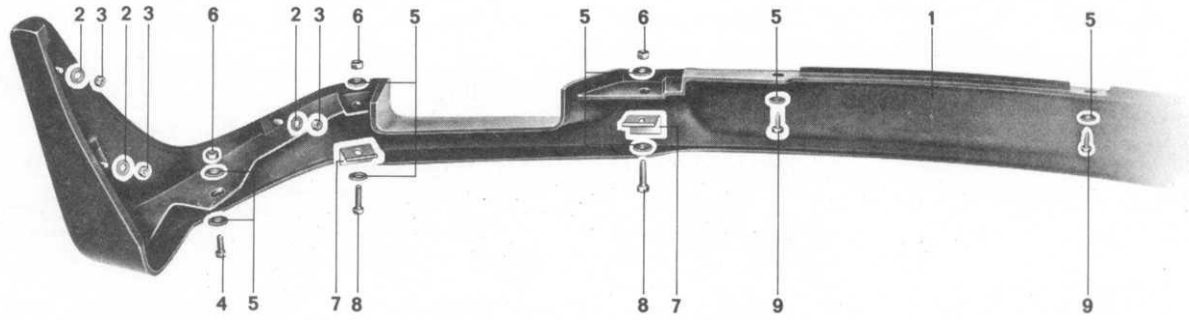
Distance B = 48 mm
(lower edge of grip plate to center of strip)



Distance C = about 78 mm
(fender opening to center of strip)



Press in sockets and make sure that tongues engage behind metal edge.

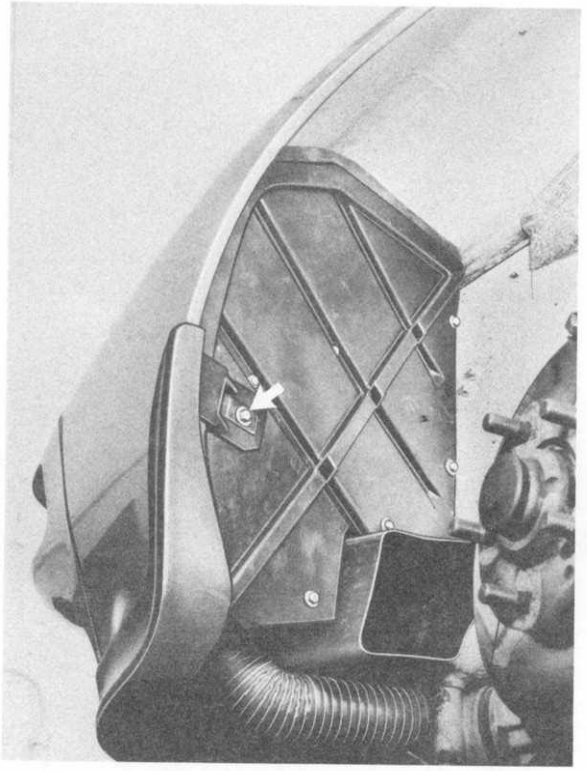


No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Front spoiler	1	Disconnect at fender rim	Connect on fender rim; make sure of clean fit on outside of fender!	
2	Washer	6			
3	Locknut M 5	6		Replace, if necessary. Tighten only against stop	
4	Bolt M 6 x 16	2		Bolt with fender support	
5	Washer	12			
6	Locknut M 6	6		Use locknuts, replacing if necessary	
7	Bracket	4		Place bevelled edges against front spoiler	
8	Bolt M 6 x 25	4		Watch location to air inlet grill	
9	Screw 5.5 x 16	3		Watch threads in radiator grill, use studs if necessary	

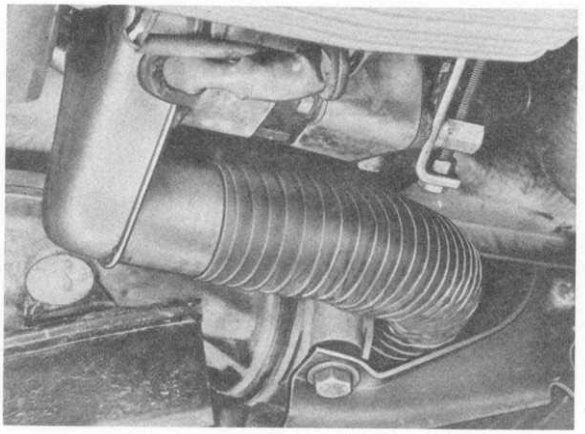
REMOVING AND INSTALLING FRONT SPOILER 928 S

Removing

1. Unscrew and remove wheel well cover and holder (arrow).

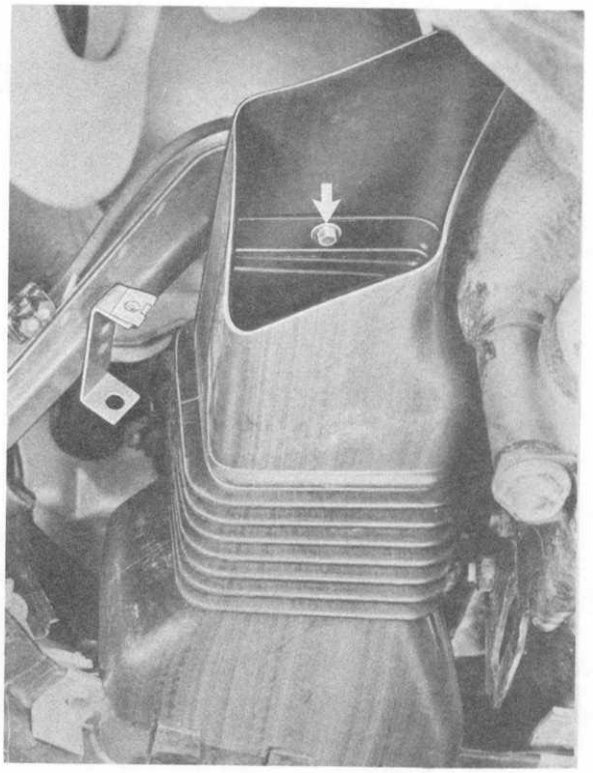


Also pull off air guide hose from alternator on left side.



Disconnect outside temperature sensor plug (air conditioner).

2. Unscrew mounting brackets in air ducts from fender supports and pull out the air ducts.

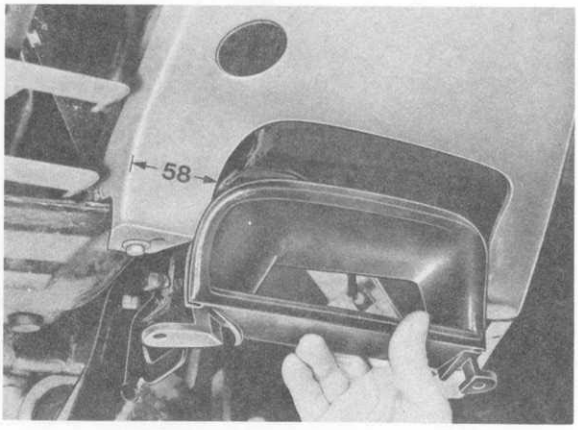


3. Unscrew front spoiler at fender, plastic part and air inlet grill. Remove front spoiler.

4. Pull out air inlet grill downward.

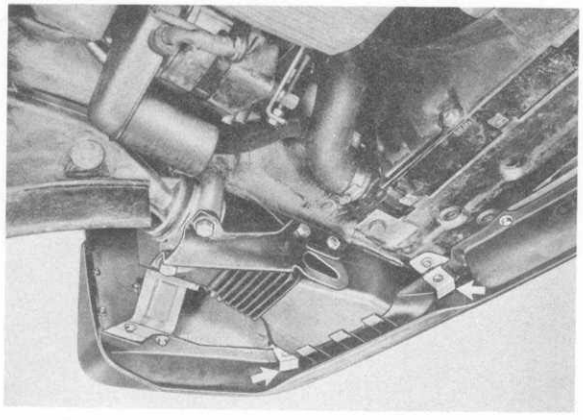
Installing

1. Push air inlet grill into openings from below. In case of new trim mark openings according to dimensions (58 mm up to opening) and make up template for air inlet grill.



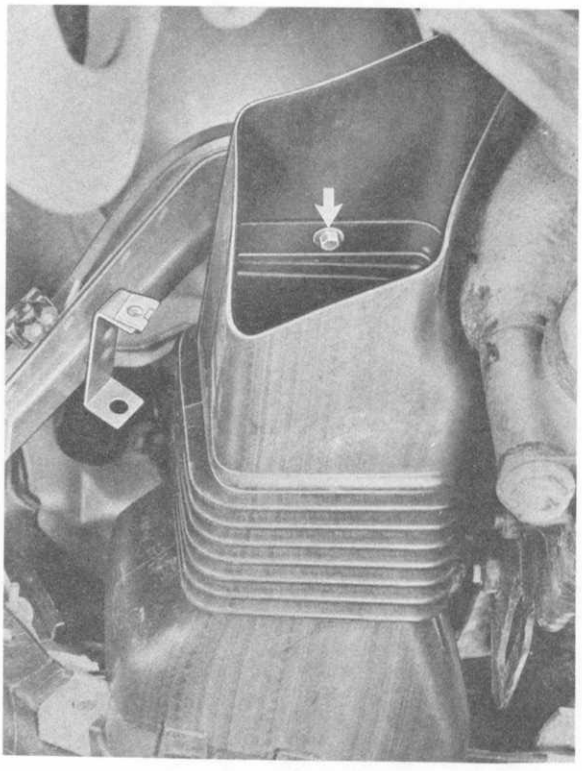
Cut out openings with a piercing saw or metal shears and, if necessary, smooth edges with a wood grater or file.

2. Install front spoiler, making sure of clean fit on fender contour and radiator grill. Secure studs with self-locking nuts. Mount front spoiler to left and right of air inlet grill with brackets.



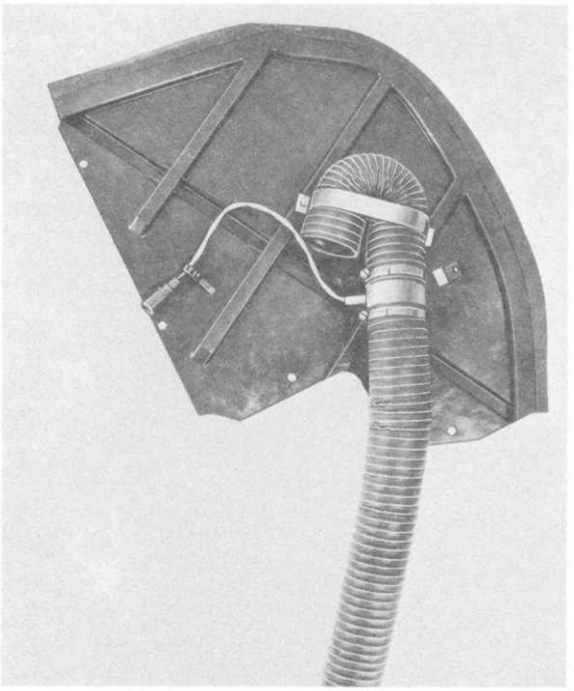
3. Insert air ducts and press in front top and bottom guide tabs on air inlet grill and front spoiler.

Mount bracket on fender support with metal screw.

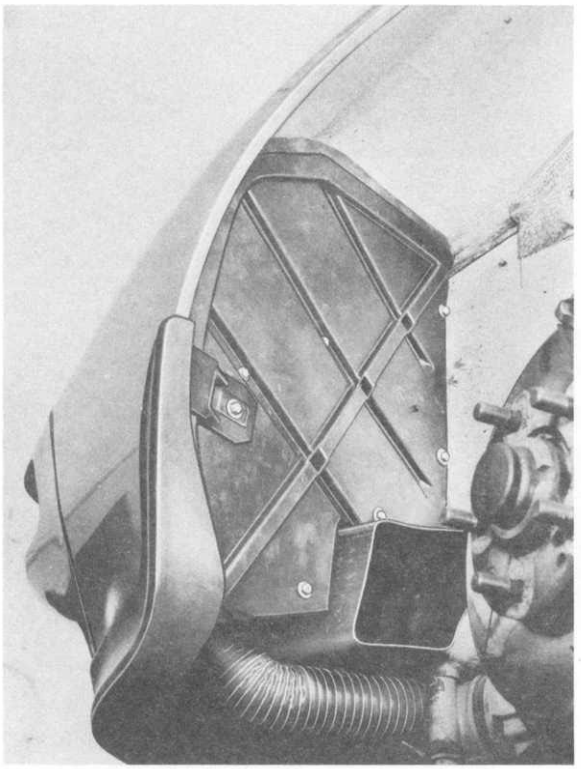


4. Install wheel well cover and secure with washers and 5.5 x 16 mm metal screws. Place and secure spacer behind fender rim. On left side also mount air guide hose on wheel well cover.

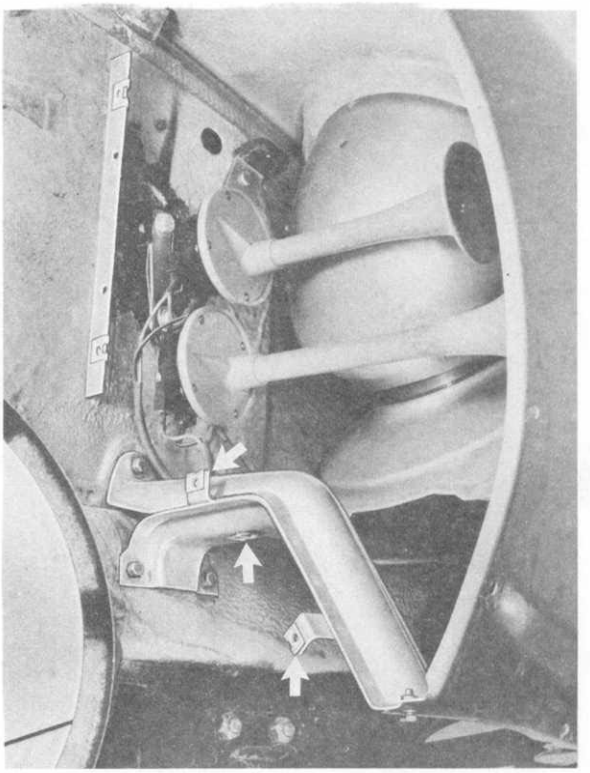
Secure plug on outside temperature sensor with a hose clamp and connect with the wire harness.



Route air guide hose underneath the air duct between the side member and cowl panel bracket, and connect on the alternator.



Prime coat entire new fender supports and apply a coat of undercoating. Install with self-locking metal nuts.

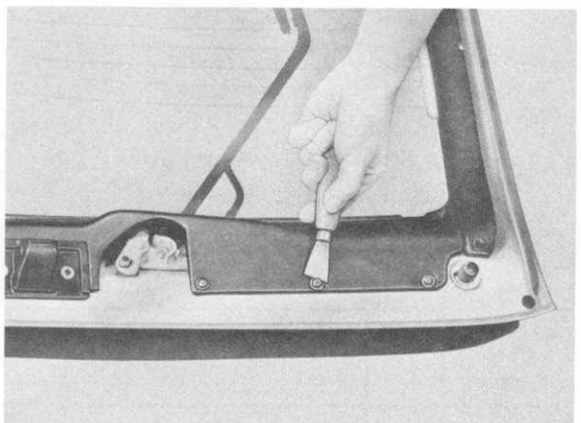


REMOVING AND INSTALLING REAR SPOILER 928 S

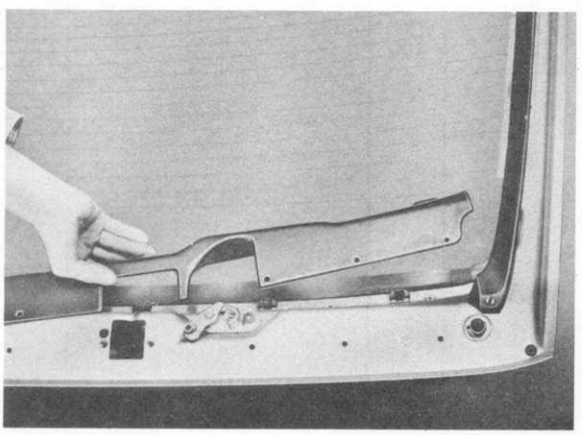
Removing Rear Spoiler on Lid

1. Remove lid lock and rear window wiper.

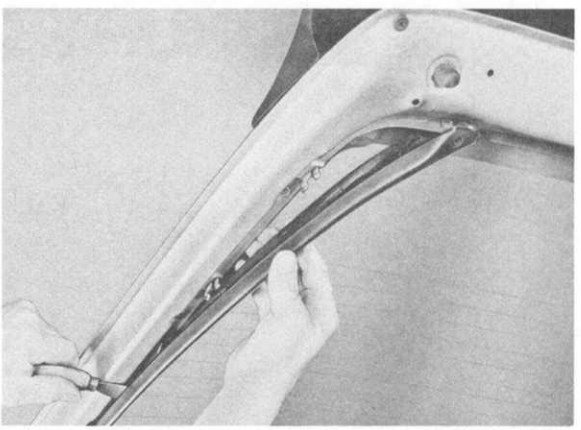
2. Pull spreader rivets out of lid trim panel.



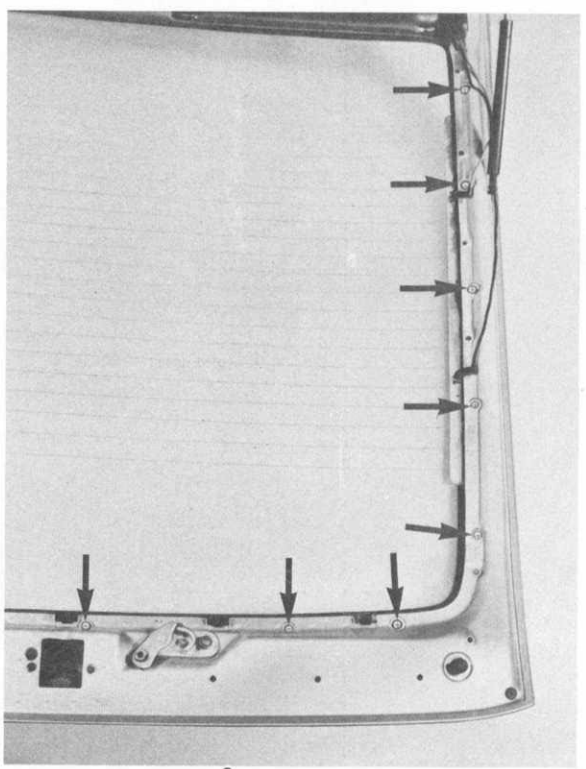
3. Press bottom of trim panel off of lid frame along window.



4. Pull down side trim panel sections, disconnecting wires at same time.

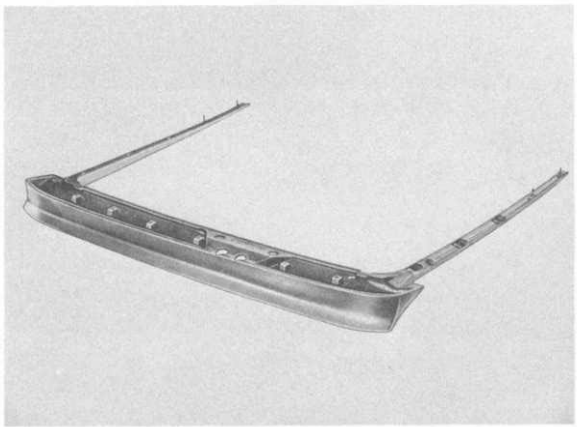


5. Unscrew all accessible Phillips screws (12) on inside of lid and two M 4 nuts on upper part of spoiler (arrows).

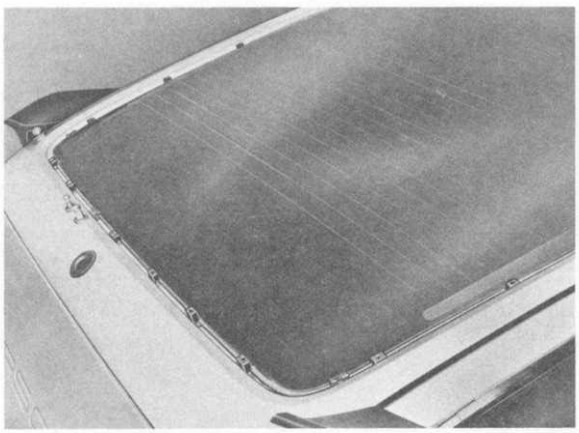


Installing

1. Check metal nuts inserted in the rear spoiler, replacing missing or damaged metal nuts.

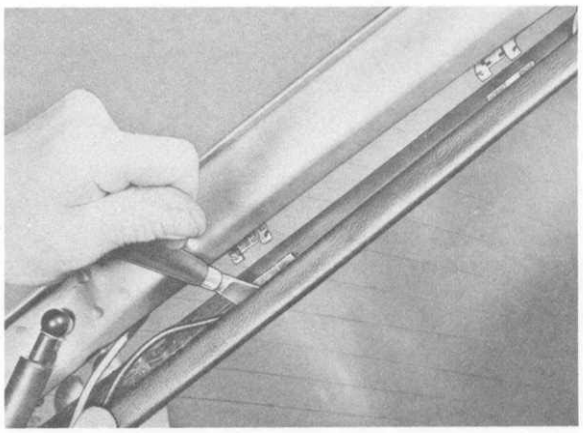


2. Check that spacers on lid are positioned correctly to bores in lid. Seal and secure loose spacers with Terostat 33 (Teroson) silicone adhesive.



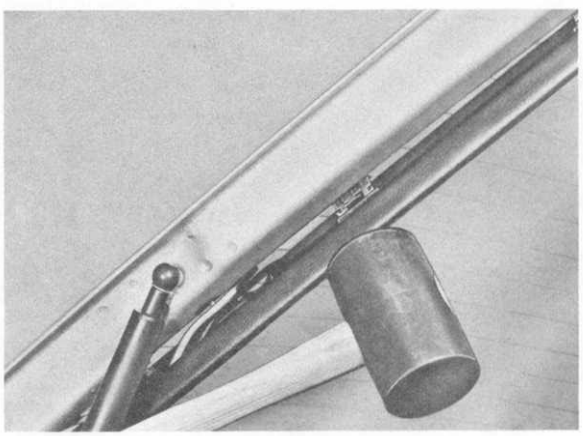
3. Install rear spoiler. Mount with 4. 2 x 32 mm metal screws and washers. Watch for neat fit on lid. Use two M 4 nuts and above mentioned washers at upper part.

4. Install side lid trim sections. Press defogger wires underneath retaining tabs on outside.

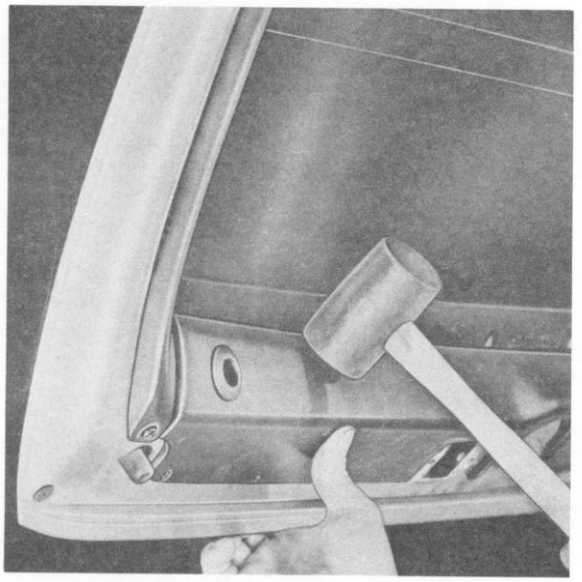


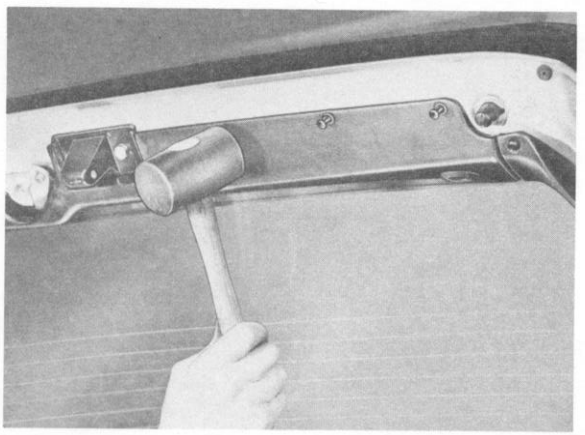
Make sure all retaining tabs engage correctly in the metal clips.

Align trim panels with lid frame and secure with new spreader rivets.

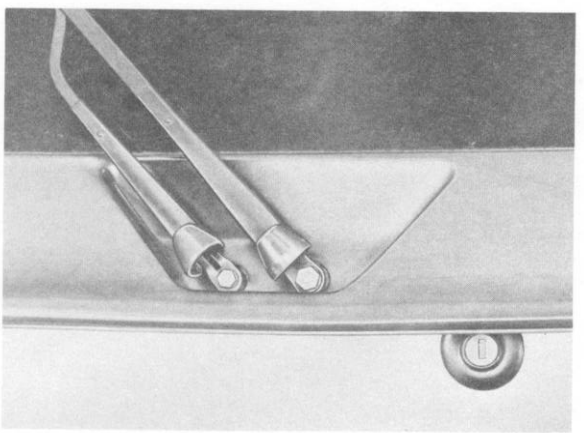


5. Insert, align and secure lower trim panel with 6 spreader rivets.





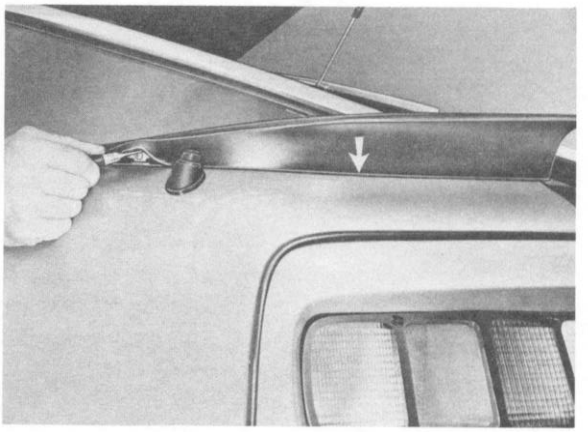
6. Install lid lock. Seal off outside of lock cylinder against upper escutcheon with a permanently elastic sealant.
Install and secure rear window wiper parallel to side window strip.



Removing Side Rear Spoiler

1. Lift spoiler with a narrow putty knife about 5 cm behind the spoiler' s front edge enough that the Phillips screw underneath is accessible and can be unscrewed.

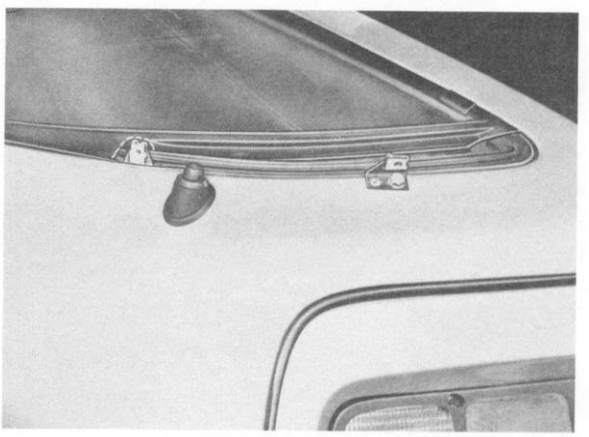
2. Provide access to second metal screw (arrow) about 25 cm behind spoiler' s front edge and remove screw.



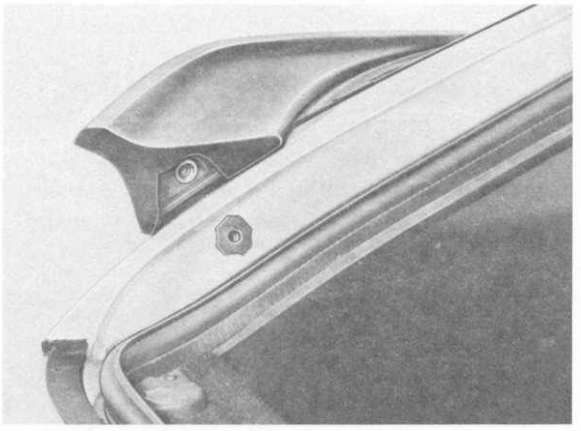
3. Unscrew bracket on inner frame. Remove spoiler.

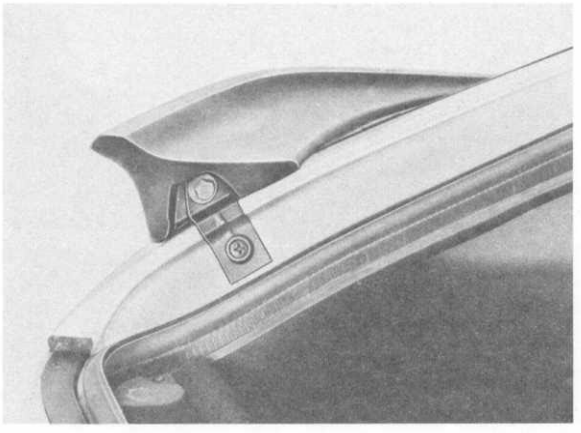
Installing

1. Insert side rear spoiler and install covered 4.2 x 9.5 mm metal screws.
Check clearance between metal screw and ornamental strip at front holding block, cutting out the ornamental strip in the broken line area if necessary.

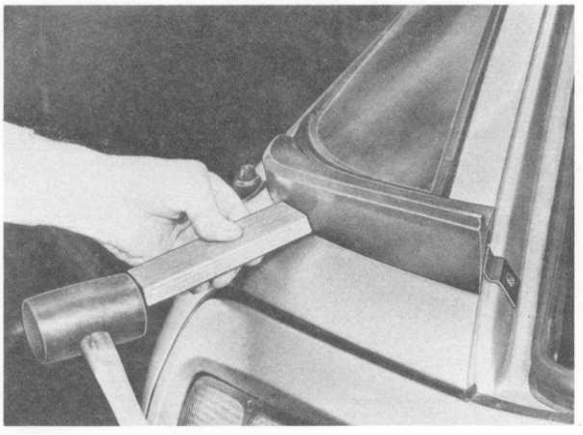


2. Mount seal on inner frame. Mount bracket on inner frame with M 6 x 16 oval head screw and on spoiler with M 6 x 10 hex. head screw with washer.





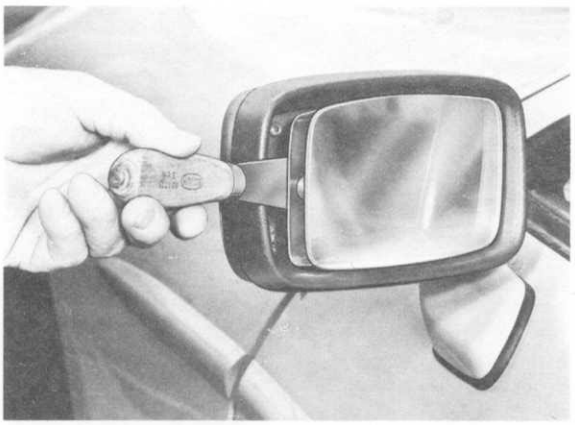
3. Check fit of spoiler on rear side section and window frame. If necessary, correct by applying light knocks against mounting surfaces with a piece of wood. Tighten bolts.



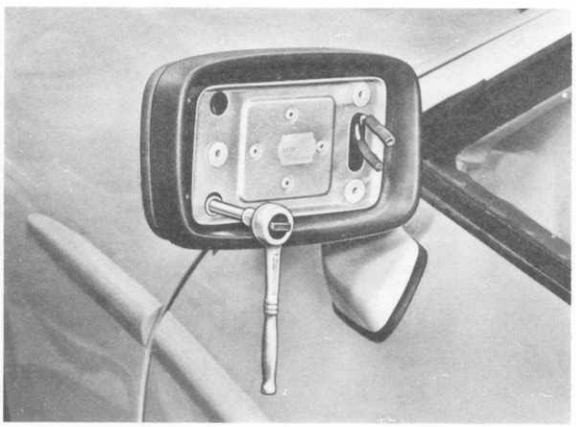
4. Check side spoiler for uniform fit to lid-mounted spoiler and correct adjustment, if necessary.

REMOVING AND INSTALLING OUTSIDE MIRROR

1. Pry off clips on mirror glass with a putty knife on backplate and disconnect contact plugs on glass carefully.



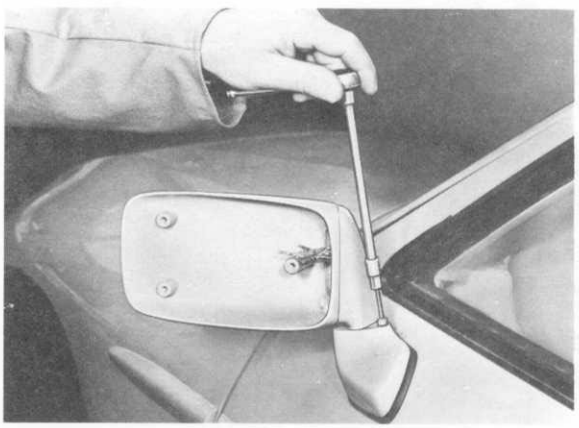
2. Unscrew 3 screws through holes in backplate, take off foam rubber part and pull off wire plugs.



3. Note wire positions in receptacle by colors. Press in locks on each wire plug separately with an extraction tool and pull out wires.

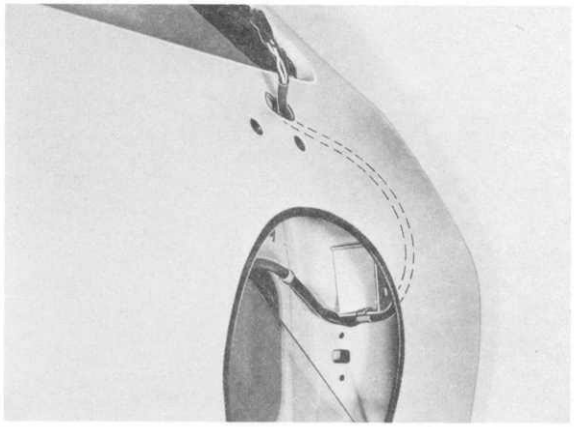


4. Unscrew fillister head screw on mirror base so that mirror can be removed with the liner.



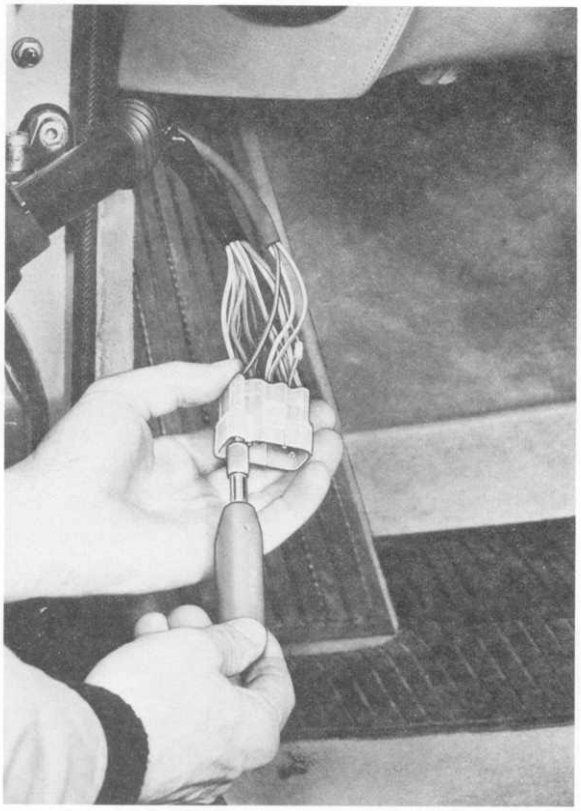
5. Install in reverse order.

6. If wire harness in door has to be removed, take off inside door trim panel and take harness out of holders.



8. When installing, make sure wire harness is secured with the provided holders and cannot contact the door window glass.

7. Disconnect plug underneath instrument panel, press out wires on outside door mirror with an extraction tool and pull out wire harness.



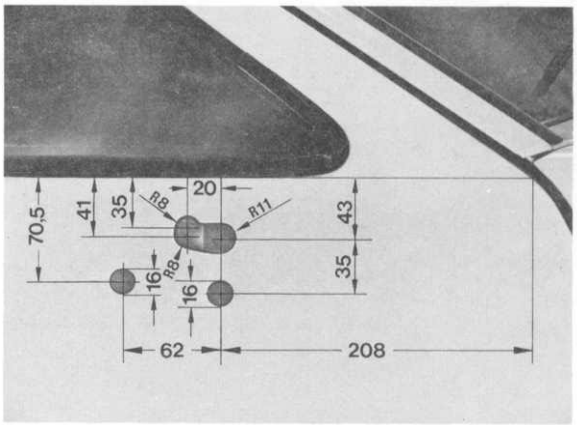
SERVICE INSTALLING OUTSIDE MIRROR ON PASSENGER'S DOOR

1. Remove inside trim panels on doors. Pull off door plastic sheets partially. Remove outside mirror and wire harness on driver's door.

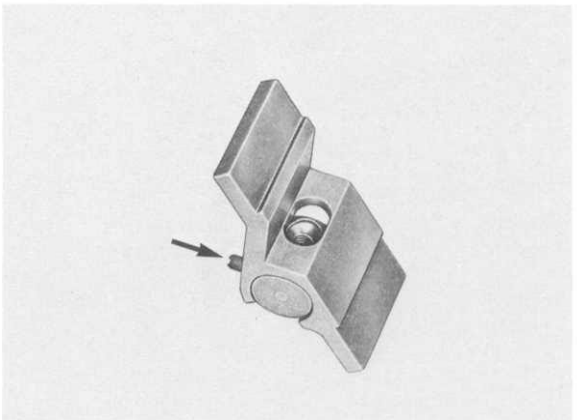
2. Paint mirror set to match body color of car.

3. Insert guide tube with spring and centering plates and torque to 15 + 3 Nm (130 + 2 in.lb) with a multiple socket wrench.





5. Push threaded insert into door reinforcement and hold with a rollpin.



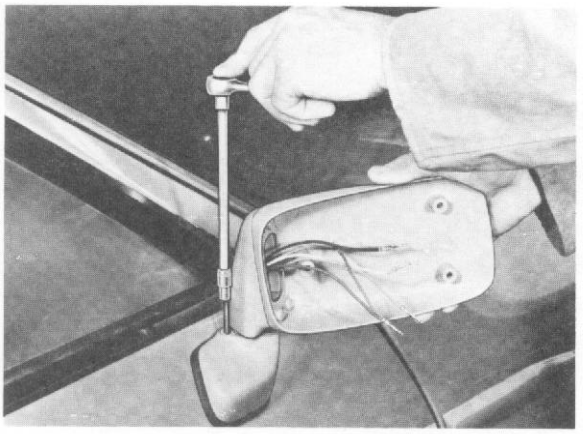
4. Mark location of hole on door outside panel according to specified dimensions, punch mark and drill 16 mm and 22 mm dia. holes with a standard compass saw. Cut out and file opening with suitable tools.

Caution!

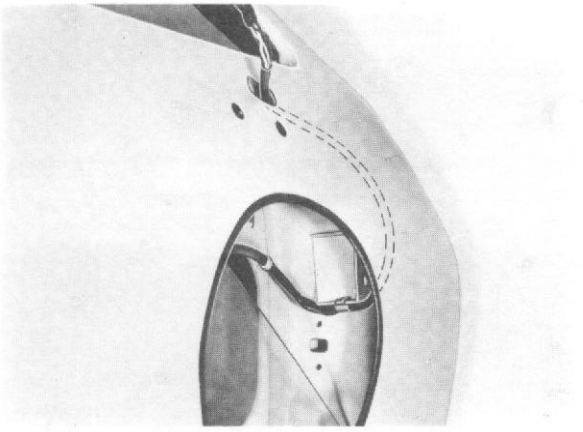
Do not damage door reinforcement.

6. If necessary, align door reinforcement on door outside panel. Fit in mirror base, correcting drilled holes if necessary. Make sure of proper fit.

7. Install new wire harnesses from inside of door to outside and pull into mirrors. Mount mirrors and liners on doors with fillister head screws, which are torqued to 5.6 Nm (4 ftlb).



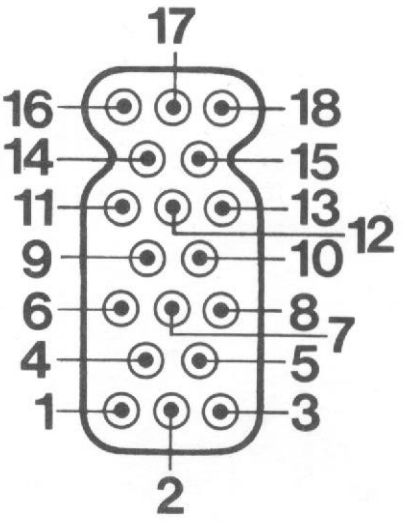
8. Wire harnesses must be secured in holders provided in a manner to prevent contact with the door window.



9. Insert wires harnesses through guides and press into plug connections according to sketches.

Right multiple pin plug (passenger's side)

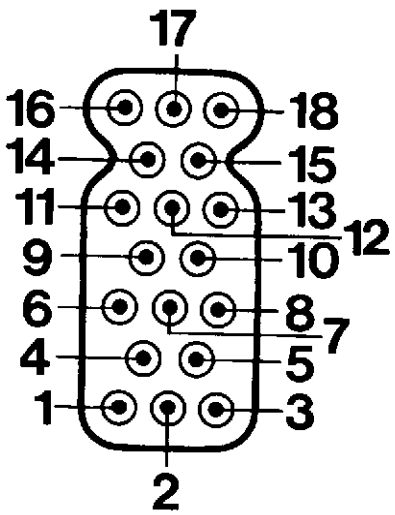
Rear view:



Terminal 66 = blue
Terminal 7 = white
Terminal 8 = black
Terminal 9 = gray/green
Terminal 16 = brown

Left Multiple Pin Plug (Driver's Side)

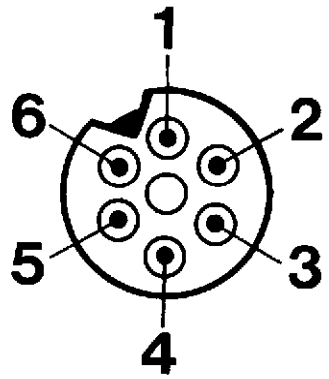
Rear view:



Terminal 6 = blue
Terminal 7 = white
Terminal 8 = black
Terminal 9 = gray/green
Terminal 10 = white/red
Terminal 16 = brown

Mirror multiple pin plug (passenger's side)

Rear view:

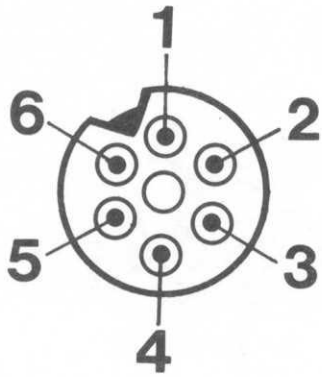


Terminal 1 = blue
Terminal 2 = black
Terminal 3 = gray/green
Terminal 4 = brown
Terminal 5 = brown
Terminal 6 = white

10. Press wires in mirrors into round male plugs according to sketches.

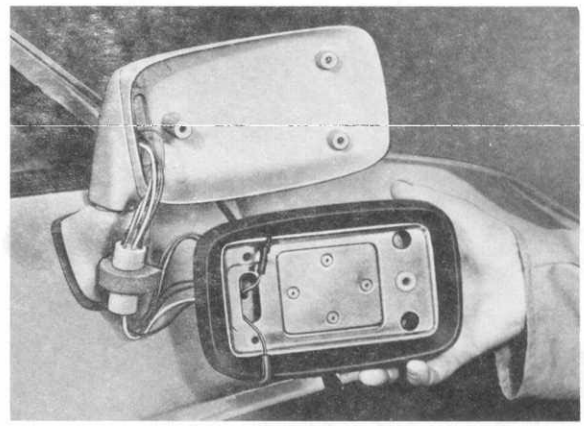
Mirror multiple pin plug (driver's door)

Rear view:



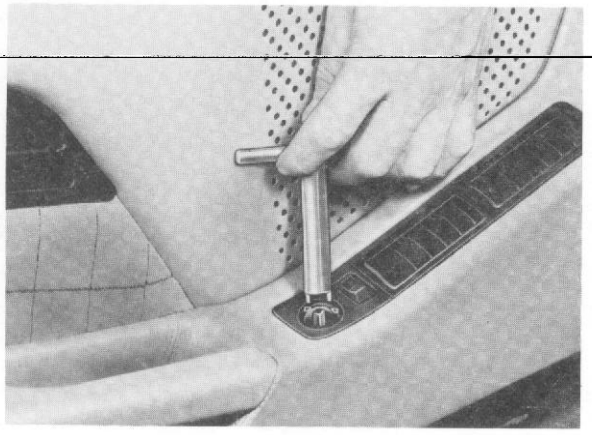
Terminal 1 = black
Terminal 2 = yellow
Terminal 3 = gray/green
Terminal 4 = brown
Terminal 5 = brown
Terminal 6 = white

11. Compress wire plugs and secure with self-adhesive tape.

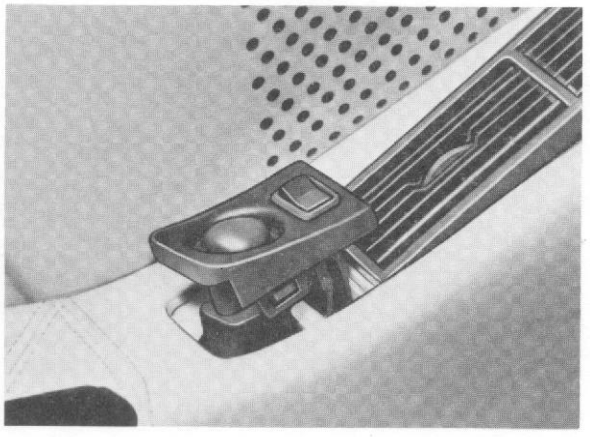


12. Mount cover with mirror glass carrier, connect and insert mirror glass.

13. Lift off knob on outside mirror switch and unscrew threaded sleeve with Special Tool 9209.



14. Remove outside mirror switch and disconnect plug. Cut out hole for switch. Insert switch in clips and connect with wire harness.

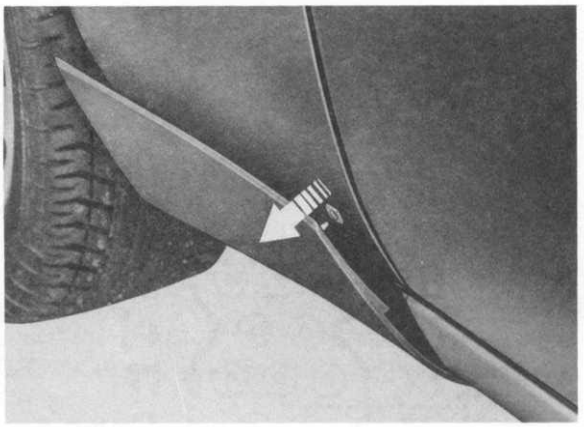


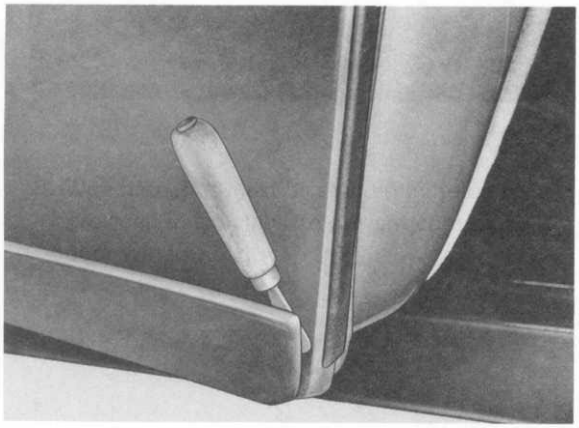
15. Paste plastic sheets on doors. Connect electric wires between door trim panels and wire harnesses with each other and install door trim panels.

REMOVING AND INSTALLING SILL COVERS

R e m o v i n g

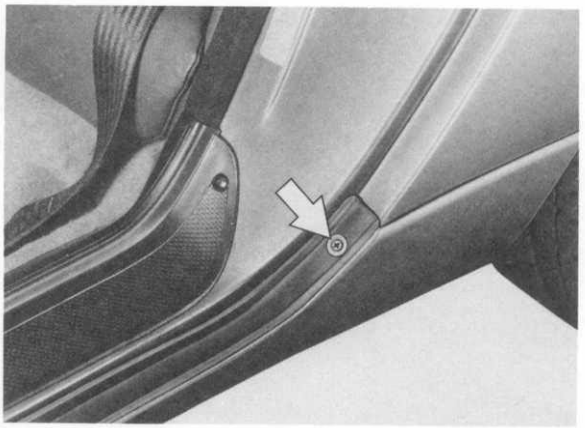
1. Use a hot-air blower to heat sill cover on door to approx. 70°C, carefully detach with a suitable tool and pull off.

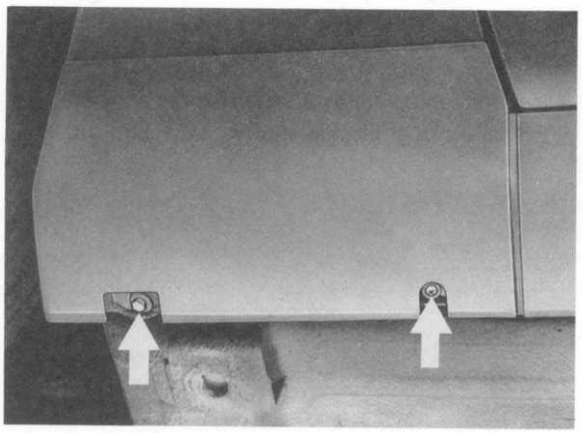




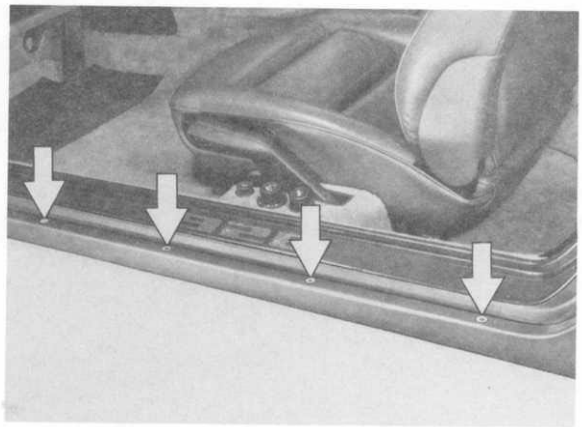
3. Remove screw holding cover strip in place.

2. Remove sill strip mounting screws from front fender, use a hot-air blower to heat sill strip to approx. 70°C, carefully detach, unclip and remove.

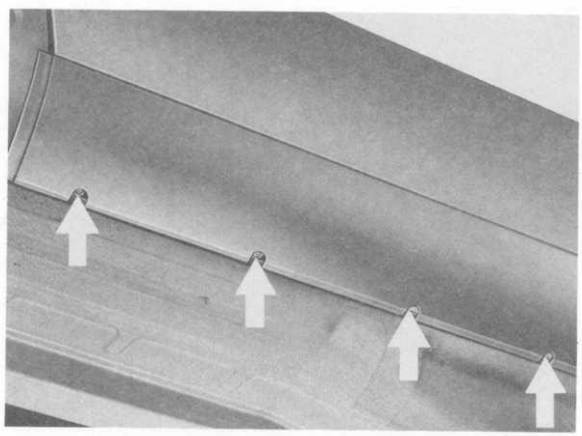


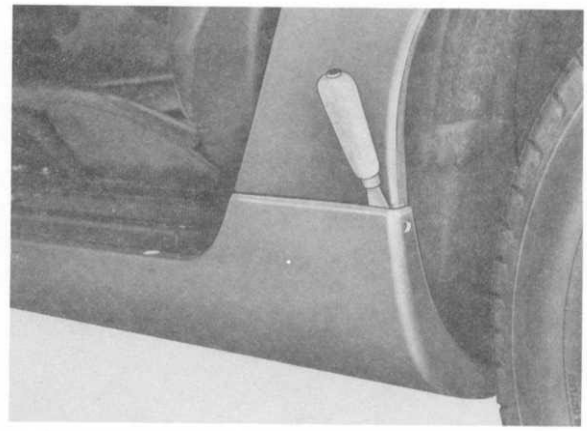


4.Unclip trim strip and remove upper securing screws of sill cover.

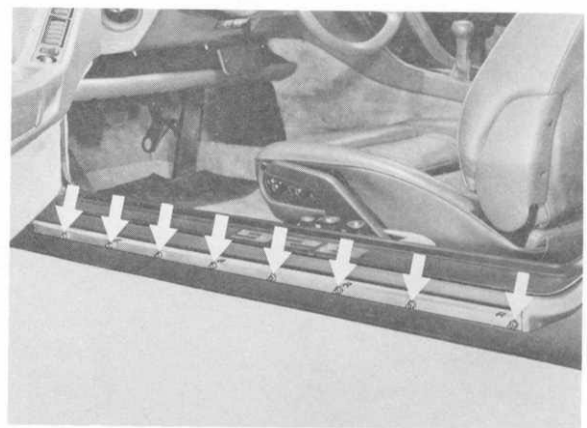


5.Remove lower securing screws from sill cover; where cover is held by adhesive, use hot-air blower to heat cover to approx. 70°C, carefully detach and pull off.

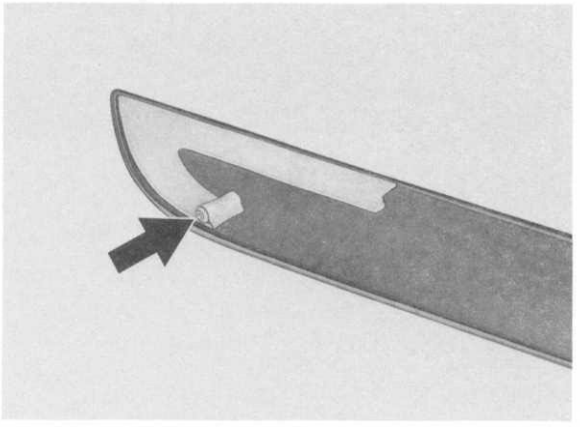




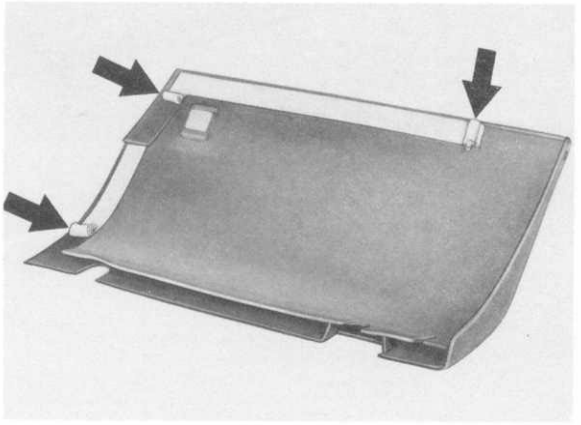
6.Remove sill cover securing nuts and remove cover from car.



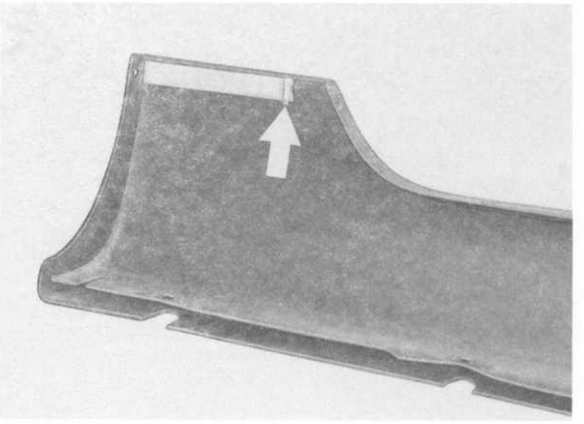
7.Lay sill cover on a level surface. To avoid damaging finish, place soft material beneath strip. Heat adhesive tape with hot-air blower to approx. 70°C and rub tape off.



8.Use hot-air blower to heat adhesive strips on fender sill cover to approx. 70°C and rub off.

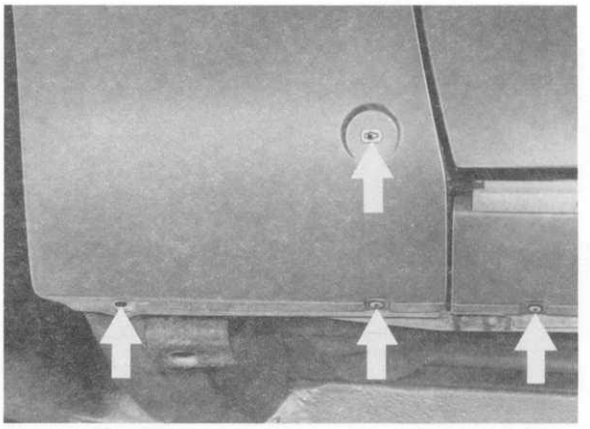


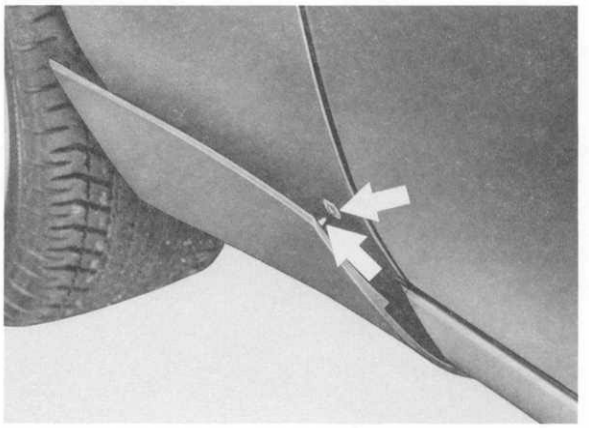
9.Use a hot-air blower to heat adhesive tape on sill cover to approx. 70°C and rub off.

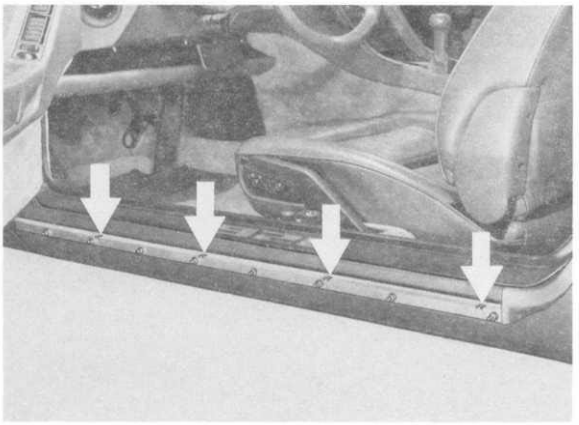


I n s t a l l i n g

1.Check all sill cover securing points, renew if necessary.







2.Clean sill covers with methylated spirits and a closed-cell cloth and apply new adhesive tape.

N o t e :

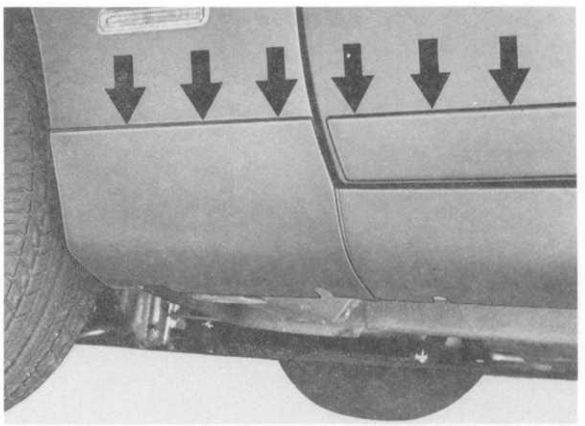
Never use tape older than 1 year, see date of manufacture.

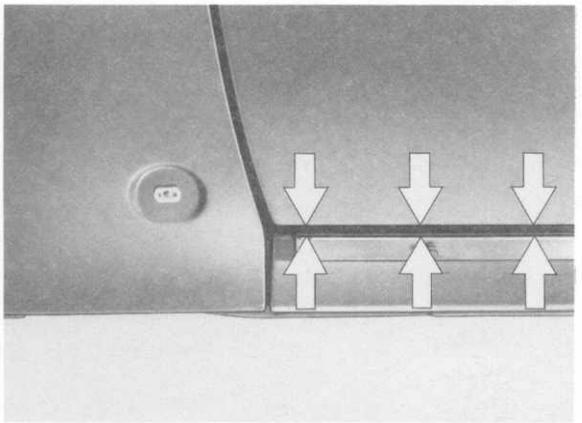
3.Install cover strip. Check that gap between door and strip is uniform throughout its length.

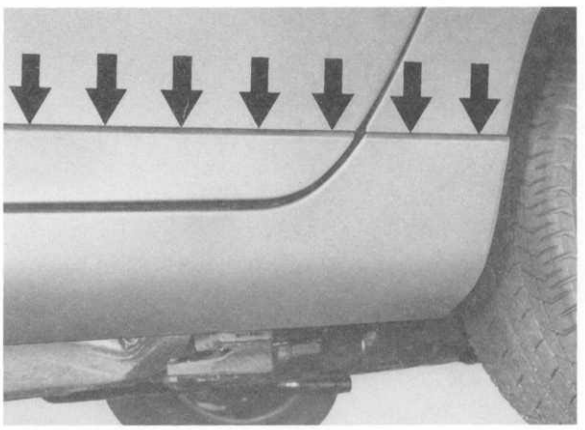
4.Carefully clean body with methylated spirits and closed-cell cloth in the area around the sill cover.

5.Peel protective backing from adhesive strips. Do not touch the adhesive surfaces.

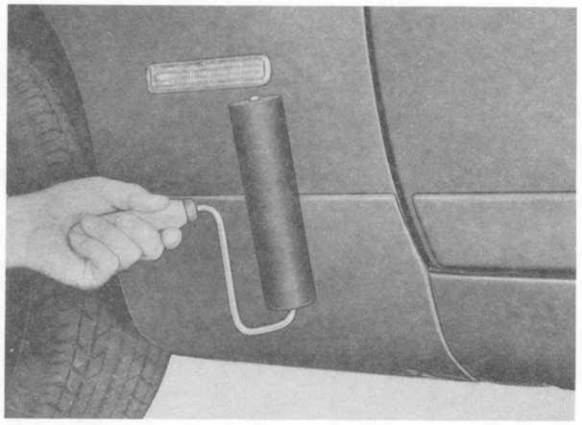
6.Installation of the sill covers is the reverse of the removal procedure. Check that the height of the door-sill cover at front and rear corresponds to that of the other sill covers.

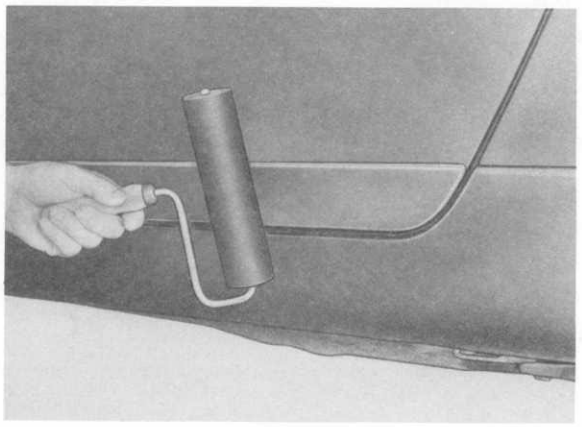






7. Complete installation by pressing the sill covers firmly along the adhesive strip with a rubber roller.





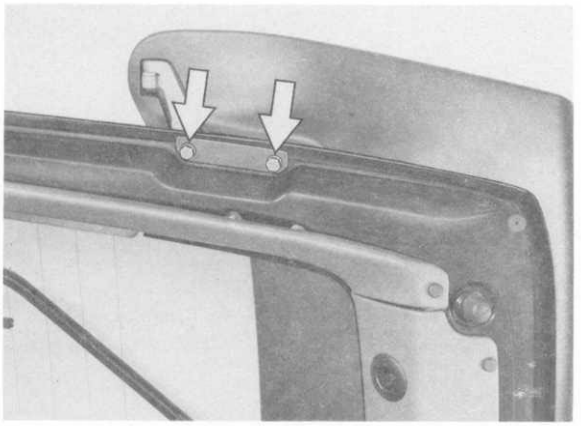
8. The ambient and vehicle temperatures must be at least 20°C.

9. After reapplication of adhesive sill strips, do not wash the car or apply preserving agents for at least 24 hours.

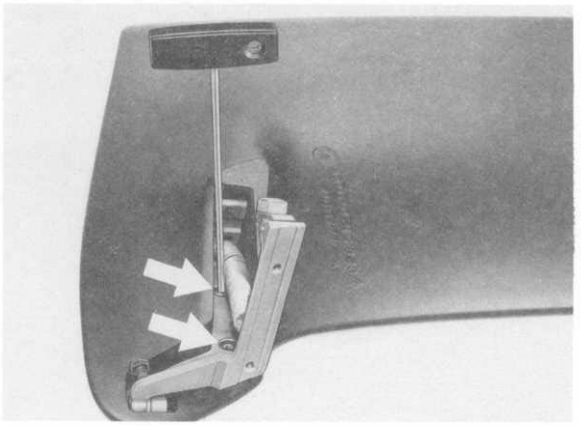
REMOVING AND INSTALLING REAR SPOILER

R e m o v i n g

1.Open tailgate, remove spoiler securing screws and lift spoiler off tailgate.



2.Place spoiler on a soft surface, unscrew securing screws from hinges and remove hinges from spoiler.

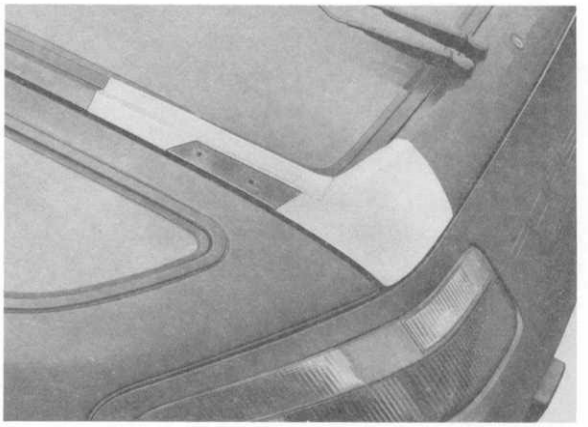


3.Check hinges, renew if necessary.

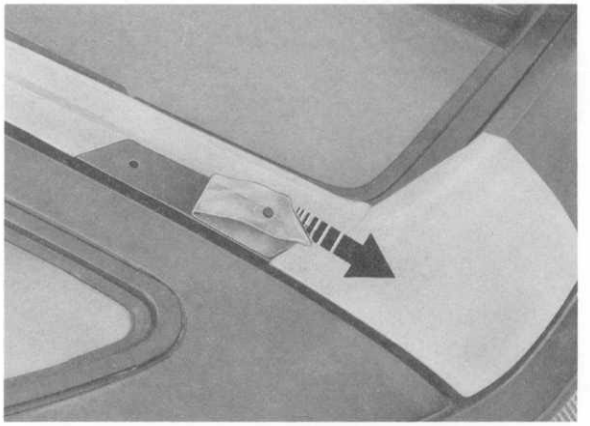
I n s t a l l i n g

1.Using new screws, attach hinges to spoiler.

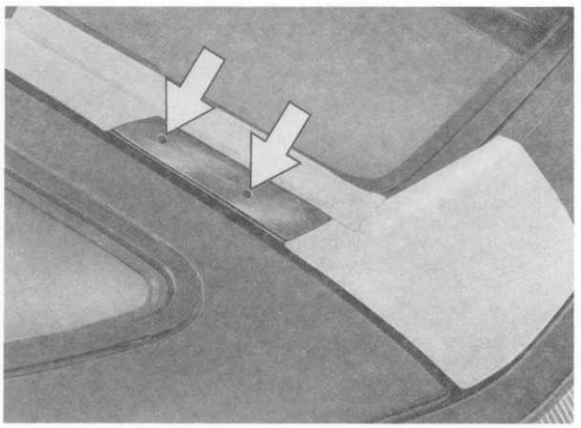
2.To protect paintwork, cover tailgate with adhesive tape.



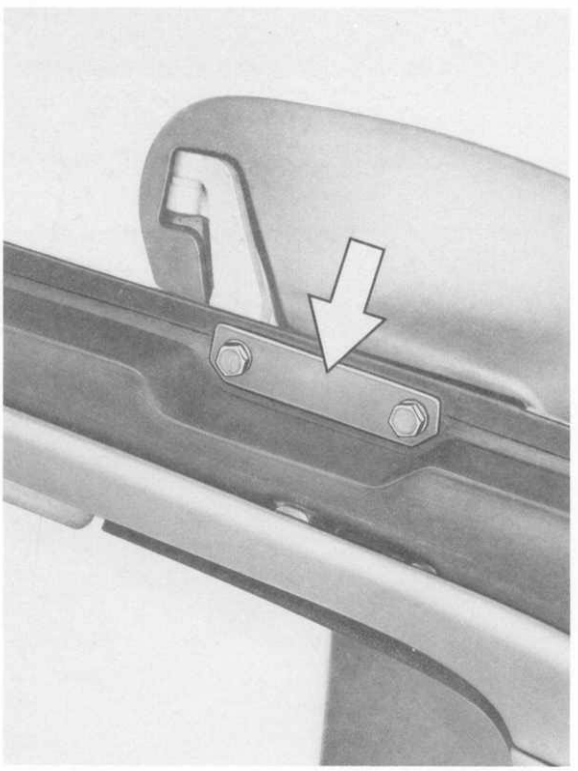
3.Inspect adhesive membrane which protects paintwork, renew if necessary, remove all traces of adhesive with methylated spirits and a closed-cell cloth.



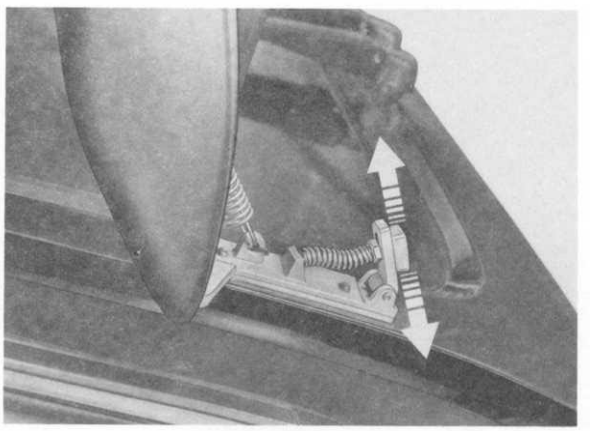
4.When the new adhesive membrane is applied, the holes in the membrane must align exactly with the holes in the tailgate.

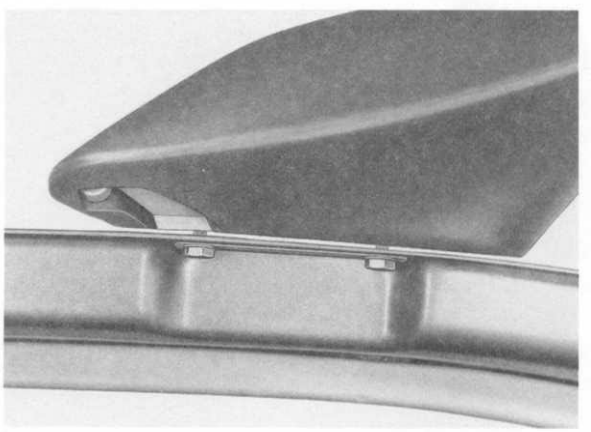


5.Set spoiler on tailgate and secure with new micro-encapsulated screws and washers.



6.To adjust, disengage spoiler, slacken screws and adjust on both sides until spoiler holders engage simultaneously without spoiler touching tailgate.

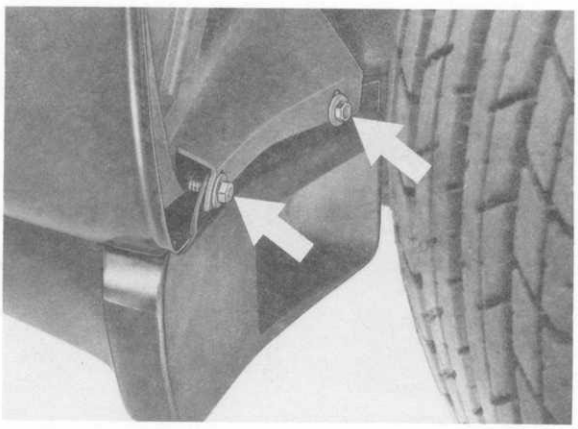


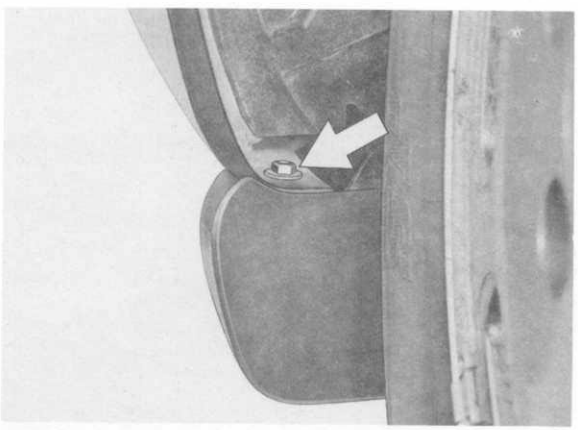


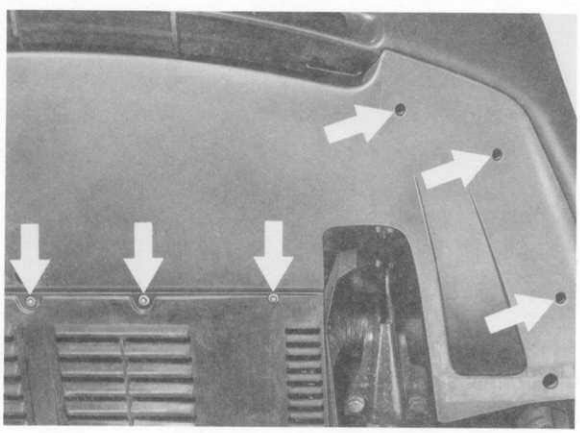
REMOVING AND INSTALLING FRONT AIR DAM

R e m o v i n g

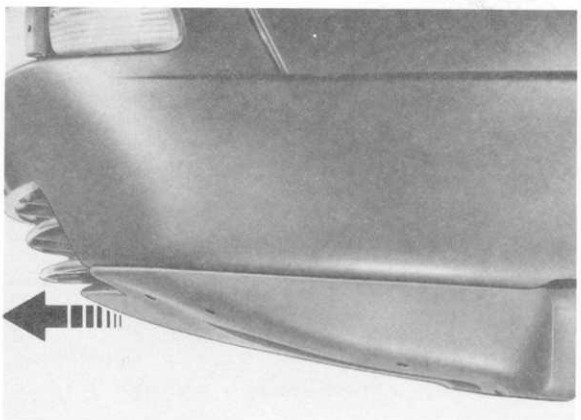
1.Remove securing screws.



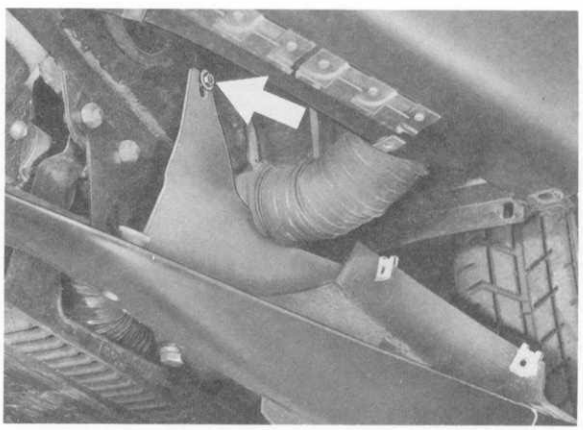




2.Pull front air dam horizontally off mounting clamps.

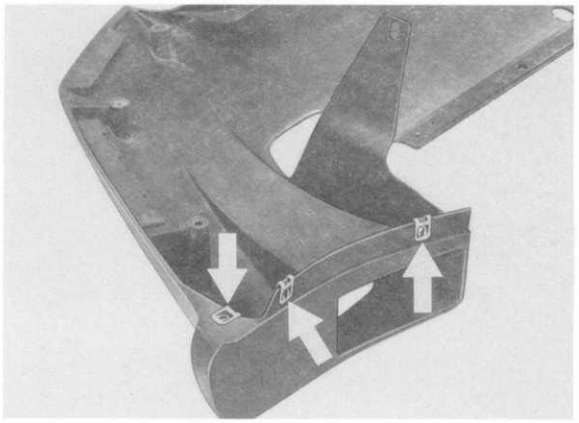


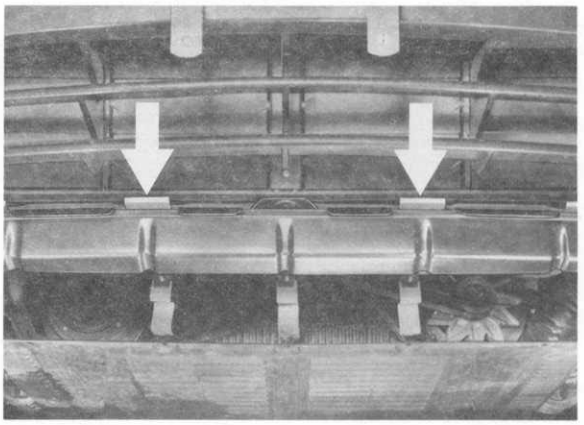
3.Press air dam down and remove the inner securing screws.

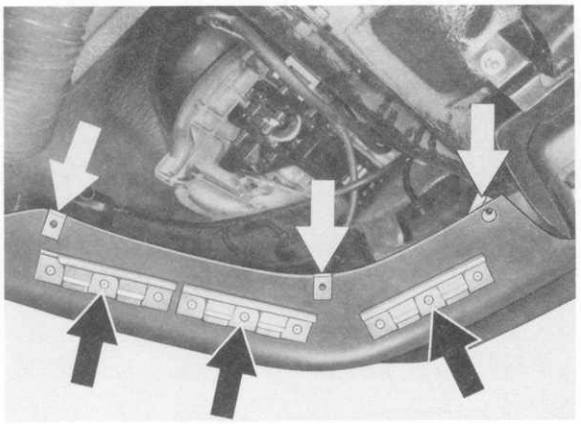


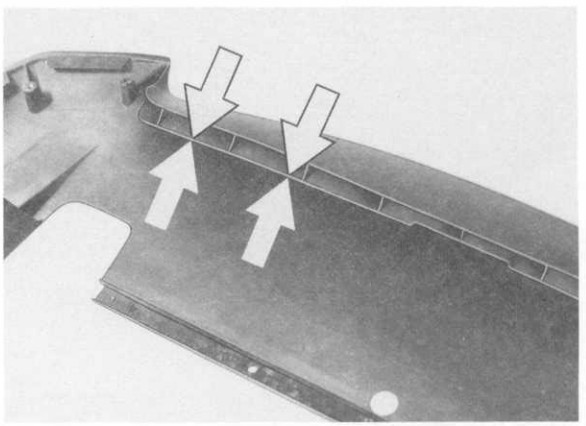
I n s t a l l i n g

1.Prior to installation of the front air dam, inspect all securing points and renew as necessary.









2.Installation is the reverse of the removal procedure.

3.When pressing the front air dam into the securing clamps, check that the lower edge of the air dam engages the foremost holder on the transverse member.

Fitting the CLUB SPORT emblem

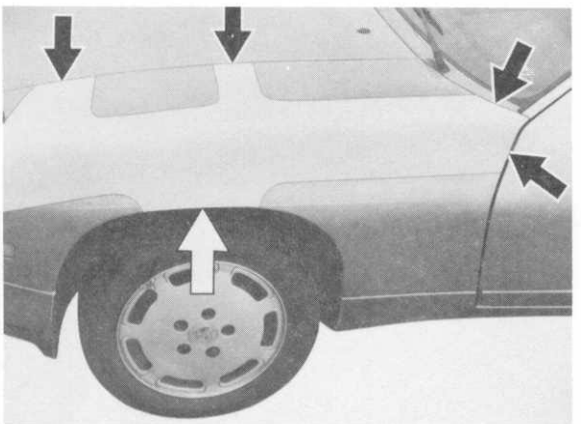
Note

The temperature of the vehicle and that of the foil must be at least 20°C when fitting the emblem .

1. Remove any dirt from the area involved and clean with methlated spirit.

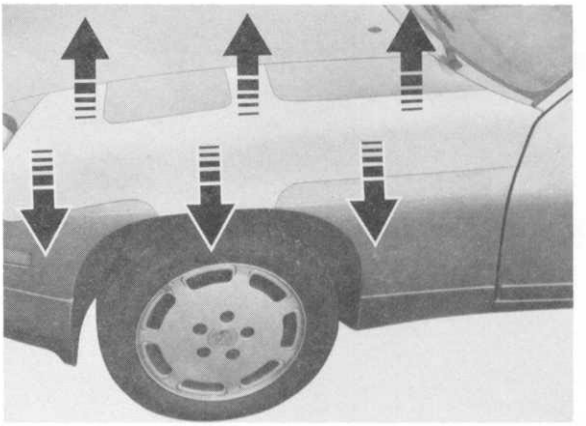
2. Dampen the area on the fender with a 50 % alcohol - water solution to ensure that the foil does not stick immediately when positioning.

3. Pull the beige protective paper from the foil and lay the foil on the edge of the fender.



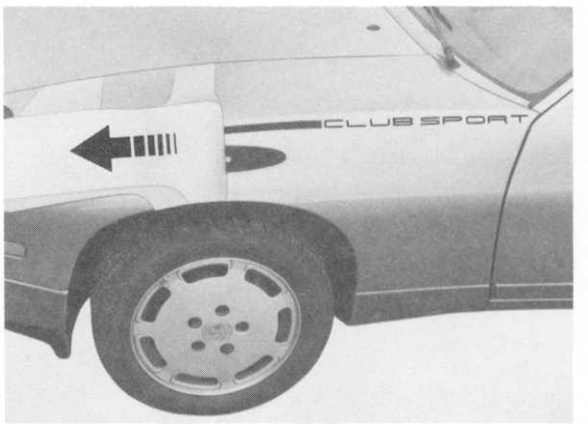
88/49A

4. Using a plastic spatula or similar, smooth out the moisture from the center outwards. Make sure that no air bubbles remain trapped.



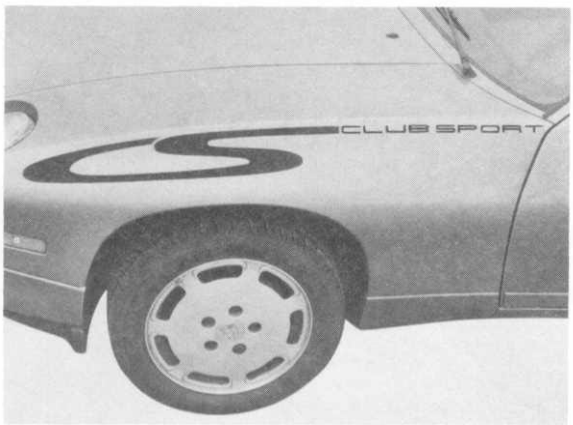
88/49B

5. Pull the outer protective paper from the foil.



88/50

6. Puncture any remaining air bubbles with a needle and press down the foil.



88/48

Retrofitting new mirror generation for vehicles as of MY '87

Note

Only for vehicles fitted with door mirrors on driver's and passenger's side.

1. Remove door mirror.

2. Assemble new door mirror.

3. Cut wire at mirror to required length (connector is engaged into the reinforcement plate).

4. Install new connectors and engage into connector housing half according to below list.

1 - white

2 - blue

3 - black

4 - red

5 - brown

6 - brown

Vehicles with seat memory require an additional 4-pin connector (connector sockets).

1 - grey

2 - green

3 - pink

4 - yellow

On vehicles without seat memory, the wires not required are tied out of the way.

5. Fit mirror (route wire through stud into mirror housing).

6. Engage connector into connector housing half.

7. Assemble both connector housing halves and lock connector housing (6-pin) in the reinforcement plate (the 4-pin connector housing is tied out of the way).

8. Fit mirror glass.

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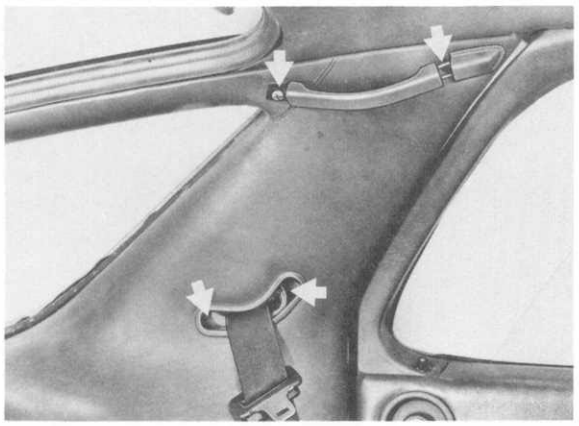
REMOVING AND INSTALLING REAR SIDE TRIM PANEL

1. Disconnect and remove luggage compartment cover, tool plate, floor mat, spare wheel cover, edge guard on B pillars, parking brake cable cover, emergency seat cushions and backrests.

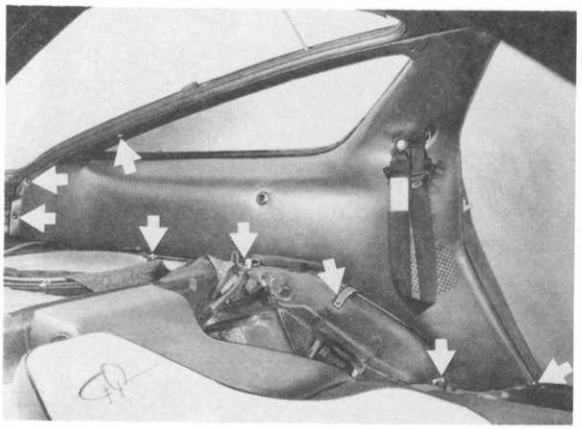
2. Remove seat belt on side member and seat well at outside (arrows).



3. Remove escutcheon for seat belt and grab handle (arrows).



4. Remove screws (arrows) and pry off trim panel at top with a suitable tool (clips) and pull forward slightly. Pull off radio speaker wires, slide seat belt through opening and remove trim panel.



5. Install in reverse order.

6. Make sure trim panel engages in proper holders in area of wheel house.

Safety regulations for handling airbag vehicles

The airbag units are pyrotechnical objects of danger class T 1. Handling, transport and storage are subject to the Law on Explosives.

The listed legal regulations apply to the Federal Republic of Germany. The respectively applicable regulations must be observed in all other countries.

The start of work with pyrotechnical objects must be reported to the trade board (responsible authority) 14 days previously.

Shipment

Shipment of airbag units must occur only in the transport packaging officially approved for this purpose. The airbag units must not be transported with other dangerous goods.

On company premises, transport must always occur in the trunk or cargo space of a vehicle using the above-mentioned transport packaging. Transport in the passenger compartment is prohibited.

Storage

Airbag units must be stored in accordance with the 2nd ordinance of the Law on Explosives. In accordance with this ordinance, small quantities of substances and objects can be stored in certain locations without special storage approval. In the case of pyrotechnical objects of the class T 1, these quantities are max. 20 kg (gross) in a working room and max. 200 kg (gross) in a storage room. The air bag units must be stored locked away.

When storing the airbag units, it must be ensured that the padded side faces upward (risk of injury as the result of the airbag unit being catapulted up in the event of accidental ignition).

The airbag units must not be stored with other dangerous goods (paints etc.).

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Installation and adjustment work

Inspection and installation work must be performed only by competent personnel.

The following safety measures must always be taken before starting work on the airbag system as well as for work on neighboring parts where there is a risk of live parts coming close to the airbag system:
1. Switch off ignition.
2. Disconnect and cover negative terminal of the battery.

Note

Disconnect ground cable directly at the battery negative terminal on vehicles fitted with a telephone. If the ground terminal is disconnected in the luggage compartment, ground contact may be established across the telephone, thus destroying the telephone.

After disconnecting the battery, installation work or work on the vehicle with a hammer or similar tools must be started only after a waiting period of 20 minutes. This is necessary to interrupt the power supply to the airbag system and to ensure that the system is not ignited unintentionally.

Installation of the airbag units must take place immediately afterremoval from the storage location. They must not be left unattended under any circumstances. In the event of interruptions in work, the airbag units must be locked away again immediately.

Airbag units must not come into contact with grease, oil, cleaning agents or similar.

Airbag units must not be exposed to temperatures over 90°C, even on a short-term basis.

Airbag units, front sensors and control units which have been dropped from a height of more than 0.5 m must no longer be installed.

No additional panels, stickers or similar must be attached to the steering wheel and in the area of the passenger airbag.

No changes must be made to the cabling and components of the airbag system.

The battery must always be disconnected before the start of adjustment and welding work with an electrical welding unit.

If welding is necessary in the direct proximity of the front sensors and the control unit, these must be removed previously.

Cables from electrical auxiliary equipments must not be laid close to the airbag cable bundle.

Airbag components must not be repaired. They must always be replaced.

Note

Wash your hands after touching tripped airbag units.

Disposal of airbag units

Non-ignited airbag units represent a danger, also to the environment. Non-ignited airbag units must not be scrapped. They should be neutralized by triggering them electrically (refer to page 68 - 15).

If the airbag units cannot be ignited, return them to Porsche or to the importer of your country, respectively, using the original transport container of the spare part and returning it via the same transport route.

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Disposal of airbag units

Airbag units that have not been ignited constitute a safety and environmental hazard. Never scrap airbag units that have not been ignited. Deactivate the units by igniting them electrically (refer to page 68 - 15).

If the airbag units cannot be ignited, return them to Porsche or to the respective importer using the original packaging material and the same mode of transport.

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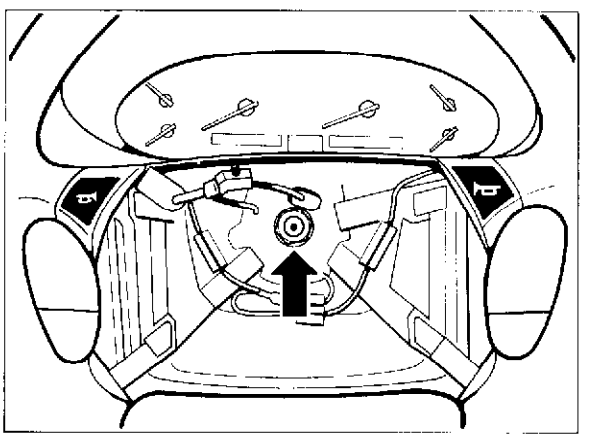
Removing and installing the airbag steering wheel

Removal

1. Disconnect the battery and cover the terminal or battery.

2. Remove the driver airbag unit (refer to Page 68 - 4).

3. Undo the hexagon nut and remove with the spring washer.



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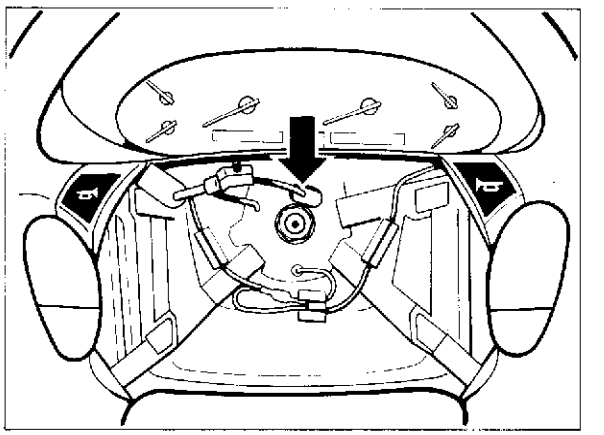
4. Mark the position of the steering wheel with respect to the steering shaft for re-installation.

Installation

1. Mount the steering wheel with the wheels in straight-ahead position or in accordance with the mark made during dismantling so that the upper steering wheel spokes are horizontal.

Note

The steering wheel must be fitted so that the cable of the contact unit is not trapped.



361-68

2. Fit the hexagon nut with spring washer and tighten with 45 Nm.

3. Install the driver airbag unit.

4. Check horn functioning.

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Removing and installing airbag components

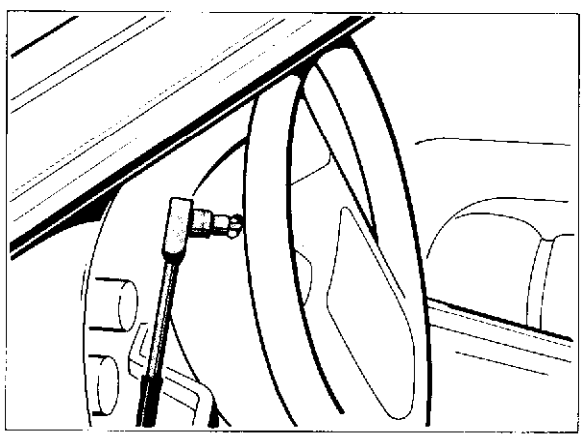
Removing and installing the drive airbag unit

1. Disconnect the battery and cover the terminal or battery.

2. Undo the fixing screws (2 each) with a screwdriver for internal Torx T 30.

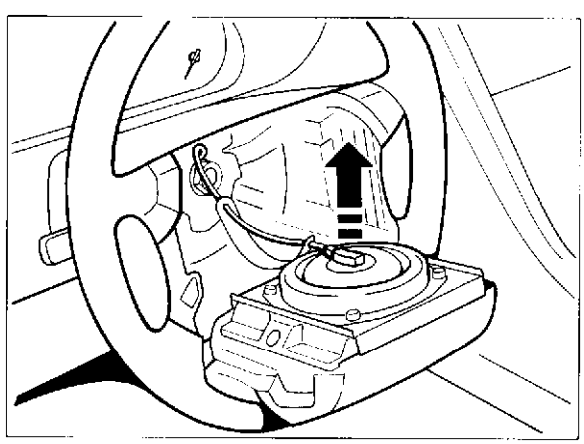
Note

The screws must be renewed after undoing. Only use screws with a collar.



362-68

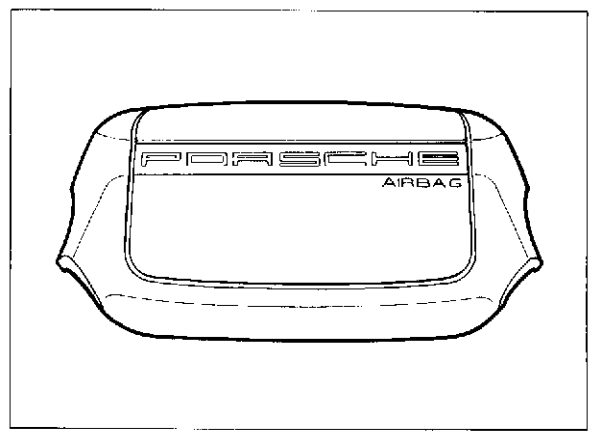
3. Disconnect the plug-in connection.



363-68

Note

The airbag unit must always be put down so that the padded side is facing upwards.



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In the case of removal for a long period of time, the airbag unit must be kept locked away. Observe the safety regulations.

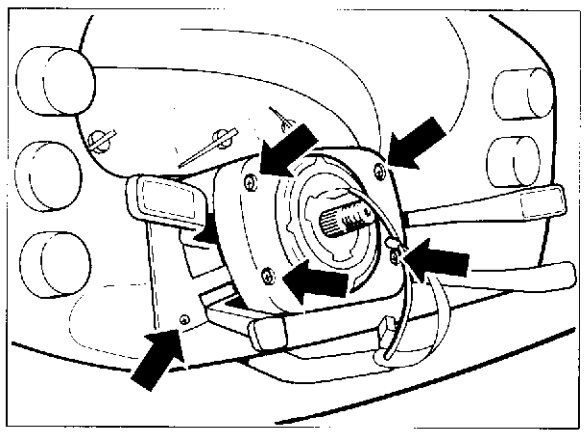
Tightening torque for fixing screws: 10 Nm

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Removing and installing the contact unit

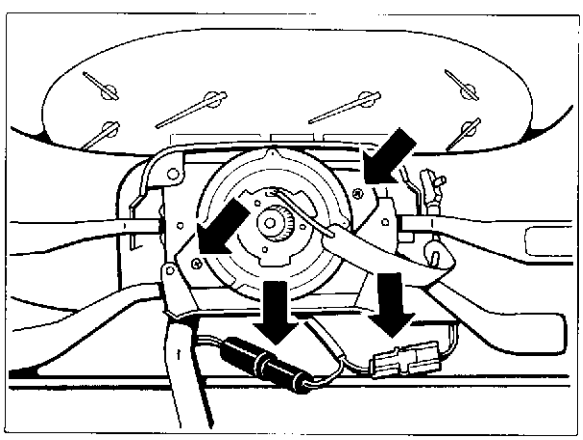
1. Remove the airbag steering wheel (refer to P. 68 - 3).

2. Undo and remove the paneling.



364-68

3. Disconnect the plug-in connections.



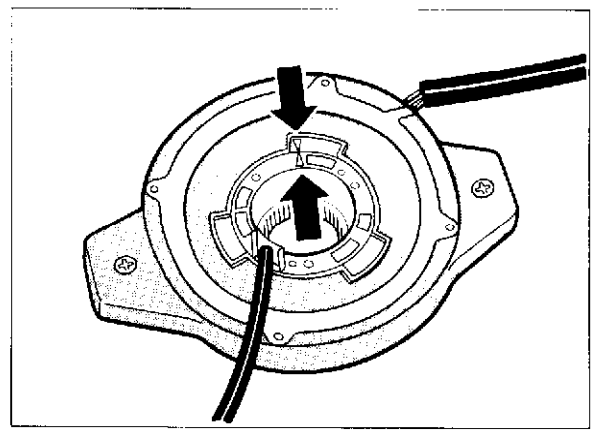
365-68

4. Undo the fixing screws.

5. Remove the contact units

Note

Before installing the contact unit, adjust the front wheels to straight-ahead position and adjust the contact unit to center position (approx. 4 1/2 turns from the left or right limit). The exact center position is indicated by the two arrows.



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A new contact unit is locked in center position. The locking facility is removed only after installation of the contact unit.

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Removing and installing the front sensors

Note

The front sensors are located on the left and right in the driver and passenger footwells on the top of the wheel house wall.

The installation position is defined by the mounting:

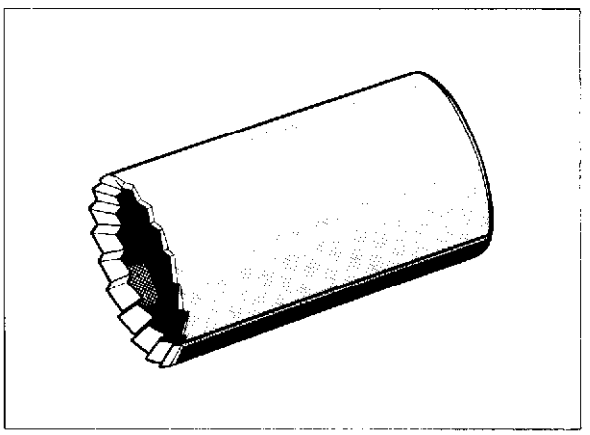
Front sensor, left

1. Disconnect the battery and cover the terminal or battery.

2. Remove the tire pressure warning system (RdK), mirror and ABS control units.

3. Disconnect the plug-in connection. The plug-in connection is located on the reinforcement of the front car strut.

4. Undo the tear-off nut with special tool 9259.



Special tool 9259 281-68

5. Undo the hexagon nut with the socket insert.

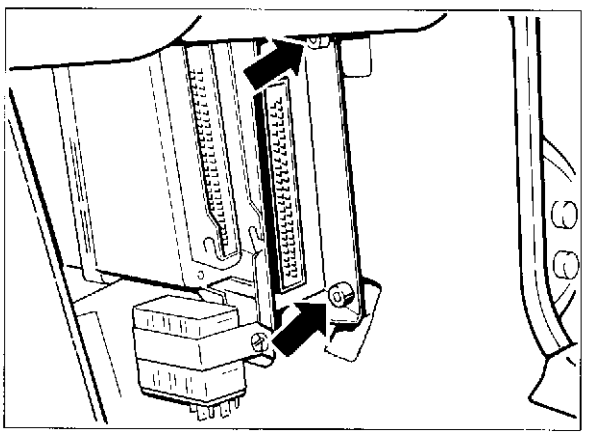
Front sensor, right

1. Disconnect the battery and cover the terminal or battery.

2. Remove the control unit cover.

3. Disconnect the plug-in connections at the LH and EZK control units, ignition circuit monitoring relay and at the coding connector.

4. Undo the fixing screws of the control unit holding plate and remove the holding plate with control units.



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5. Remove the cover on the right next to the glove compartment.

6. Disconnect the plug-in connection. The plug-in connection is located nex to the lamp monitoring device.

7. Undo the tear-off nut with special tool 9259.

8. Undo the hexagon nut with the socket insert

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Note

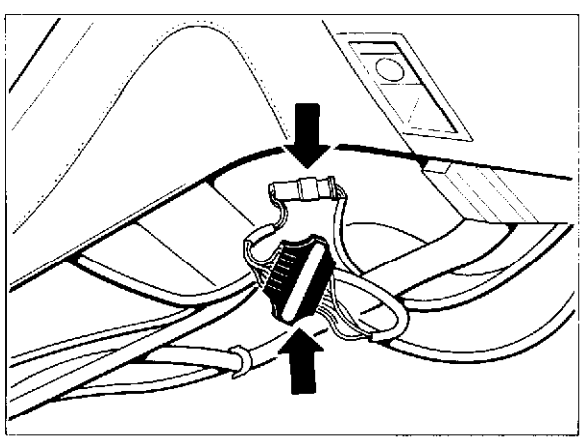
To tighten the tear-off nuts, use hexagon socket 1/4 inch.
The fixing point on the bodywork must be metallically bright. The tear-off nuts are fitted without washers, while the hexagon nuts are fitted with washers.

Removing and installing the control unit

Note

The control unit is located on the tunnel below the center console.

1. Disconnect the battery and cover the terminal or battery.
2. Remove the side paneling of the center console on the left and right.
3. Remove the kick protection.
4. Disconnect the plug-in connections at the left front sensor, contact unit, right front sensor, right front sensor, passenger airbag unit and the 2-fold and 6-fold plug-in connections to the main cable bundle.

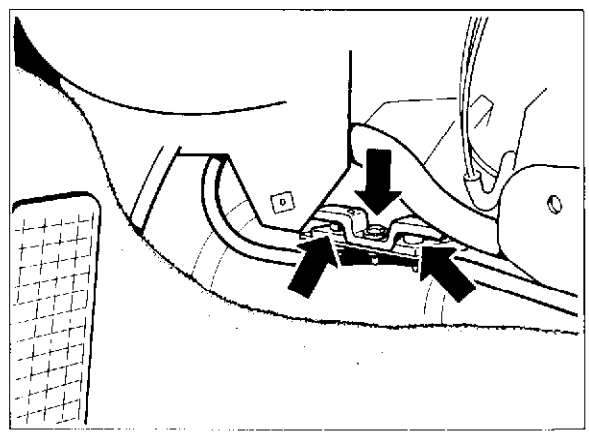


2-fold and 6-fold plug-in connections under the right side paneling 367-68

Note

The 6-fold plug-in connection is secured by a red clip which is destroyed by dismantling.
The plug-in connection must be secured with a green clip during assembly.

5. Undo the cable ties along the cable bundle.
6. Undo the cover on the fixing screws.



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7. Undo the tear-off screws with special tool 9259.
8. Undo the hexagon screws with a socket insert.

Note

Install the tear-off screws diagonally.
The fixing points on the bodywork must be metallically bright.
Use a hexagon socket 1/4 inch to tighten the tear-off screws. The tear-off screws are installed without washers, while the hexagon screws are installed with washers.

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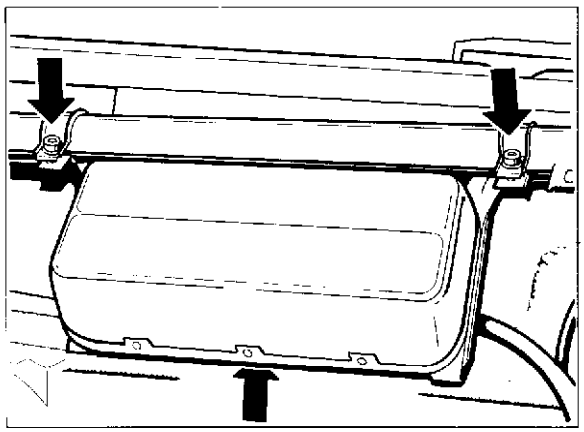
Removing and installing the passenger airbag unit

1. Disconnect the battery and cover the terminal or battery.

2. Remove the instrument panel.

3. Disconnect the plug-in connections at the unit.

4. Undo the fixing screws.



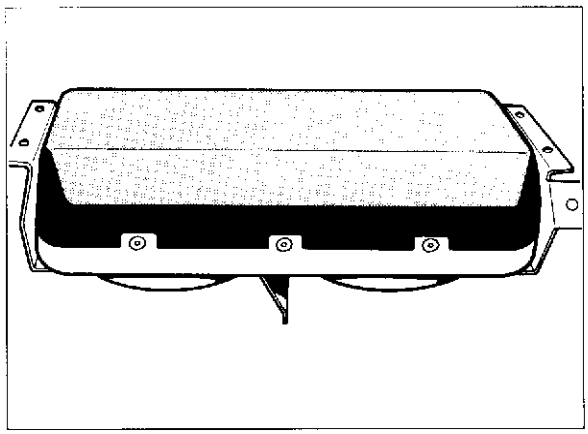
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Note

The fixing screws are micro-encapsulated.
Use new screws for installation.

Tightening torque: 10 Nm

The airbag unit must always be put down so that the airbag is facing up.



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Checking operational readiness of airbag system

1. Check correct operation of the airbag warning light. Switch on the ignition. The airbag warning light must come of for approx. 5 seconds. If it does not come on, check the bulb and the power supply.

2. With the ignition switched on, pull out the fuse for the power supply to the instrument cluster for about 30 seconds. The airbag warning light should now indicate a fault. Obtain a readout of the fault and check whether fault code 58 (warning light: short circuit to U_B or ground, no fault present) is shown.

Note

In addition to the airbag warning light, the central warning light and the **seat belt symbol** (for U.S. vehicles only) should also come on if a fault has been stored in the fault memory.

3. Erase the fault memory.

4. Check that no trim, adhesive labels or similar items have been applied to the steering wheel or in the passenger's airbag area.

5. System checking must be confirmed by stamping the appropriate spaces in the Warranty and Maintenance Booklet.

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Checking the readiness for operation of the airbag system

As of software level B 01

1. **Functional check of the airbag warning light.** Switch on ignition. The airbag warning lamp must light up for approx. 5 seconds*. If the warning lamp does not light up, the bulb or the power supply should be checked.

2. **Functional check of the fault memory.** Pull off fuse for instrument cluster power supply for approx. 30 seconds with the ignition switched on. The airbag warning must now display a fault. Read out fault and check if fault code 30 (Airbag warning light, signal unplausible, fault not present) is displayed.

Note

Along with the airbag warning lamp, the central warning lamp must light up as well if a fault has been stored in the fault memory.

3. Erase fault memory.

4. Check to make sure that no trim, decals or other items are attached in the passenger airbag area.

5. Visually check components for damage or modifications.

6. The system check should be confirmed in the stamp fields provided for this purpose in the Warranty and Maintenance booklet.

* Reduced to approx. 2.5 seconds as of production date June 12, 1992.

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Checking the safety belts

Functional test

It must be possible to unroll the belt without jerks from the automatic retractor by uniformly pulling it over the guide fitting. The plug-in tongue of the safety belt must engage audibly in the belt lock. The automatic retractor must lock when the belt is tugged abruptly.

Inspection of condition

The visual inspection must not reveal any damage or wear on the belt. If the belt shows signs of damage in the form cuts, fraying, seam tears, worn places etc., the safety belt must be replaced.

Additional inspection for safety belts with overload indicator (color marking – Airbag equipment

In addition to the functional test and inspection of the condition of the safety belts, the color marking made above the holder fitting on the belt in the form of a white bar must not be visible outside the belt protector. This color marking acts as an overload indicator whose emergence from the belt protector indicates overloading and the necessity to replace the safety belt.

1 = Mounting point for holder fitting

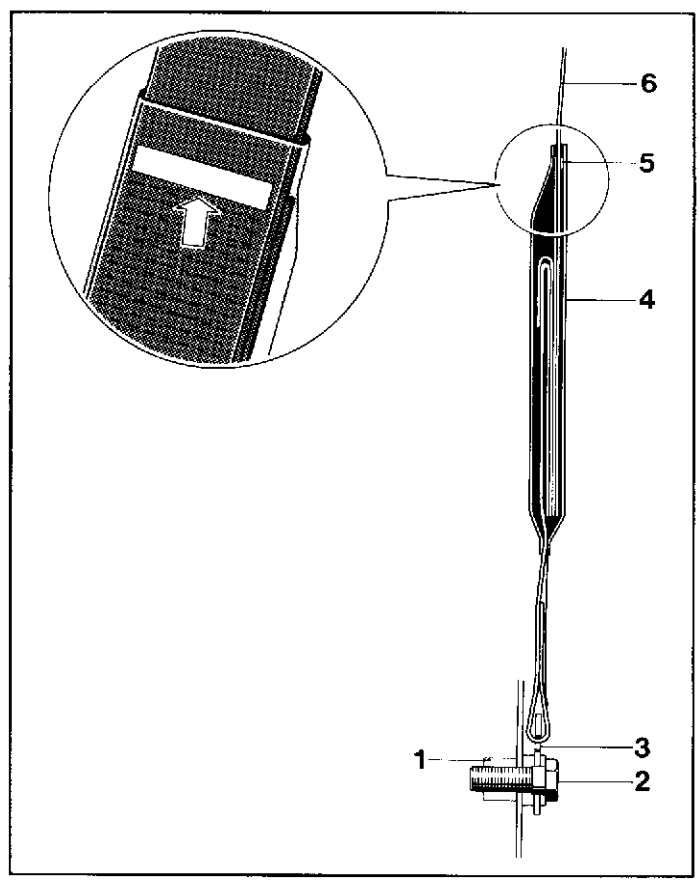
2 = Fixing screw

3 = Holder fitting

4 = Belt protector

5 = Indicator (color mark)

6 = Belt



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Correct disposal of airbag units

Airbag units are pyrotechnic objects and can represent an environmental hazard on account of their character as explosion-risk bodies and because of the materials they contain. For this reason, airbag units which have not yet been ignited, or complete vehicles containing such units must not be treated as "normal" waste or disposed of on any other final refuse dumps.
To avoid possible misues, the airbag units must first be rendered harmless by electrical ignition, making sure that all the relevant precautions are complied with
In the case of airbag units incapable of igniting or if ignition cannot be carried out in safety, the airbag units must in all cases be returned to Porsche or to the relevant importer in their original spare part packs and by the usual transport channels.

Note

Any specific local or national regulations or legal verdicts which go beyond these instructions must be complied and given preference over these instructions.

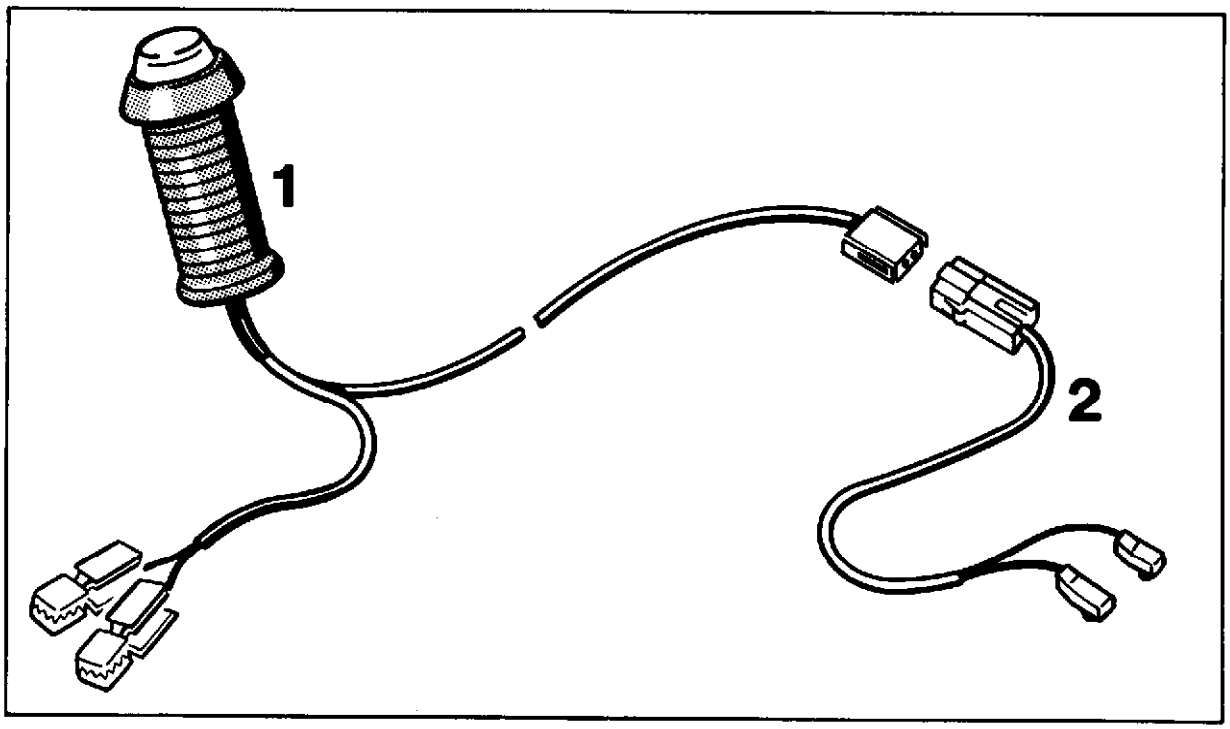
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Safety measures

- Ignition and preparation should only be carried out by properky qualified personnel under the supervision of a second, responsible person.
- All other generally applicable accident prevention regulations must be complied with.
- Only ignite airbag units which are in original condition and properly installed.
- Ignite airbag units only in suitable open spaces.
- Use only the ignition equipment specifically intended for the purpose.
- First remove all loose objects from the airbag expansion area.
- Anyone likely to be affected should be warned about the noise in advance.
- Use the whole length of the ignition device's cable in order to maintain a safe distance from the airbag unit which is to be ignited.
- Do not connect the ignition device to the power source until everything else is ready.
- Position yourself and anyone else involved in front of the vehicle.
- Ignite the airbag unir with the vehicle's doors closed but the tailgate/trunk lid or side windows open.
- If ignition fails to occur, do not approach the vehicle until approx. 3 minutes have elapsed.
- Allow airbag units to cool down after ignition and observe them carefully.
- Avoid skin contact with airbag units which have been ignited.

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Tools

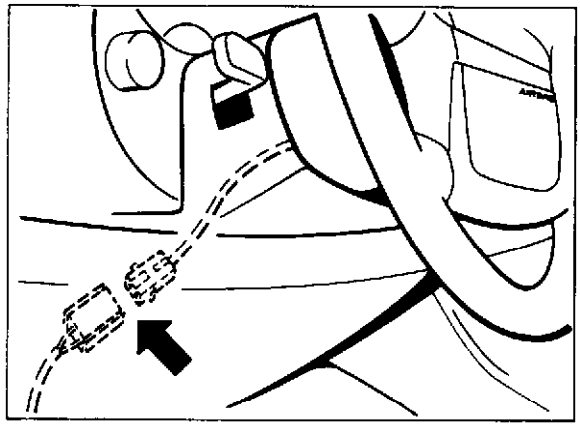


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No.	Designation	Special Tool	Order number	Explanation
1	Ignition device	—	000.721.925.70	
2	Ignition cable	—	000.721.925.71	Non-reusable part

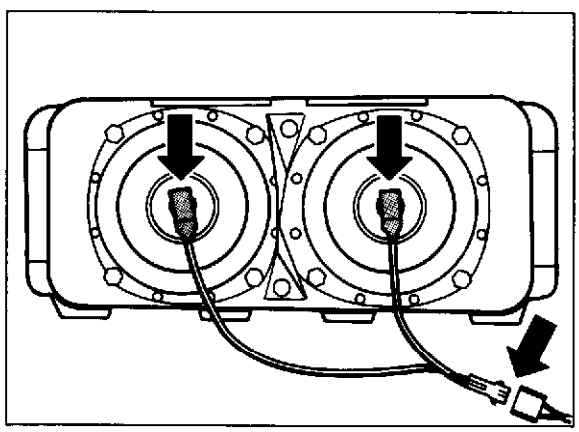
Connecting the ignition device

Driver's side



Direct to 2-pin plug of contact unit (below steering column).

Passenger's side

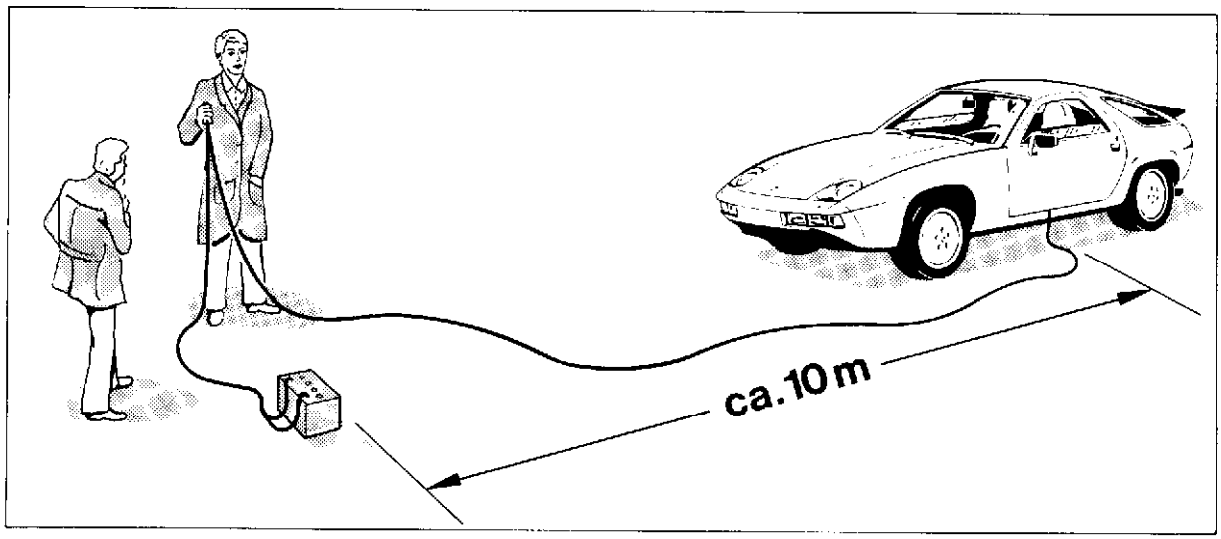


With ignition cable to both gas generators.

Run the ignition device out through the door gap to a point in front of the vehicle.

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Ignition



Connect the ignition device to a car battery and operate the switch.

Note

The driver's side and passenger's side airbag units must be ignited separately.

After igniting the passenger's side airbag unit, check that both gas generators have ignited (can be identified by both ignition cable plugs having melted).

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Diagnosis / Troubleshooting

The airbag system is continuously monitored by a diagnosis unit in the control unit. If a fault occurs, it is indicated by a warning lamp in the instrument cluster.

In the event of a fault, the central warning lamp and this warning lamp come on. In cars for the USA, the fasten seat belts symbol also lights up.

The airbag warning lamp comes on for approx. 5 seconds when the ignition is switched on, and then goes out. When the engine is started, the warning lamp again comes on for approx. 5 seconds.

Should the warning lamp come on again later, this indicates a fault in the airbag system. The fault can be read out with System Tester 9288 and flashing code tester 9268.

Note:

The control unit needs approx. 70 seconds to identify all faults in the system, and the ignition must therefore be switched on for at least this time.

After a fault in the airbag system has been identified and rectified, **the fault memory must be erased.**

If any components are exchanged, this must be noted in the warranty and maintenance booklet. The document number should be attached in the free space provided. The document number is shown on an adhesive label which can be torn off the spare part.

Following an accident in which the airbag system was activated, the following components must be removed and renewed:

– control unit

– both front sensors

– contact unit

– both airbag units

If non-activated airbag units have to be removed, they must be ignited electrically before being disposed of (see Page 68 - 15).

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Reading out the fault memory

System Tester 9288: see Repair Manual Group 03, Self-diagnosis
Tester 9268: see Technical Service Information, Model '90.

Meaning of fault codes

1st figure:	3 = Airbag system
2nd figure:	1 = Fault still present
	2 = Fault no longer present
	3 = Failure time since first fault occurrence
3rd figure:	= Fault code
4th figure:	

Before troubleshooting can be carried out correctly, the person concerned must

- be familiar with the component positions and the function and technical relationship of the systems to be checked (model information)
- be able to read and evaluate Porsche circuit diagrams
- understand the function of the electrical circuits and relays
- be capable of operating and assessing the information supplied by the test gear.

Important:

If the tester display or the fault list indicates that a component is defective, the fault may not necessarily be found in the component indicated but may be in the associated control unit or the connecting circuits (electrical paths) between the component and the control unit. Before the fault memory has been read out, no troubleshooting involving the pulling off of plugs or similar is to be carried out, as this could also be stored as a fault in the memory.

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Note

The fault code can show two types of fault:

– Fault still present

– Fault no longer present

Faults are stored as no longer present if they occur briefly while the ignition is switched on, but are no longer present when the ignition is switched off.

Faults still present are those which are permanent or remain present when the ignition is switched off.

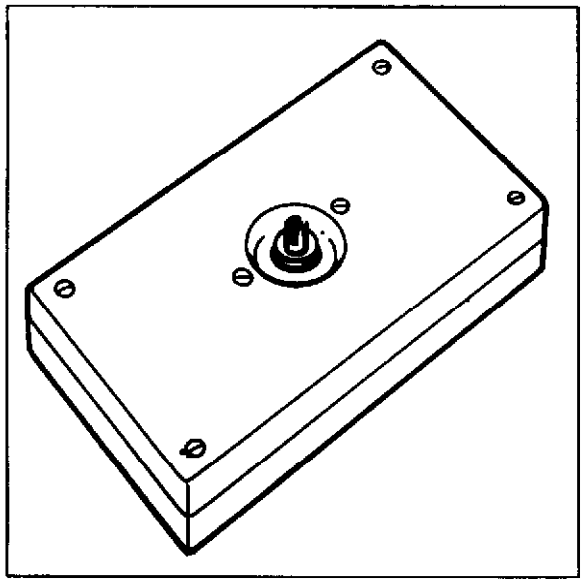
Do not assume that the fault in the readout is actually present or clearly identifiable during the check.

The cause of a fault being memorized may for example be undesirable interference with the airbag system wiring while the ignition was switched on.

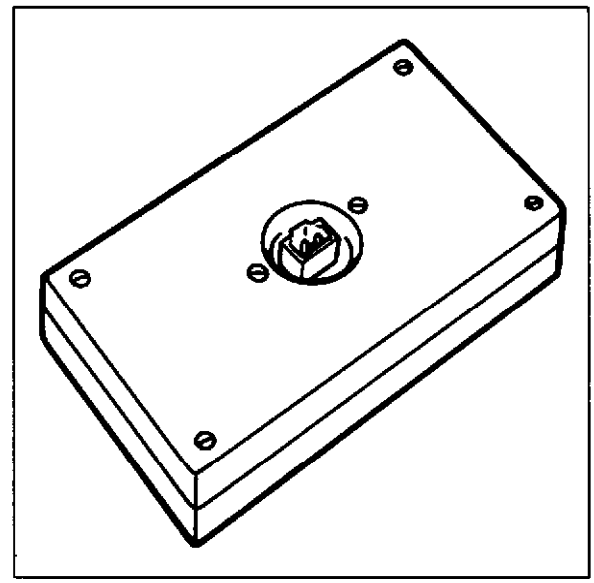
It is therefore important in the case of faults no longer present to determine the cause of the fault in order to prevent it from recurring and to avoid renewing parts unnecessarily. Check the entire length of the airbag system wiring for damage (wires no longer intact or trapped).

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Tools



560-68



561-68

Special tools 9516 and 9516/1 are used to check the ignition pill circuits.

If there is a fault in the ignition pill circuits, attach special tool 9516 in place of the airbag units, then erase the fault memory. Switch the ignition off and on again.

The fault can then be localized by means of the diagnosis unit in the control unit.

If the warning light no longer indicates a fault, the airbag unit is defective and must be renewed.

If the warning light again indicates a fault, this is to be sought in the control unit or the wiring.

A fault in ignition pill circuit 1 may also be caused by the contact unit. Disconnect the wiring from the contact unit and attach special tool 9516/1 in place of the contact unit. Erase the fault memory. Switch the ignition off and then on again. If the warning light no longer indicates a fault, the contact unit is defective; if the warning light again indicates a fault, this must be in the control unit or the wiring.

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Fault code table

Fault code	Designation of fault
11	Left front sensor: closed once
12	Left front sensor: closed several times
13	Right front sensor: closed once
14	Right front sensor: closed several times
15	Left front sensor: permanently closed*
16	Right front sensor: permanently closed
17	Left front sensor: contact resistance to U_B
18	Right front sensor: contact resistance to U_B
19	Left front sensor: contact resistance to earth/ground
20	Right front sensor: contact resistance to earth/ground
21	Left front sensor: short circuit to U_B
22	Right front sensor: short circuit to U_B
25	Left front sensor: resistance to earth/ground too high
26	Right front sensor: resistance to earth/ground too high
27	Left front sensor: break in feed wire**
28	Right front sensor: break in feed wire**
29	Left front sensor: line resistance too high
30	Right front sensor: line resistance too high
33	Ignition capacitor 1: capacitance too low
34	Ignition capacitor 2: capacitance too low
35	Ignition capacitor 1: contact resistance too high
36	Ignition capacitor 2: contact resistance too high
37	Ignition pill circuit 1: contact resistance to U_B
38	Ignition pill circuit 2: contact resistance to U_B

* Fault code 60 is also shown with fault codes 15 and 16. Renew front sensor and erase fault memory. Repeat the diagnosis. If fault code 60 appears again, renew the control unit.

** Fault code 25 or 26 also appears with fault code 27 or 28 respectively.

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Fault code	Designation of fault
39	Ignition pill circuit 3: contact resistance to U_B
40	Ignition pill circuit 1: short-circuit to U_B
41	Ignition pill circuit 2: short-circuit to U_B
42	Ignition pill circuit 3: short-circuit to U_B
43	Ignition pill circuit 1: contact resistance to earth/ground
44	Ignition pill circuit 2: contact resistance to earth/ground
45	Ignition pill circuit 3: contact resistance to earth/ground
46	Ignition pill circuit 1: short-circuit to earth/ground
47	Ignition pill circuit 2: short-circuit to earth/ground
48	Ignition pill circuit 3: short-circuit to earth/ground
49	Ignition pill circuit 1: break
50	Ignition pill circuit 2: break
51	Ignition pill circuit 3: break
52	Ignition pill circuit 1: resistance too low
53	Ignition pill circuit 2: resistance too low
54	Ignition pill circuit 3: resistance too low
55	Ignition pill circuit 1: resistance too high
56	Ignition pill circuit 2: resistance too high
57	Ignition pill circuit 3: resistance too high
58	Warning lamp: short-circuit to U_B or earth/ground
59	Warning lamp: break
60	Diagnosis unit: defective
61	Correct ignition sequence (after crash)
62	Correct ignition current (after crash)
65	Ignition pill current transmitted (after crash)
67 bis 105	Internal fault*

Ignition pill circuit 1: driver's airbag
Ignition pill circuit 2 and 3: passenger's airbag

* When the airbag system is checked with the 9268 tester, fault code 60 is always indicated in the event of an internal fault.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Note

After any airbag system fault has been detected and rectified, the fault memory **must** be erased.

Test point 1

Left front sensor
closed once
Fault code 3 _ 11

– Renew front sensor.

Test point 2

Left front sensor
closed several times
Fault code 3 _ 12

– Renew front sensor.

Test point 3

Right front sensor
closed once
Fault code 3 _ 13

– Renew front sensor.

Test point 4

Right front sensor
closed several times
Fault code 3 _ 14

– Renew front sensor.

Test point 5

Left front sensor
closed permanently
Fault code 3 _ 15

– Renew front sensor.

Test point 6

Right front sensor
closed permanently
Fault code 3 _ 16

– Renew front sensor.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 7

Left front sensor
Contact resistance
to U_B
Fault code 3 _ 17

– Check front sensor at plug connection with ohmmeter.
1. Ohmmeter at terminal 1 and terminal 2
   Display: 10 kΩ

2. Ohmmeter at terminal 2 and terminal 3
   Display: 0...0.5 Ω
   If measured values are within tolerance, renew the control unit; if out of tolerance, renew the front sensor.

Test point 8

Right front sensor
Contact resistance
to U_B
Fault code 3 _ 18

– See test point 7

Test point 9

Left front sensor
Contact resistance
against earth/ground
Fault code 3 _ 19

– See test point 7

Test point 10

Right front sensor
Contact resistance
against earth/ground
Fault code 3 _ 20

– See test point 7

Test point 11

Left front sensor
Short-circuit to U_B
Fault code 3 _ 21

– See test point 7

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Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 12 Right front sensor Short-circuit to U_B Fault code 3 _ 22	– See test point 7
Test point 13 Left front sensor Earth/ground resistance too high Fault code 3 _ 25	– Check front sensor: plug contacts and plug connection must engage correctly. – Check front sensor with ohmmeter; see test point 7 – Check mounting points; the metal must be bright for good electrical contact.
Test point 14 Right front sensor Earth/ground resistance too high Fault code 3 _ 26	– see test point 13
Test point 15 Left front sensor Break in feed line Fault code 3 _ 27	– Check front sensor plug connection: plug contacts and plug connection must engage correctly. – Check front sensor mit ohmmeter (see test point 7). If no fault is detected at front sensor, renew the control unit.
Test point 16 Right front sensor Break in feed line Fault code 3 _ 28	– see test point 15
Test point 17 Left front sensor Line resistance too high Fault code 3 _ 29	– Check front sensor mit ohmmeter (see test point 7). If no fault is detected at the front sensor, renew the control unit.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 18 Right front sensor Line resistance too high Fault code 3 _ 30	– See test point 17
Test point 19 Ignition condenser 1 Capacitance too low Fault code 3 _ 33	– Renew the control unit.
Test point 20 Ignition condenser 2 Capacitance too low Fault code 3 _ 34	– Renew the control unit.
Test point 21 Ignition condenser 1 Contact resistance too high Fault code 3 _ 35	– Renew the control unit.
Test point 22 Ignition condenser 2 Contact resistance too high Fault code 3 _ 36	– Renew the control unit.

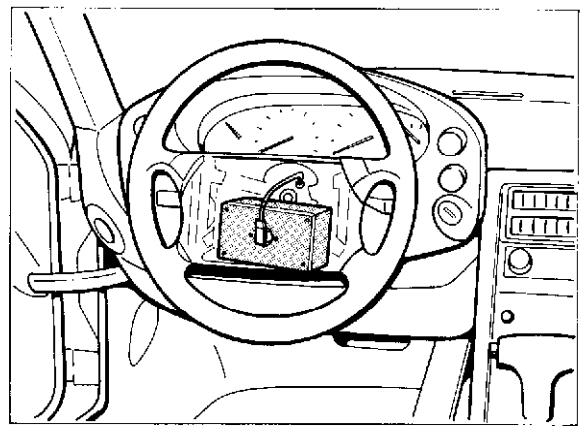
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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 23

Ignition pill circuit 1
Contact resistance
to U_B
Fault code 3 _ 37

1. Remove driver's airbag unit.
2. Attach special tool 9516 in place of the airbag unit.

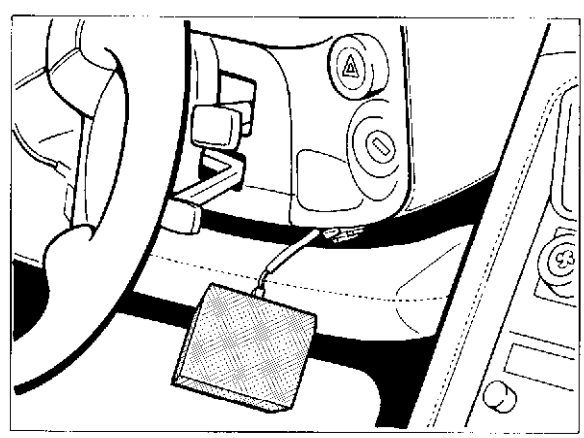


3. Erase the fault memory.

4. Check whether fault is still present.

a) If fault is no longer present, renew the airbag unit.

b) If fault is still present, separate connections at contact unit and attach special tool 9516/1.



5. Erase the fault memory.

6. Check whether fault is still present.

a) If the fault is no longer present, renew the contact unit.

b) If the fault is still present, renew the control unit.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
	Note Ignition pill circuit 2 is the left of the two passenger-side airbag circuits, ignition pill circuit 3 the right circuit.
Test point 24 Ignition pill circuit 2 Contact resistance to U_B Fault code 3 _ 38	1. Pull off plug at passenger-side airbag unit. 2. Attach special tool 9516. 3. Erase the fault memory. 4. Check whether fault is still present. a) If fault is no longer present, renew passenger-side airbag. b) If fault is still present, renew the control unit.
Test point 25 Ignition pill circuit 3 Contact resistance to U_B Fault code 3 _ 39	– see test point 24
Test point 26 Ignition pill circuit 1 Short-circuit to U_B Fault code 3 _ 40	– see test point 23
Test point 27 Ignition pill circuit 2 Short-circuit to U_B Fault code 3 _ 41	– see test point 24
Test point 28 Ignition pill circuit 3 Short-circuit to U_B Fault code 3 _ 42	– see test point 24

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Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 29 Ignition pill circuit 1 Contact resistance to earth/ground Fault code 3 _ 43	– see test point 23
Test point 30 Ignition pill circuit 2 Contact resistance to earth/ground Fault code 3 _ 44	– see test point 24
Test point 31 Ignition pill circuit 3 Contact resistance to earth/ground Fault code 3 _ 45	– see test point 24
Test point 32 Ignition pill circuit 1 Short-circuit to earth/ground Fault code 3 _ 46	– see test point 23
Test point 33 Ignition pill circuit 2 Short-circuit to earth/ground Fault code 3 _ 47	– see test point 24
Test point 34 Ignition pill circuit 3 Short-circuit to earth/ground Fault code 3 _ 48	– see test point 24

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 35

Ignition pill circuit 1
Break
Fault code 3 _ 49

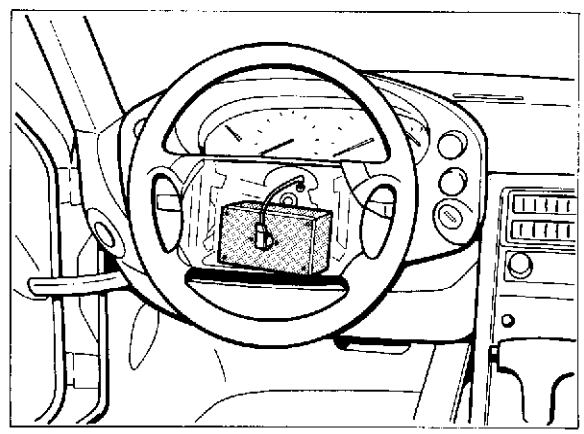
– Check that plug connection to airbag unit is correctly engaged.

– Check that plug connection to contact unit is correctly engaged.

If no fault is detected:

1. Remove driver's airbag unit.

2. Attach special tool 9516 in place of the airbag unit.

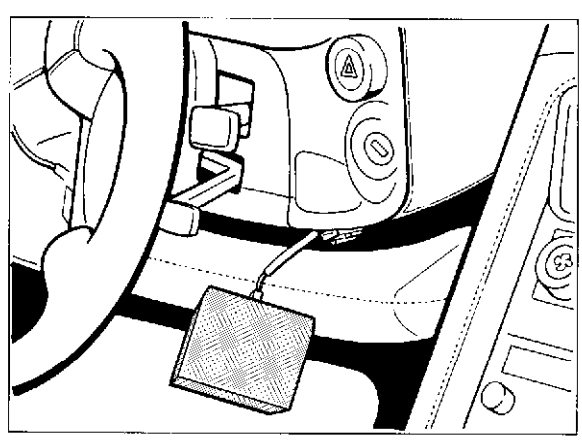


3. Erase the fault memory.

4. Check whether the fault is still present.

a) If the fault is no longer present, renew the airbag unit.

b) If the fault is still present, separate the plug connection to the contact unit and attach special tool 9516/1.



5. Erase the fault memory.

Fault, Fault Code	Possible Causes, Elimination, Remarks
	6. Check whether fault is still present. a) If the fault is no longer present, renew the control unit. b) If the fault is still present, renew the control unit.
Test point 36 Ignition pill circuit 2 Break Fault code 3 _ 50	– Check that the plug connection to the airbag unit is correctly engaged. If no fault is detected: 1. Pull off plug at passenger-side airbag unit. 2. Attach special tool 9516. 3. Erase the fault memory. 4. Check whether fault is still present. a) If the fault is no longer present, renew the passenger-side airbag unit. b) If the fault is still present, renew the control unit.
Test point 37 Ignition pill circuit 3 Break Fault code 3 _ 51	– see test point 36
Test point 38 Ignition pill circuit 1 Resistance too low Fault code 3 _ 52	– see test point 23
Test point 39 Ignition pill circuit 2 Resistance too low Fault code 3 _ 53	– see test point 24

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Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 40	
Ignition pill circuit 3 Resistance too low Fault code 3 _ 54	– see test point 24
Test point 41	
Ignition pill circuit 1 Resistance too high Fault code 3 _ 55	– see test point 23
Test point 42	
Ignition pill circuit 2 Resistance too high Fault code 3 _ 56	– see test point 24
Test point 43	
Ignition pill circuit 3 Resistance too high Fault code 3 _ 57	– see test point 24
Test point 44	
Warning lamp: short-circuit to U_B or earth/ground Fault code 3 _ 58	– Check wiring for damage. – Check instrument cluster.
Test point 45	
Break in circuit at warning lamp Fault code 3 _ 59	– Check power supply fuse for instrument cluster – Check warning lamp and renew if necessary. – Check wiring for damage.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 46

Defective diagnosis unit
Fault code 3 _ 60

– Renew the control unit

Test point 47

Ignition sequence correct (after crash)
Fault code 3_61

– All airbag components must be renewed after the airbag has been activated.

Test point 48

Ignition current correct (after crash)
Fault code 3 _ 62

– see test point 47

Test point 49

Ignition pill current has flowed (after crash)
Fault code 3 _ 65

– see test point 47

Test point 50

Control unit defective
Fault code 3 _ 67

– Renew the control unit

Note on test point 50

With the 9288 System Tester, a fault code can be displayed in the range from 67 to 105.
On the 9268 Tester, code 60 is always displayed if the fault is in the range from 67 to 105.

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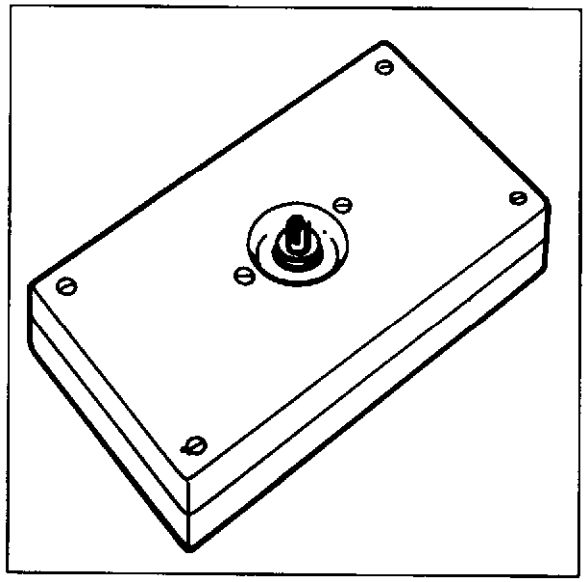
Diagnosis / Troubleshooting Airbag

As of software level B 01

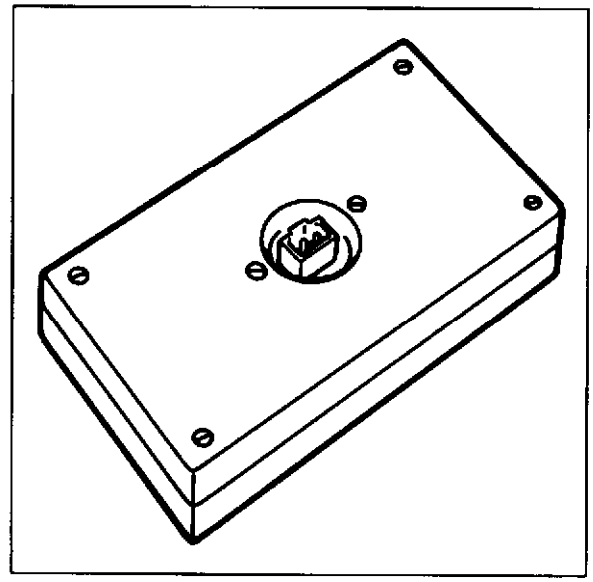
As of software level B 01, the waiting time for service operations is reduced from 20 minutes to 5 minutes (also refer to page 68 - 4).
As of manufacturing date June 12, 1992, the switch-on time of the airbag warning light is reduced from approx. 5 seconds to approx. 2.5 seconds.

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Tools



Special Tool 9516 580-68



Special Tool 9516/1 561-68

Special Tools 9516 and 9516/1 are used to check the ignition pill circuits.

If there is a fault in the ignition pill circuits, attach Special Tool 9516 in place of the airbag units, then erase the fault memory. Switch the ignition off and on again.

The fault can then be identified by means of the diagnosis unit in the airbag control unit.

If the warning light no longer indicates a fault, the airbag unit is defective and must be replaced.

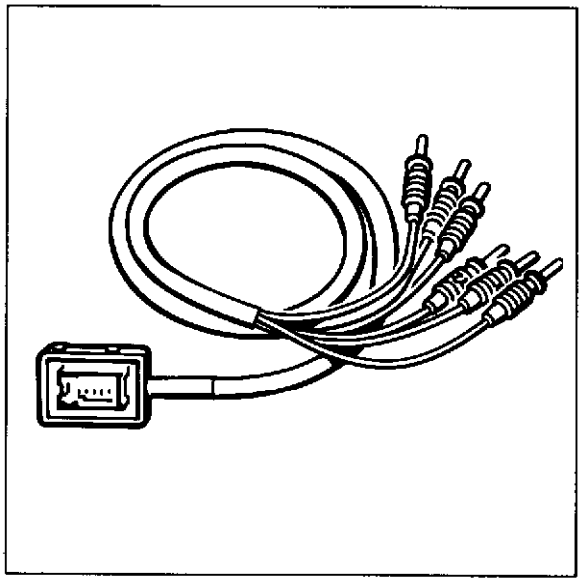
If the warning light again indicates a fault, the control unit or the wiring are at fault.

A fault in ignition pill circuit 1 may also be caused by the contact unit. Disconnect the wiring harness from the contact unit and attach Special Tool 9516/1 in place of the contact unit. Erase the fault memory. Switch the ignition off and then on again. If the warning light no longer indicates a fault, the contact unit is defective; if the warning light again indicates a fault, the control unit or the wiring are at fault.

Note

For safety reasons, never drive the vehicle with the special tools installed in place of the airbag units.

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Special Tool 9541 1074-68

Special Tool 9541 is used to check the wiring of the airbag system. It is attached in place of the control unit. For safety reasons, the wiring to the ignition pills cannot be checked with this tool.

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1. Fault memory

Fault code table

Fault code	Designation of fault	
10	Ignition circuits	– closed once
		– closed several times
		– permanently closed
		– contact resistance to U_B
		– contact resistance to ground
		– coupled 1/3 or 2/3
11	Left front sensor	– resistance too high
12	Right front sensor	– resistance too high
21	Ignition pill circuit 1	– resistance too high / too low
22	Ignition pill circuit 2	– resistance too high / too low
23	Ignition pill circuit 3	– resistance too high / too low
30	Warning light airbag	– Signal implausible
31		– Control unit defective
40 to 47		– Control unit defective
50 to 54		– Control unit defective
60 to 62		– Control unit defective
70	Crash entry	– only if airbag has been triggered

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Note

After an airbag system fault has been detected and rectified, the fault memory **must** be erased.

Test point 1

Ignition circuits
closed once
Fault code 10

- Replace both front impact sensors.
- Check wiring harness for squeezed sections or chafing and replace if required.

Test point 2

Ignition circuits
closed several times
Fault code 10

- Refer to test point 1.

Test point 3

Ignition circuits
closed permanently
Fault code 10

- Refer to test point 1.

Test point 4

Ignition circuits
Contact resistance
to U_B
Fault code 10

- Check wiring harness to front impact sensors and ignition pills for squeezed sections and chafing. Replace if required.
- Using Special Tool 9541, check wiring to front impact sensors for short to positive terminal, replace if required.
- Check front impact sensors for short to positive terminal.
- If no fault can be detected at the front impact sensors and at the wiring, the control unit must be replaced.

Test point 5

Ignition circuits
Contact resistance
to ground
Fault code 10

- Check wiring harness to front impact sensors and ignition pills for squeezed sections and chafing. Replace if required.
- Using Special Tool 9541, check wiring harness to front impact sensors for short to ground.
- Check front impact sensors for short to ground.
- If no fault can be detected at the front impact sensors and at the wiring harness, replace the control unit.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 6 **Ignition circuits** Coupled 1/3 or 2/3 Fault code 10	– Check wiring harness and ignition pills for squeezed sections and chafing. Replace if required. – If no fault can be detected, replace control unit.
Test point 7 **Left front sensor** Resistance too high Fault code 11	– Using an ohmmeter, check front impact sensor at connector. 1. Ohmmeter to terminals 1 and 2 Display: 10 kΩ 2. Ohmmeter to terminals 2 and 3 Display: 0...0.5 Ω – Check control unit wiring to front impact sensor connector with Special Tool 9541 and ohmmeter Display: 0...0.5 Ω – If no fault is detected at the front impact sensor and at the wiring, replace control unit.
Test point 8 **Right front sensor** Resistance too high Fault code 12	– refer to test point 7.

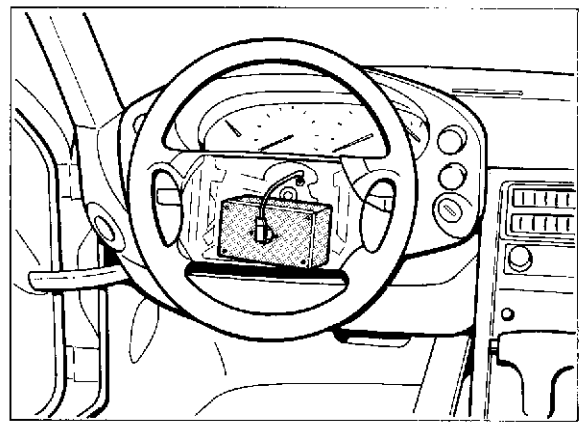
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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test point 9

Ignition pill circuit 1
Resistance too high / too low
Fault code 21

1. Remove driver airbag – unit.
2. Attach Special Tool 9516 in place of airbag unit.

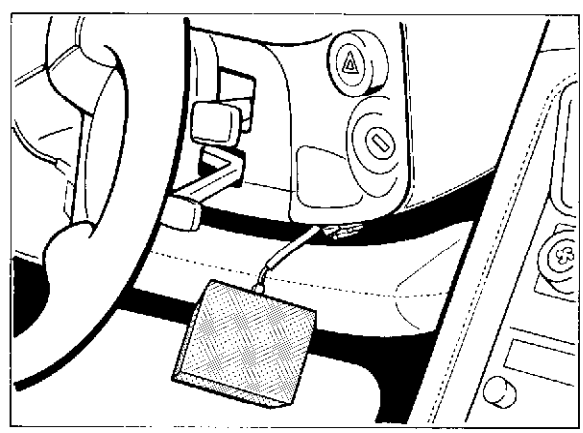


567-68

3. Erase fault memory.
4. Check if fault is still present.

   a) Replace airbag unit if the fault is no longer present.

   b) If the fault is still present, disconnect the contact unit wiring and attach Special Tool 9516/1.



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5. Erase fault memory.
6. Check if fault is still present.

   a) Replace contact unit if the fault is no longer displayed.

   b) If the fault is still present, check wiring harness for squeezed sections and chafing. Replace if required.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
	c) If no fault is detected in the wiring harness, replace the control unit.
Test point 10 **Ignition pill circuit 2** Resistance too high/too low Fault code 22	Note Ignition pill circuit 2 at the passenger side airbag is the leftmost of the two circuits. 1. Disconnect plug at passenger side airbag unit. 2. Attach Special Tool 9516. 3. Erase the fault memory. 4. Check if fault is still present. a) If the faut is no longer present, replace passenger side airbag unit. b) If the fault is still present, check wiring harness for squeezed sections and chafing. Replace if required. c) If no fault is detected in the wiring harness, replace the control unit.
Test point 11 Ignition pill circuit 3 Resistance too high/too low Fault code 23	Ignition pill circuit 3 at the passenger-side airbag is the rightmost of the two circuits. – refer to test point 10.
Test point 12 Airbag warning light Signal implausible Fault code 30	– Check warning lamp, replace if required. – Check wire from control unit to instrument cluster or to diagnosis socket, respectively, for short to positive terminal. – Check instrument cluster.
Test point 13 **Control unit defective** Fault code ...	– Replace control unit. Note This fault message may display several fault codes: 31, 40 to 47, 50 to 54 and 60 to 62.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 14:	
Unknown fault code fault code xxx	– Check secondary ignition circuit. – Erase fault memory.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

2. Failure time

The Failure Time menu item displays the time elapsed since the first fault was stored in the fault memory.

The maximum time that can be displayed is 99 hours and 59 minutes. If this time is exceeded, the ">" sign is displayed ahead of the hours.

3. Results

The Results menu item displays the crash data.

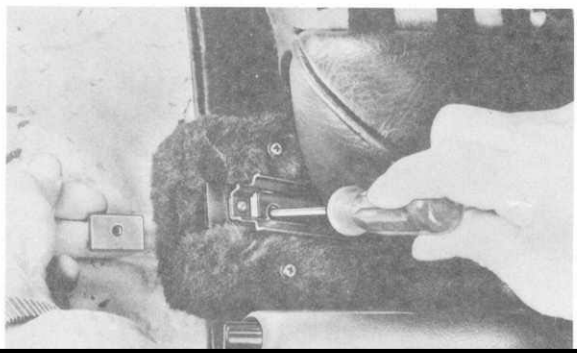
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REMOVING AND INSTALLING ELECTRIC SEAT

Removing

1. Fold back front carpet and remove rear carpet.

2. Move back seat all the way and unscrew front socket head screws, then move seat forward and unscrew rear screws.



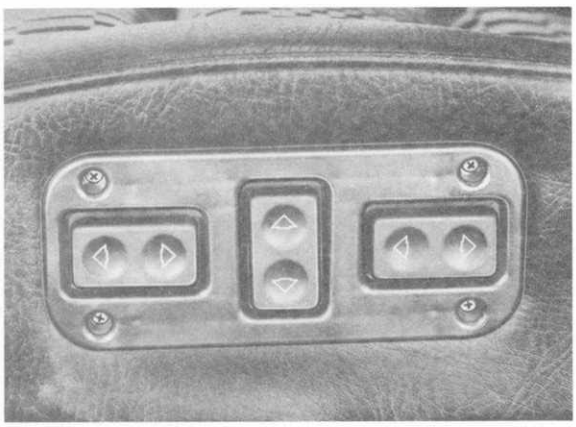
3. Lift seat and disconnect wire plugs, then remove seat and take threaded plates out of seat carrier consoles.

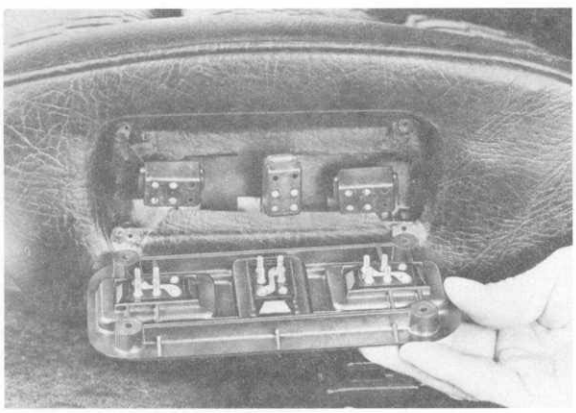
4. Unscrew left and right seat frame trim.

Installing

When installing the seat is normally bolted at the front holes of the seat rail carriers, but if more legroom is wanted, the holes 25 mm further back can be used.

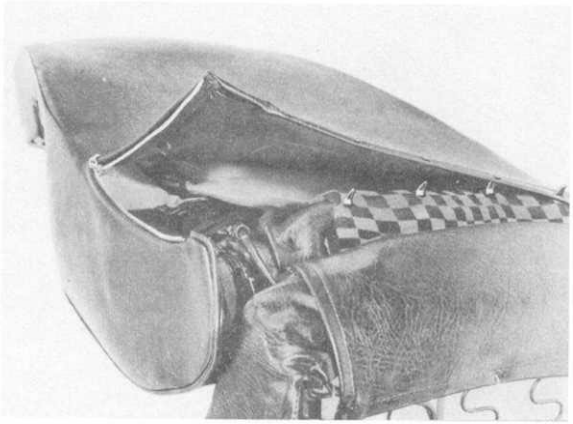
If damaged switches or wire harnesses are causing the trouble and have to be replaced, unscrew the entire escutcheon plate. Afterwards the switches can be disconnected from the wires and removed.



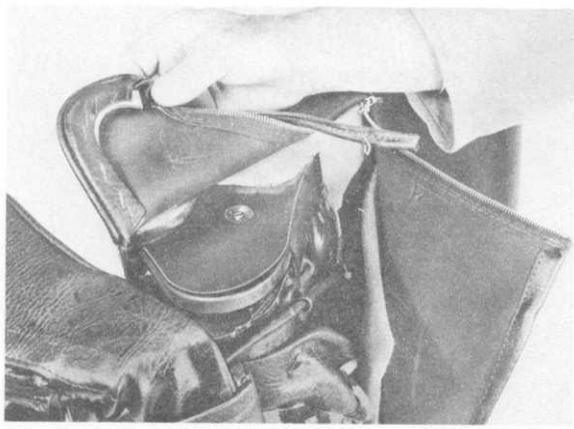


REMOVING SEAT BACKREST MOTOR

1. Open zipper. Bend open metal tabs at bottom of backrest and disconnect backrest cover.

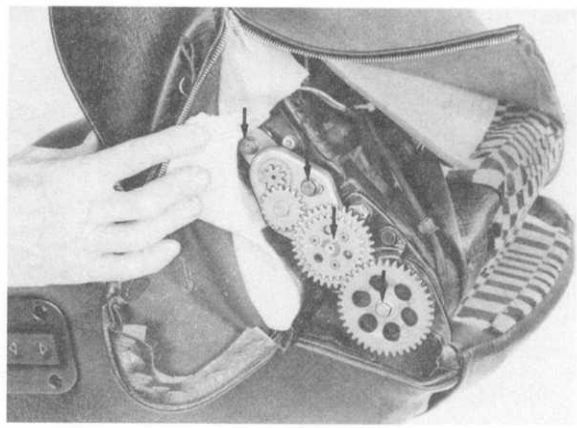


2. Disconnect side cheek and strip on backrest springs.

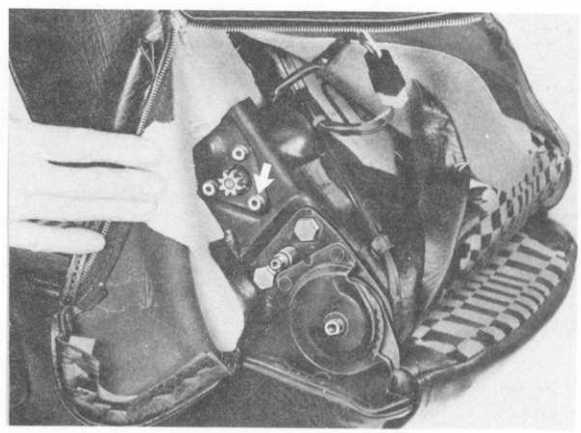


3. Detach pasted padding, unscrew cover and remove.

4. Unscrew gear wheels or remove circlip and take off gear wheels.



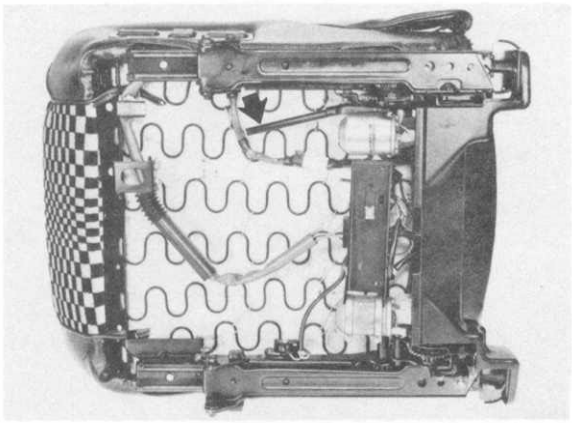
5. Unscrew motor screws.

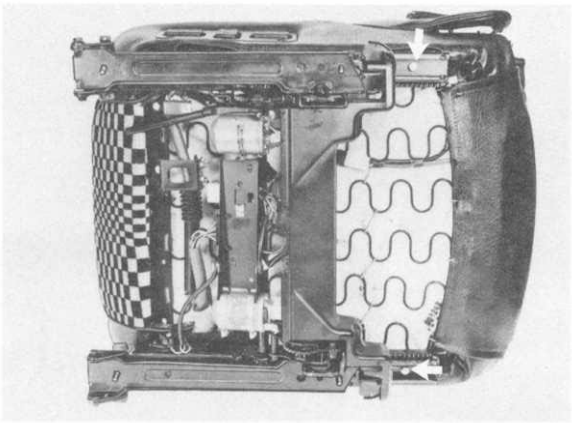


6. Detach front seat cover and pull up far enough, that motor is accessible from front and can be removed.

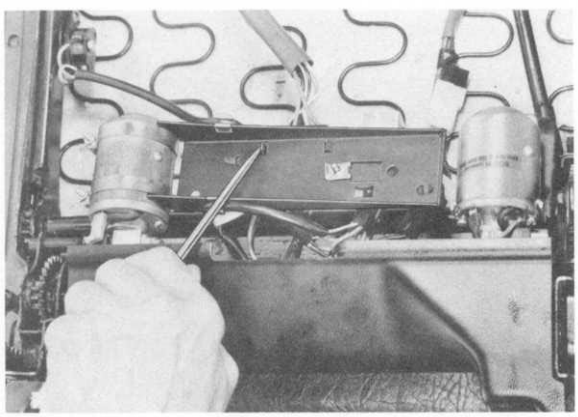
DISASSEMBLING SEAT CONTROLS

1. Operate release lever, push seat forward or back against final stop and unscrew hexagon head screws (arrows).

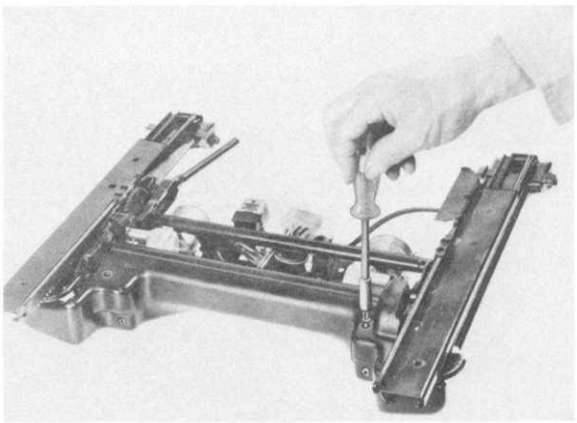




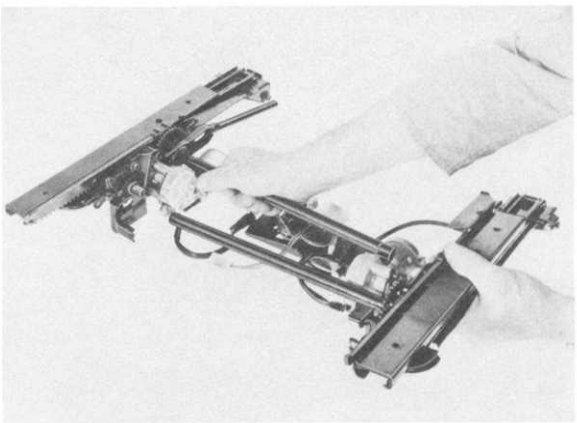
2. Detach and disconnect wire plugs.



3. Remove entire seat control and unscrew cover.



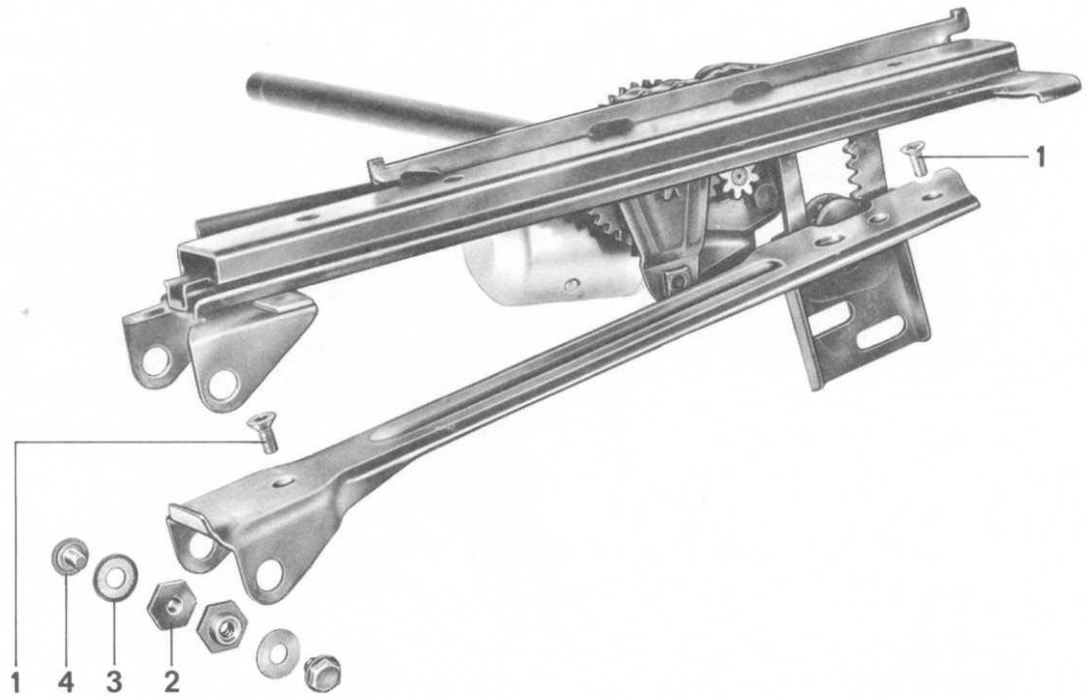
4. Pull apart control halves.



DISASSEMBLING LEFT CONTROL HALF AND REMOVING AXIAL SEAT CONTROL MOTOR

1. Undo threaded connection at front of joint.

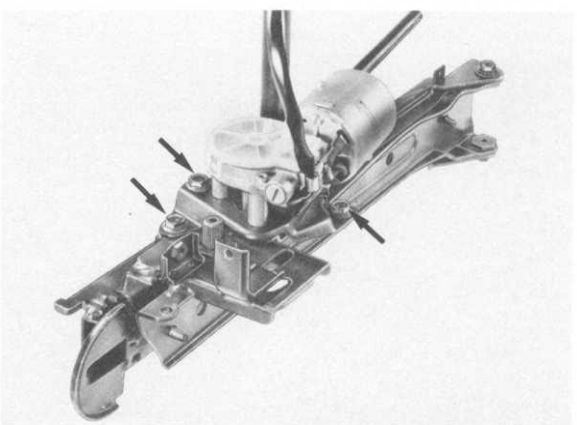
2. Turn up height control on transmission tube.



1 - Countersunk screw M 6
2 - Collar nut
3 - Washer
4 - Self-locking screw M 6

Note

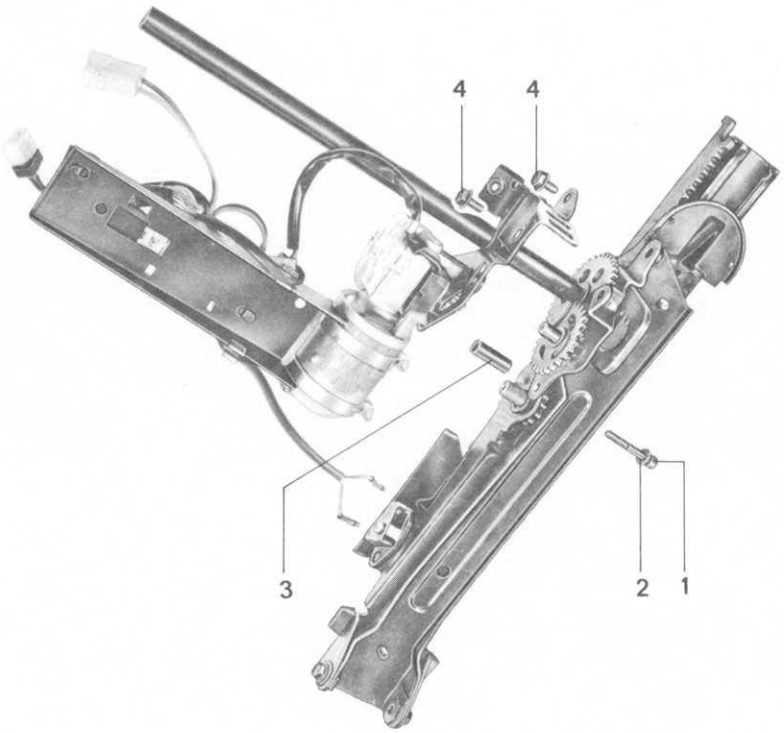
In this position the M 6 countersunk screws holding the seat carrier console could be replaced, if damaged.



3. Loosen motor carrier console and unscrew motor (3 self-locking screws).

DISASSEMBLING RIGHT CONTROL HALF AND REMOVING SEAT HEIGHT CONTROL MOTOR

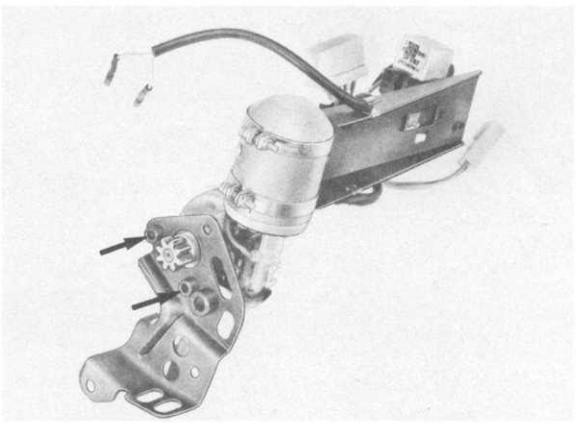
1. Disconnect motor carrier console from control half.



1 - Socket head screw
2 - Washer
3 - Sleeve
4 - Self-locking screw M 6 x 12 mm

Note

If the countersunk screws holding the seat on the seat carrier console have to be replaced, disconnect the threaded connection at front of joint (see page 72 - 5).

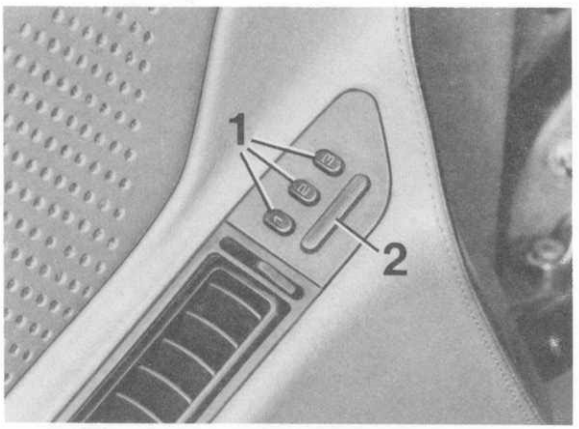


2. Unscrew socket head screws (arrows) on motor carrier console, loosen straps and pull out motor.

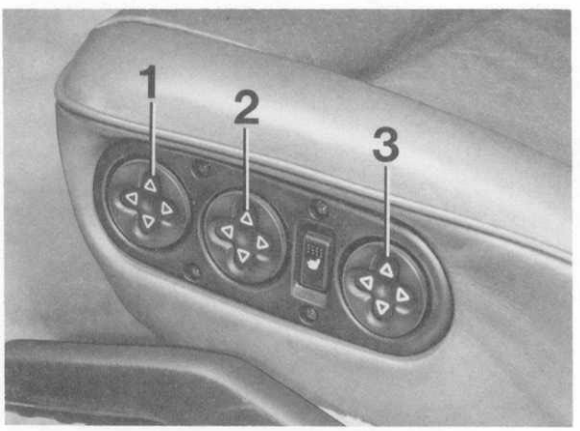
SEAT AND MIRROR POSITION CONTROL SYSTEM, '87 MODELS ONWARD

The seat and mirror position control system comprises the following components:

Control panel with 3 illuminated position keys (1) and one memory key (2) with integral pilot lamp.



3 seat switches for manual adjustment.



Switch 1

- horizontal: fore and aft adjustment
- vertical: seat height adjustment, front

Switch 2

- horizontal: backrest adjustment
- vertical: seat height adjustment, rear

Switch 3

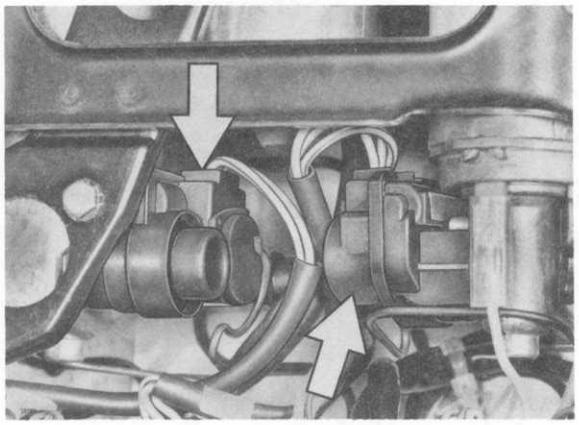
- horizontal: lumbar support shape
- vertical: lumbar support/height

6 adjusting motors



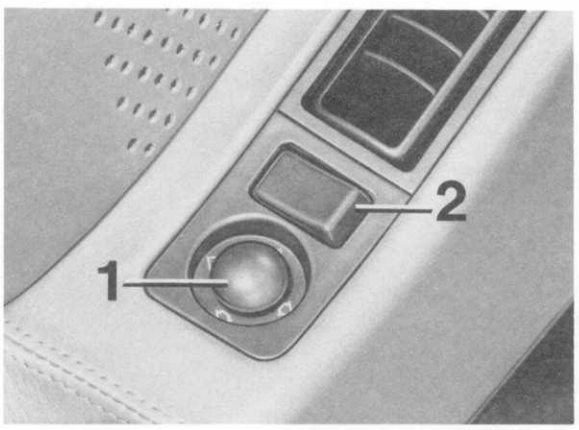
1 - Height, rear
2 - Fore-and-aft adjustment
3 - Height, front
4 - Lumbar support, height
5 - Backrest adjustment
6 - Lumbar support, size

6 potentiometers to detect seat position

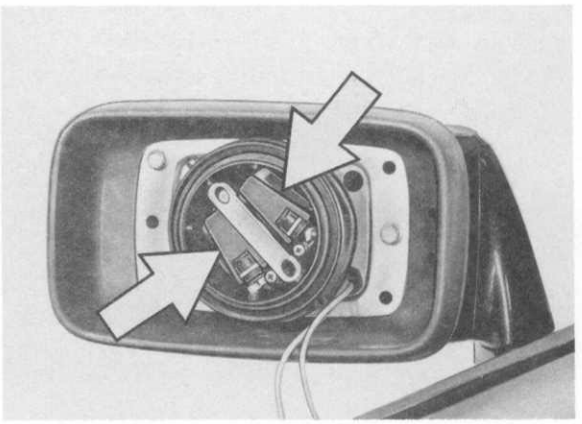


The potentiometers are mounted directly on the adjusting motors. 2 are visible in the illustration.

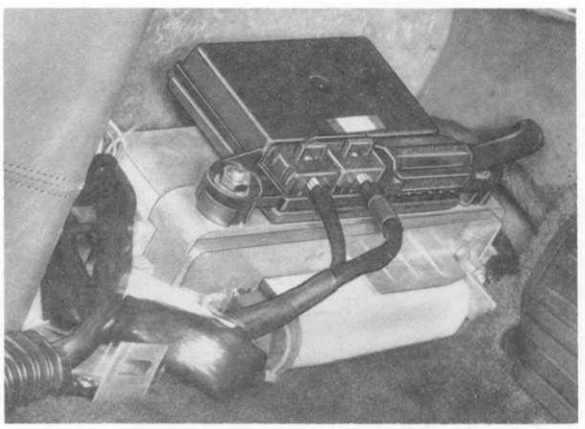
1 mirror adjustor switch (1) and 1 mirror selector switch (2) for manual adjustment of the mirrors



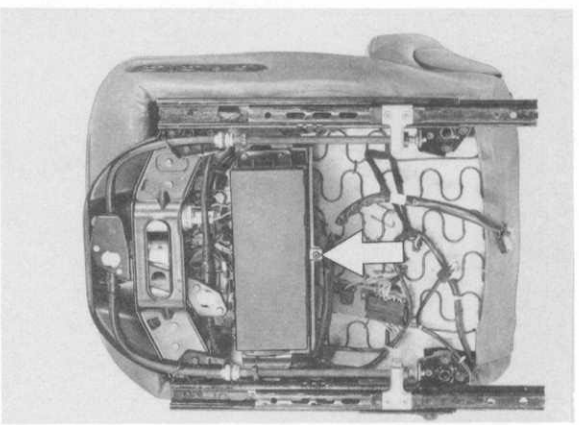
4 motors for mirror adjustment with 4 potentiometers to detect position of mirrors (2 for driver's-side and 2 for passenger-side mirrors).



Control unit for mirror adjustment



Control unit for seat adjustment



2 relay units integrated in the wire harness.

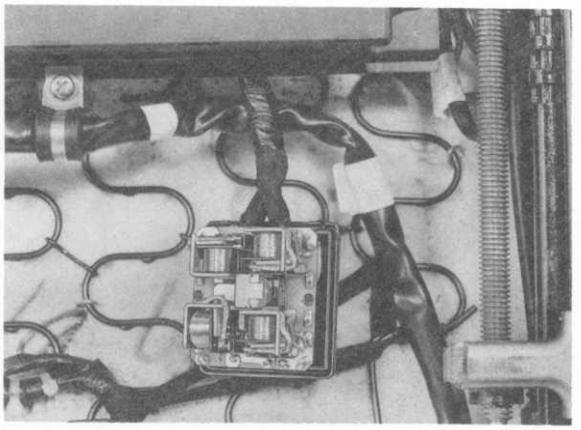
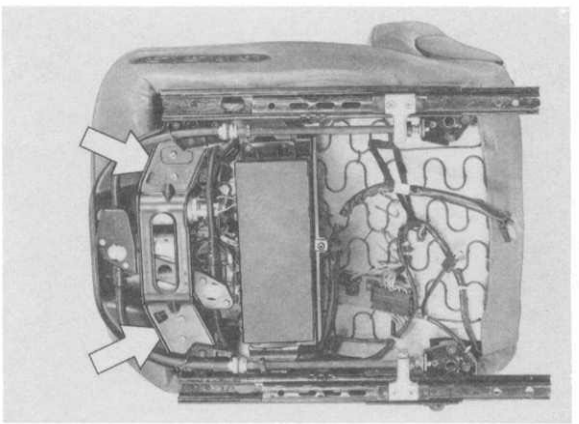


Photo shows relay unit removed with cover open.



Arrows indicate installation positions

METHOD OF OPERATION

Manual adjustment

The manual adjustment facility has been retained. This function always takes priority over automatic adjustment and is always possible regardless of vehicle status.

Storing a position

To store a position in the memory, press the memory key and the key for the desired position. The memory key must be pressed before the position key. Both keys must be held down simultaneously for at least 0.2 seconds.

Positions can be stored in the memory regardless of vehicle status.

Calling up a position

To assume a stored position automatically, hold the key for the desired position down. If the key is released, the adjustment is interrupted immediately.

The position of the mirror is not changed until approx. 0.5 seconds after the position key has been depressed. When the key is released, mirror adjustment is also interrupted unless the seat has reached its final position. Once the seat position is reached, the mirrors automatically move to the position stored in the memory.

A position can be called up regardless of vehicle status.

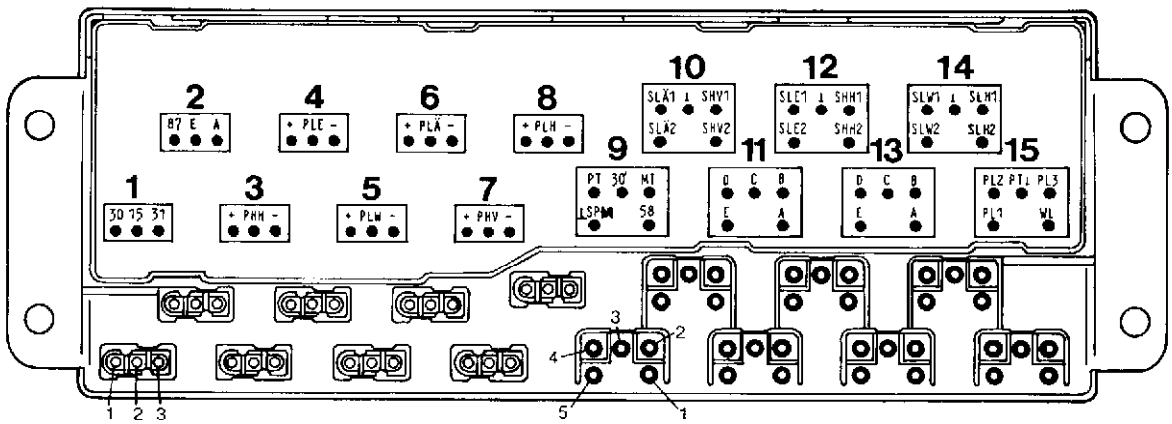
Pilot lamp in the control panel.

Three position keys illuminated to aid orientation and a red pilot lamp with the following functions are housed in the control panel:

If a position key is depressed requesting an adjustment, the pilot lamp lights up until the adjustment has been completed. If the adjustment is interrupted, the pilot lamp will not go out if the ignition is on, or will continue to burn for 60 seconds after the interruption if the ignition is off.

If the position key for a position to which the seat is already set is pressed, the red pilot lamp lights up for approx. 0.5 seconds. If the position is adjusted manually, the pilot lamp goes out.

Plug assignment, control unit for seat adjustment



Plug	Terminal designation		Pin
1	30	- Ter. 30	1
	15	- Ter. 15	2
	31	- Ter. 31	3
2*	87	- Ter. 87 seat heating relay	1
	E	- Tip switch, seat heating on	2
	A	- Tip switch, seat heating off	3
3	+	- Potentiometer height rear +	1
	PHH	- Potentiometer, height rear, pick-off	2
	-	- Potentiometer, height rear -	3
4	+	- Potentiometer backrest +	1
	PLE	- Potentiometer backrest, pick-off	2
	-	- Potentiometer, backrest -	3
5	+	- Potentiometer lumbar support shape +	1
	PLW	- Potentiometer lumbar support pick-off	2
	-	- Potentiometer lumbar support shape -	3
6	+	- Potentiometer fore-and-aft adjustment +	1
	PLÄ	- Potentiometer fore-and-aft adj. pick-off	2
	-	- Potentiometer fore-and-aft adjustment -	3
7	+	- Potentiometer height front +	1
	PHV	- Potentiometer height, front, pick-off	2
	-	- Potentiometer, height, front -	3
* as of MY '89	HZG	- Seat heating	1
	E/A	- Tip switch seat heating on / off	2
	P +	- Potentiometer seat heating +	3

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Plug	Terminal designation		Pin
8	+	- Potentiometer, lumbar support, height +	1
	PLH	- Potentiometer, lum. sup. height pick-off	2
	-	- Potentiometer, lumbar support, height -	3
9	58	- Ter. 58	1
	MT	- Memory key	2
	30'	- Ter. 30 for mirror memory control unit	3
	PT	- Position key	4
	⊥SPM	- Ter. 31 for mirror memory control unit	5
10	SHV2	- Seat switch, height, front downward	1
	SHV1	- Seat switch, height, front upward	2
	⊥	- Ter. 31 for seat switch 1	3
	SLA1	- Seat switch, fore-and-aft adjustment, toward rear	4
	SLA2	- Seat switch, fore-and-aft adjustment, toward front	5
11	A	- Relay unit 2	1
	B	- Relay unit 2	2
	C	- Relay unit 2	3
	D	- Relay unit 2	4
	E	- Relay unit 2	5
12	SHH2	- Seat switch, height, rear downward	1
	SHH1	- Seat switch, height, rear upward	2
	⊥	- Ter. 31 for seat switch 2	3
	SLE1	- Seat switch, backrest, toward rear	4
	SLE2	- Seat switch, backrest, toward front	5
13	A	- Relay unit 1	1
	B	- Relay unit 1	2
	C	- Relay unit 1	3
	D	- Relay unit 1	4
	E	- Relay unit 1	5
14	SLH2	- Seat switch, lum. sup. height downward	1
	SLH1	- Seat switch, lum. sup. height upward	2
	⊥	- Ter. 31 for switch 3	3
	SLW1	- Seat switch, lumbar support shape retract	4
	SLW2	- Seat switch, lumbar support shape extend	5
15	WL	- Pilot lamp	1
	PL3	- Lamp for position key 3	2
	PT⊥	- Ter. 31 for operating switch	3
	PL2	- Lamp for position key 2	4
	PL1	- Lamp for position key 1	5

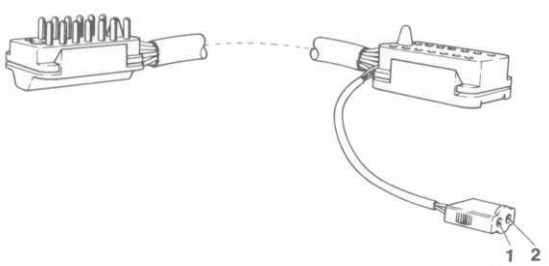
CHECKING SEAT AND MIRROR POSITION CONTROL SYSTEM

Checking seat control unit

Note:

Use the adapter cable (special tool 9269) to check the seat control unit.

Precondition for testing: charged battery



Note:

Ter. 30 and Ter. 31 can be picked off at the 2-pole plug for a number of test steps.

1 - Ter. 31

2 - Ter. 30

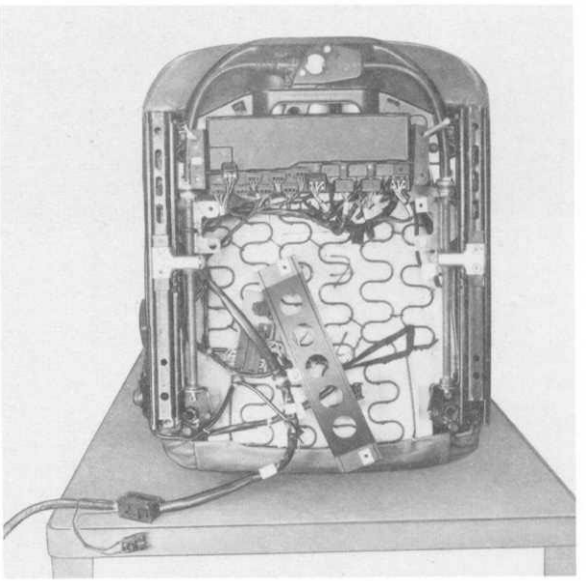
1.Remove seat.

2.Lay seat on a trolley and position trolley beside car.

3.Connect adapter cable to seat.

4.Write seat position into memory with position key 1.

5.Detach control unit, open flap and attach by means of cable clips.



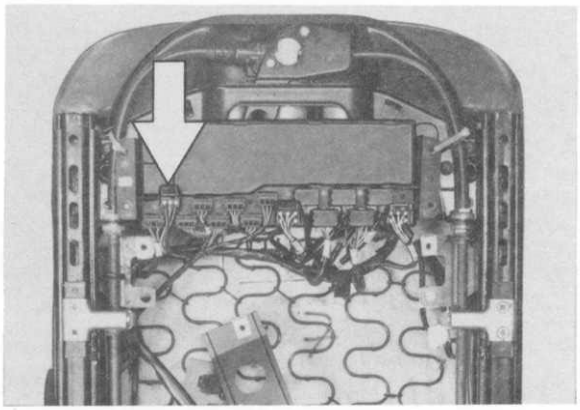
6.Disconnect plug 1. Connect voltmeter to terminal 1 (plus) and Ter. 3 (minus) in plug receptacle.
Reading: battery voltage
Connect voltmeter to Ter. 2 (plus) and Ter. 3, switch on ignition.
Reading: battery voltage

If there is no reading, check fuse No. 21* (Ter. 30) and No. 7** (Ter. 15) and minus cable.
Reconnect plug.

* As from model 88, fuse No.20

** As from model 88, fuse No.8

7. Open receptacle of plug 2. Leave plug connected.



Connect voltmeter to minus of adapter cable and pin 1. Switch on ignition and seat heating.
Reading: battery voltage

Switch off seat heating.
Reading: 0 Volt

If there is no reading, check switch for seat heating. Switch off ignition.

Checking the seat heating as of MY '89 refer to page 72 - 33

8. Disconnect plug 3. Connect voltmeter to pin 1 (plus) and pin 3 (minus) of control unit.
   Press position key 1.
   Reading: approx. 5 volts

Note

Voltage is applied for only 30 - 60 seconds after the position key is pressed.

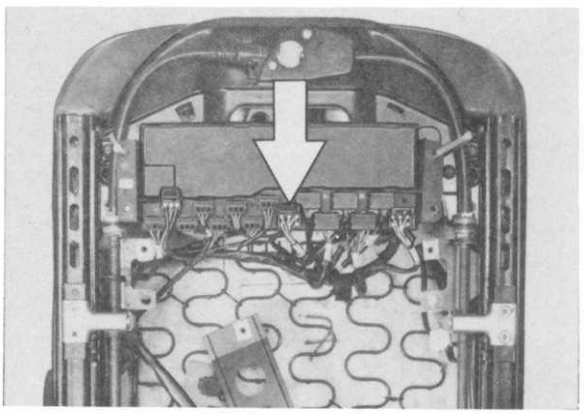
9. Connect ohmmeter to plug Ter. 1 and Ter. 3.
   Reading: 2.2 - 3.2 kohm

Connect ohmmeter to Ter. 2 and Ter. 3
Reading: 0 - 3 kohm, depending upon position of the seat.

If these values are not reached, replace potentiometers.

10. Check plugs 4 through 8 in exactly the same way as described in Step 8.

11. Open plug receptacle of plug 9.
    Leave plug connected.



Connect voltmeter to pin 3 (plus) and pin 5 (minus).
Press position key 1.
Reading: battery voltage

Note

Voltage is applied for only approx. 30 - 60 seconds after the position key is pressed.

Close plug receptacle and disconnect plug.

Connect voltmeter to plug, Ter. 1 and minus.
Switch on parking light.
Reading: battery voltage

12. Connect ohmmeter to Ter. 2 and minus.
    Press memory key.
    Reading: 0 - 2 ohm

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Connect ohmmeter to Ter. 4 and minus, press position key 1.
Reading: 0 - 1 ohm

Press position key 2.
Reading: approx. 240 ohm

Press position key 3.
Reading: approx. 820 ohm.

If these values are not reached, check control panel and wiring.

13. Disconnect plug 10.
Connect voltmeter to plus and pin 3 of control unit.
Reading: battery voltage

14. Connect ohmmeter to plug Ter. 1 and Ter. 3. Press switch 1 down.
Reading: 0 - 0.3 ohm

Connect ohmmeter to Ter. 2 and Ter. 3, push switch 1 up.
Reading: 0 - 0.3 ohm

Connect ohmmeter to Ter. 3 and Ter. 4, press switch 1 toward rear.
Reading: 0 - 0.3 ohm

Connect ohmmeter to Ter. 3 and Ter. 5, push switch 1 forward.
Reading: 0 - 0.3 ohm

If the values are not reached, replace switch.

15. Disconnect plug 12.
Test switch 2 in exactly the same way as described in steps 13 and 14.

16. Disconnect plug 14.
Test switch 3 in exactly the same way as described in steps 13 and 14.

17. Disconnect plug 11.
Connect voltmeter to plus of adapter plug. Push switch 3 up.
Pins 1 and 3 of the control unit must register minus.

Push switch 3 down.

Pins 2 and 3 must register minus.

Push switch 2 forward.

Pins 2 and 4 must register minus.

Push switch 2 toward rear.

Pins 1 and 4 must register minus.

Push switch 2 up.

Pins 1 and 5 must register minus.

Push switch 2 down.

Pins 2 and 5 must register minus.

18. Disconnect plug 13. Connect voltmeter to plus of adapter plug. Push switch 3 forward.
Pins 1 and 3 of control unit must register minus.

Push switch 3 toward rear.

Pins 2 and 3 must register minus.

Push switch 1 forward.

Pins 2 and 4 must register minus.

Push switch 1 toward rear.

Pins 1 and 4 must register minus.

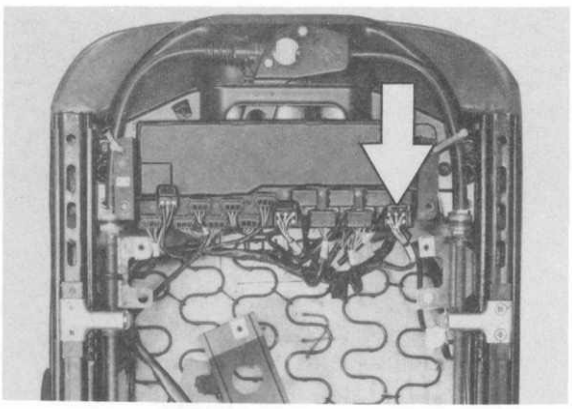
Push switch 1 up.

Pins 1 and 5 must register minus.

Push switch 1 down.

Pins 2 and 5 must register minus.

19. Open plug receptacle of plug 15. Leave plug connected.



Connect voltmeter to minus and pin 1. Press position key 2 or 3 briefly.
Reading: battery voltage

Connect voltmeter to plus and pin 3.
Reading: battery voltage

20. Switch on lights
Connect the voltmeter to negative and pin 2.

Reading: approx. 1,8 V

21. Connect the voltmeter to negative and pin 4

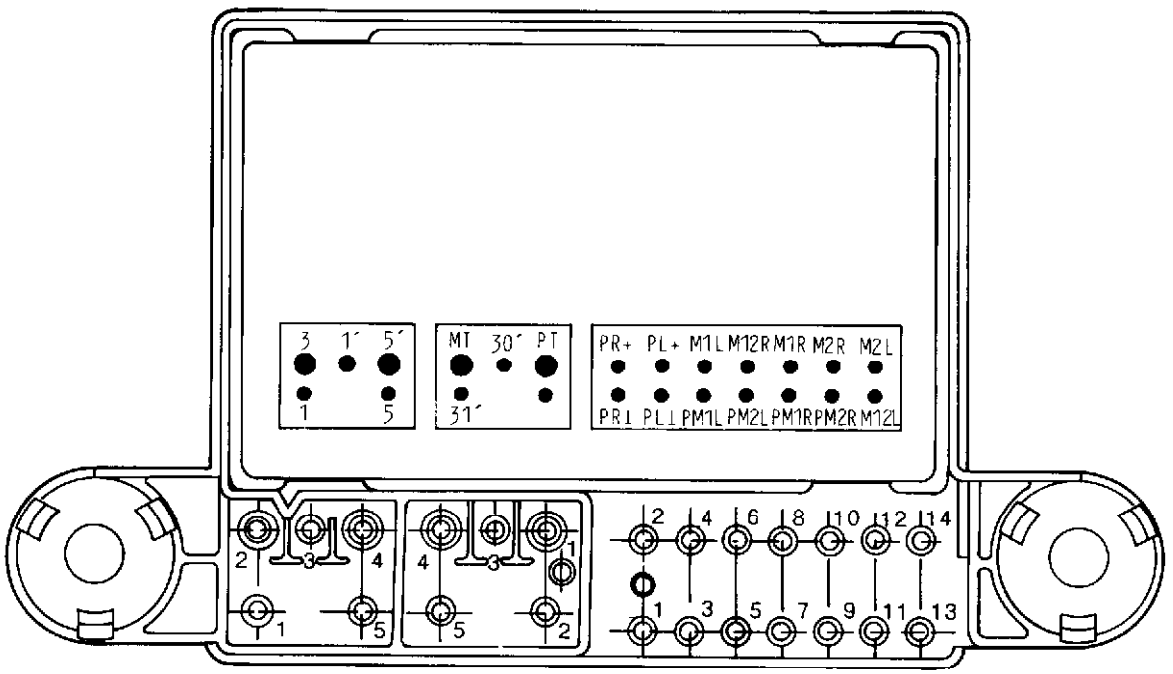
Reading: approx. 1,8 V

22. Connect the voltmeter to negative and pin 5.

Reading: approx. 1,8 V

If the values stated are not reached, the control unit is defective.

PLUG ASSIGNMENT, CONTROL UNIT FOR MIRROR ADJUSTMENT



Plug	Terminal designation	Pin
1	1 - Driver's side mirror left/right	1
	3 - Polarity, motor 1/2	2
	1' - Passenger-side mirror, left/right	3
	5' - Passenger-side mirror, up/down	4
	5 - Driver's mirror, up/down	5
2	PT - Position keys	1
	not occupied	2
	30' - Ter. 30 from seat memory control unit	3
	MT - Memory key	4
	31' - Ter. 31 from seat memory control unit	5

Plug	Terminal designation	Pin
3	PR ⊥ - Potentiometer right -	1
	PR + - Potentiometer right +	2
	PL ⊥ - Potentiometer left -	3
	PL + - Potentiometer left +	4
	PM1L - Potentiometer, motor 1 left	5
	M1L - Motor 1 left	6
	PM2L - Potentiometer, motor 2 left	7
	M12R - Motor 1/2, right	8
	PM1R - Potentiometer, motor 1 right	9
	M1R - Motor 1, right	10
	PM2R - Potentiometer, motor 2 right	11
	M2R - Motor 2, right	12
	M12L - Motor 1/2, left	13
	M2L - Motor 2, left	14

left - driver's-side mirror

right - passenger-side mirror

motor 1 - vertical travel

motor 2 - horizontal travel

Checking mirror control unit

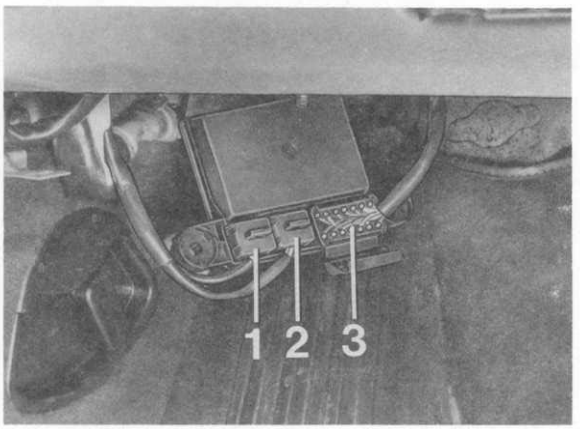
Note:

The mirror control unit is mounted on the sidewall in the driver's-side footwell beside the ABS control unit.

1.Remove oddments tray.

2.Detach mirror control unit.

3.Disconnect plug 1.



4.Set mirror selector switch to driver's-side mirror.

5.Connect voltmeter to Ter. 1 (plus) and Ter. 2 (minus).

Push mirror adjuster switch to left.
Reading: battery voltage

Connect voltmeter to Ter. 1 (minus) and Ter. 2 (plus).

Push mirror adjuster switch to right.

Reading: battery voltage

6.Connect voltmeter to Ter. 5 (plus) and Ter. 2 (minus).

Push mirror adjuster switch up.

Reading: battery voltage

Connect voltmeter to Ter. 5 (minus) and Ter. 2 (plus).

Push mirror adjuster switch down.

Reading: battery voltage

7.Set mirror selector switch to passenger-side mirror.

8.Connect voltmeter to Ter. 3 (plus and Ter. 2 (minus).

Push mirror adjuster switch to left.

Reading: battery voltage

Connect voltmeter to Ter. 3 (minus) and Ter. 2 (plus).

Press mirror adjuster switch to right.

Reading: battery voltage

9.Connect voltmeter to Ter. 4 (plus) and Ter. 2 (minus).

Push mirror adjuster switch up.

Reading: battery voltage.

Connect voltmeter to Ter. 4 (minus) and Ter. 2 (plus).

Push mirror adjuster switch down.

Reading: battery voltage

10. Disconnect plug 2.
Connect ohmmeter to minus and Ter. 1, press position key 1.
Reading: 0 - 2 ohm

Press position key 2.

Reading: approx. 240 ohm

Press position key 3.

Reading: approx. 820 ohm

11. Connect ohmmeter to minus and Ter. 4.
Press memory key.

Reading: 0 - 2 ohm

If the values are not reached, check control panel separately.

12. Connect voltmeter to Ter. 3 (plus) and Ter. 5 (minus).

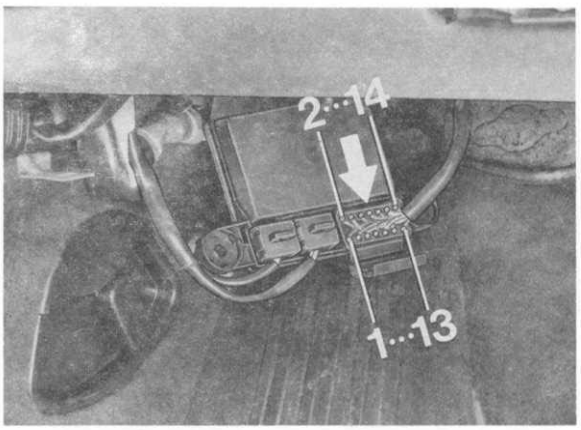
Press position key 1.

Reading: battery voltage

Note:

Voltage is applied for only approx. 30 seconds after the position keys are pressed.

13. Open plug receptacle of plug 3.
Leave plug connected.



14. Connect voltmeter to Ter. 1 (minus) and Ter. 2 (plus).
Press position key 1

Reading: approx. 4.7 V

Note:

Voltage is applied for only approx. 30 seconds after the position keys are pressed.

15. Connect voltmeter to Ter. 3 (minus) and Ter. 4 (plus).

Press position key 1.

Reading: approx. 4.7 V

16. Connect voltmeter to Ter. 4 (plus) and Ter. 5 (minus).

Press position key 1.

Reading: approx. 0.3 - 4.5 V

17. Connect voltmeter to Ter. 4 (plus) and Ter. 7 (minus).
Press position key 1.

Reading: 0.3 - 4.5 V

18. Connect voltmeter to Ter. 2 (plus) and Ter. 9 (minus). Press position key 1.

    Reading: 0.3 - 4.5 V

19. Connect voltmeter to Ter. 2 (plus) and Ter. 11 (minus). Press position key 1.

    Reading: 0.3 - 4.5 V

20. Set mirror selector switch to driver's-side mirror.

21. Connect voltmeter to Ter. 6 (plus) and Ter. 13 (minus).

    Push mirror adjuster switch up.

    Reading: battery voltage

22. Connect voltmeter to Ter. 6 (minus) and Ter. 13 (plus).

    Push mirror adjuster switch down.

    Reading: battery voltage

23. Connect voltmeter to Ter. 13 (minus) and Ter. 14 (plus). Push mirror selector switch to left.

    Reading: battery voltage

24. Connect voltmeter to Ter. 13 (plus) and Ter. 14 (minus).

    Push mirror adjuster switch to right.

    Reading: battery voltage

25. Set mirror selector switch to passenger-side mirror.

26. Connect voltmeter to Ter. 8 (minus) and Ter. 10 (plus).

    Push mirror adjuster switch up.

    Reading: battery voltage

27. Connect voltmeter to Ter. 8 (plus) and Ter. 10 (minus).

    Push mirror adjuster switch down.

    Reading: battery voltage

28. Connect voltmeter to Ter. 8 (minus) and Ter. 12 (plus).

    Push mirror adjuster switch to left.

    Reading: battery voltage

29. Connect voltmeter to Ter. 8 (plus) and Ter. 12 (minus).

    Push mirror adjuster switch to right.

    Reading: battery voltage

If the values stated are not reached, the mirror control unit is defective.

CHECKING CONTROL PANEL

1.Remove control panel.

2.Disconnect plug.

N o t e

The test is conducted with the connector housing withdrawn.

3.Connect voltmeter to Ter. 1 (plus) and Ter. 4 (minus)

Reading: battery voltage

If there is no reading, check wiring to seat control unit, if necessary replace seat control unit.

4.Connect ohmmeter to Ter. 1 and Ter. 4.

Reading: ohm

Press key 1.

Reading: approx. 0 ohm

Press key 2.

Reading: approx. 240 ohm

Press key 3.

Reading: approx. 820 ohm

5.Connect ohmmeter to Ter. 2 and Ter. 4.

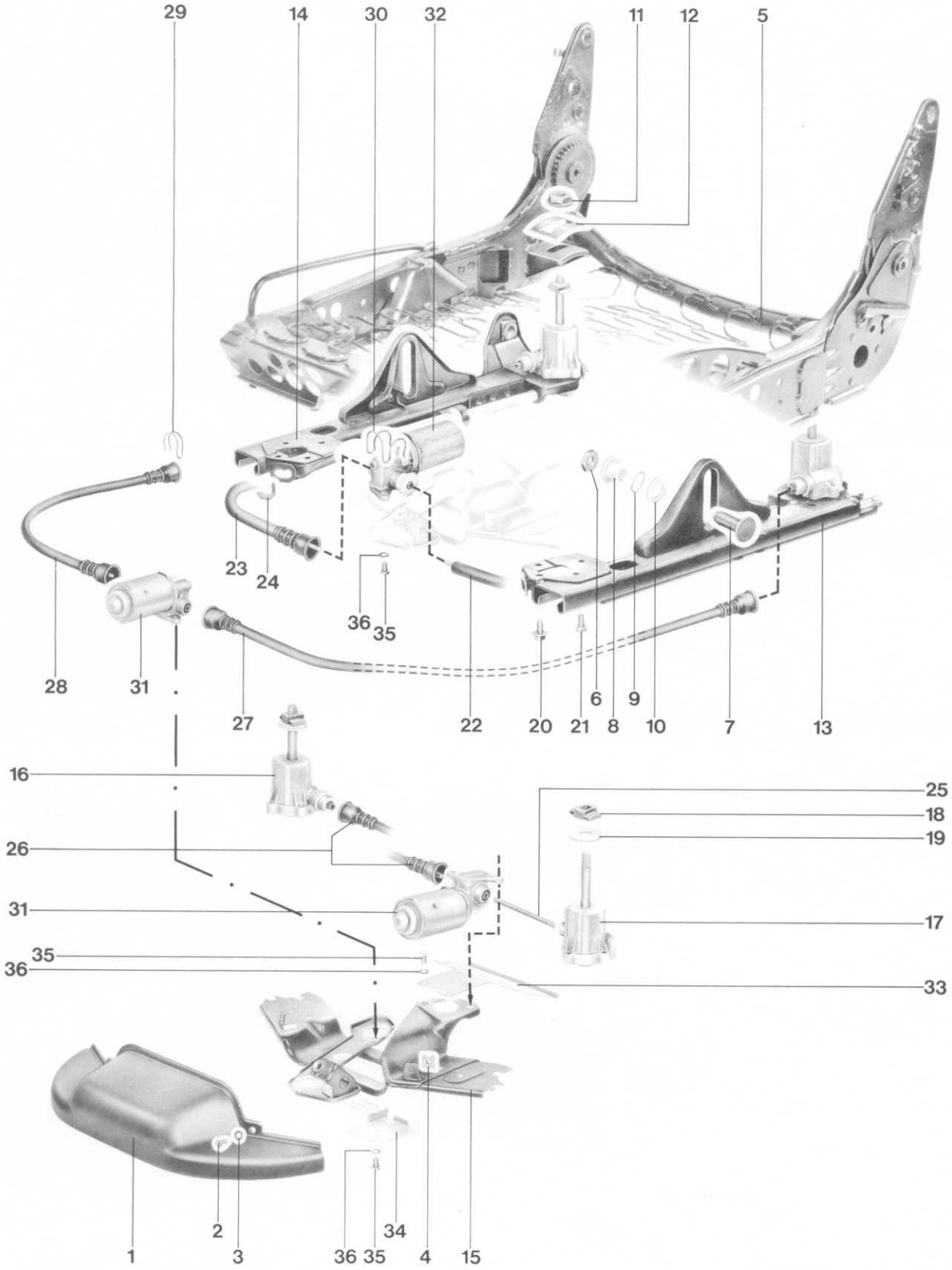
Reading: ohm

Press memory key.

Reading: approx. 0 ohm

SEAT FRAME

SEAT FRAME

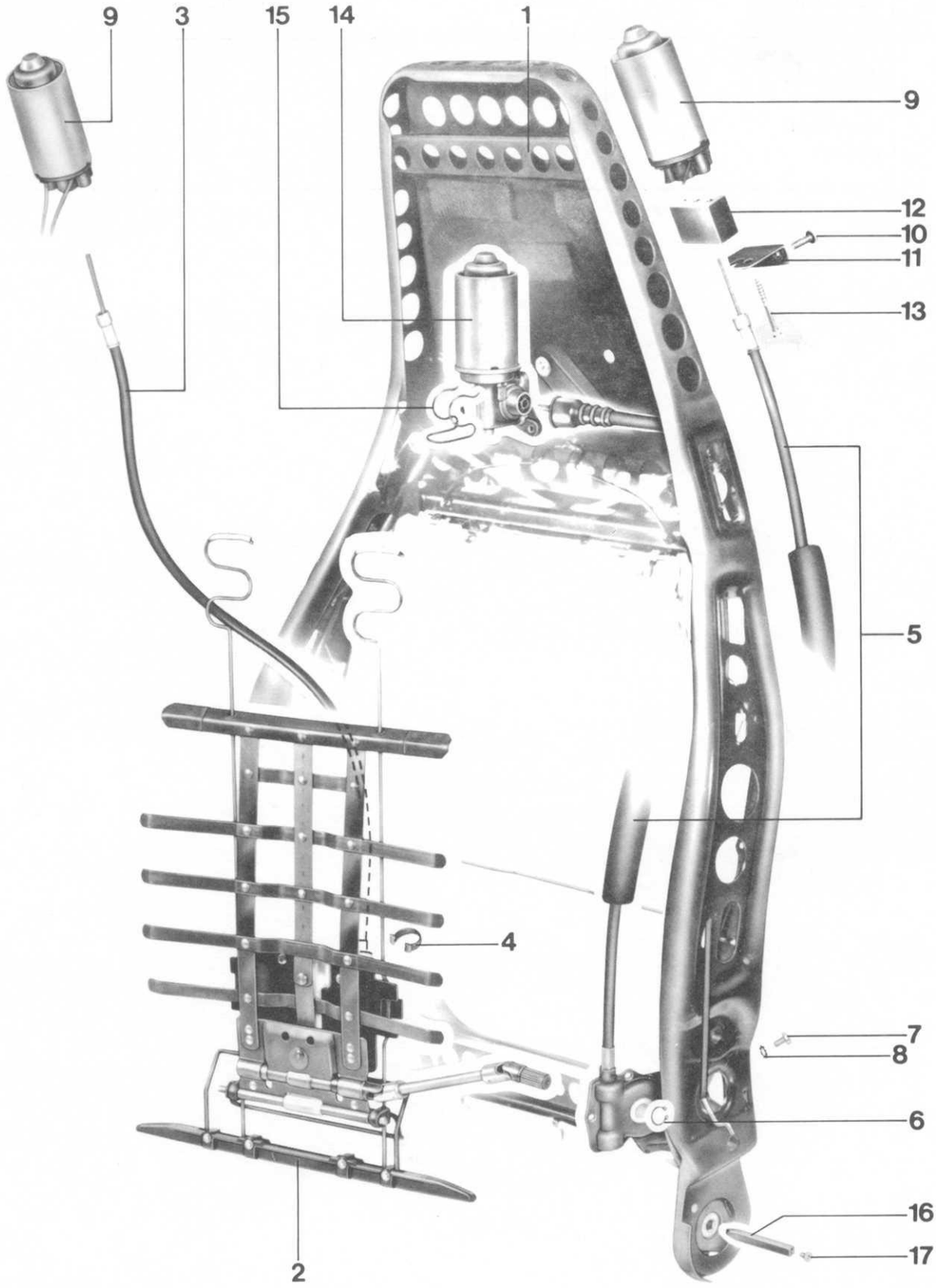

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No.	Description	Qty.	Note When: Removing	Installing
1	Cover	1		
2	Self-tapping screw	2		
3	Washer	2		
4	Sheet-metal nut	2		
5	Seat frame	1		
6	Hex nut	2		
7	Pin	2		
8	Sliding sleeve	2		
9	Spring washer	2		
10	Plastic washer	2		
11	Hex nut	4		
12	Guide spring	4		
13	Seat rail, left	1		
14	Seat rail, right	1		
15	Transverse strut	1		
16	Lifter, front right and rear left	2		
17	Lifter, front left and rear right	2		

No.	Description	Qty.	Note When: Removing	Installing
18	Slide	4		
19	Washer	4		
20	Hex bolt	8		
21	Socket-head bolt	4		
22	Shaft, seat adjustment, left	1		
23	Shaft, seat adjustment, right	1		
24	Staple	3		
25	Shaft, height adjustment, front left	1		
26	Shaft, height adjustment, front right			
27	Shaft, height adjustment, rear left	1		
28	Shaft, height adjustment, rear right	1		
29	Shaped spring	3		
30	Shaped spring	3		
31	Electric motor	2		
32	Electric motor	1		
33	Holder	1		
34	Holder	1		

No.	Description	Qty.	Note When: Removing	Installing
35	Hex bolt	6		
36	Serrated washer	6		

BACKREST



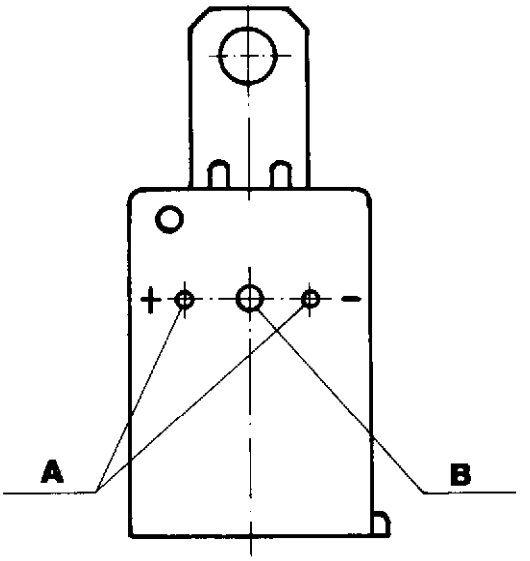
No.	Description	Qty.	Note When: Removing	Installing
1	Backrest frame	1		
2	Lumbar support	1		
3	Shaft, lumbar support, height adjustment	1		
4	Circlip	1		
5	Shaft, lumbar support, curvature	1		
6	Circlip	1		
7	Cross recessed screw M 5 x 8	2		
8	Serrated washer	2		
9	Electric motor	2		
10	Cross recessed screw M 5 x 16	6		
11	Angle	2		
12	Spacer	2		
13	Hex bolt	4		
14	Electric motor, backrest adjustment	1		
15	Shaped spring	1		
16	Guide	2		
17	countersunk screw with inside hexagon head	2		

Calibrating controllable seat heating

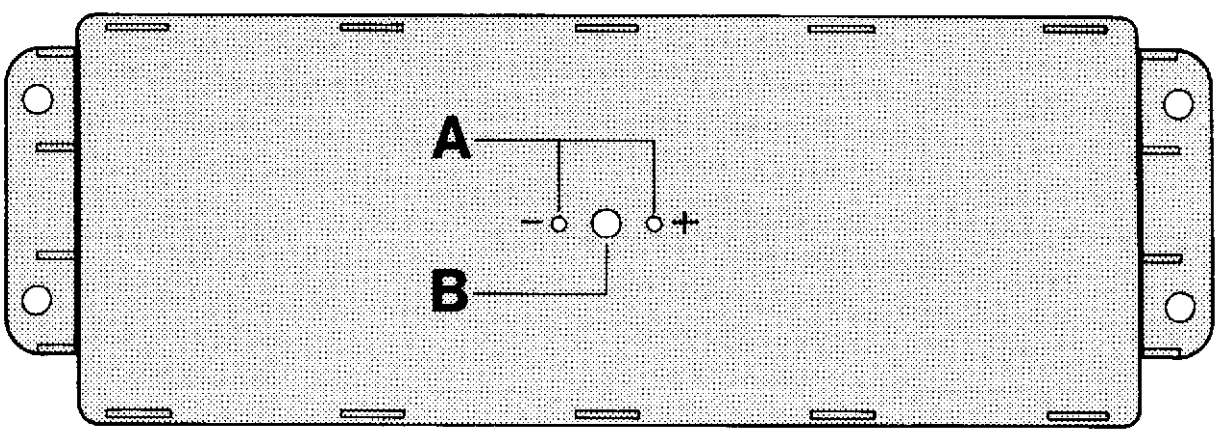
From Model 89 onwards
Control units

Note

The seat heating must be calibrated after the control unit or heating elements have been replaced.



Control unit for seat heating without seat-position control 165 - 72



Control unit for seat heating with seat-position control 163 - 72

A - measuring point (V)
B - Calibration potentiometer

Printed in Germany – XXII, 1989

Tools

1. Digital voltmeter with an internal resistance (Ri) ≥ 1 MΩ.
2. Two measuring probes with a maximum diameter of 2 mm.
3. Thermometer (as recommended in the Workshop Handbook).
4. 2 mm wrench.
5. Two auxiliary cables to supply voltage to the removed seat (terminals 15 and 31). Use adapter cable 9269 for seat-position control.

Calibration procedure

1. Store the seat to be calibrated in the working area until it has assumed the ambient temperature.
2. Provide power supply.

Note

Do not switch on the seat heating. If switched on unintentionally, the seat must cool down until the heating elements have again adopted the ambient temperature.

3. Measure the ambient temperature and refer to the table for the relevant voltage value.
4. Connect the voltmeter to the control unit (A).
5. Set the voltage value on the calibration potentiometer (B) so that it corresponds to the appropriate value for the ambient temperature.

Table

Ambient temperature in °C	Voltage in V
0	1.50
2	1.55
4	1.60
6	1.65
8	1.70
10	1.75
12	1.80
14	1.85
16	1.90
18	1.95
20	2.00
22	2.05
24	2.10
26	2.15
28	2.20
30	2.25
32	2.30
34	2.35
36	2.40
38	2.45
40	2.50
42	2.55
44	2.60
46	2.65
48	2.70

Function check

Switch on seat heating for approx. 10 seconds with maximum heating power. After switching off, measure the voltage at the control unit. The value measured now must be considerably higher.

Printed in Germany – XXII, 1989

Checking seat heating

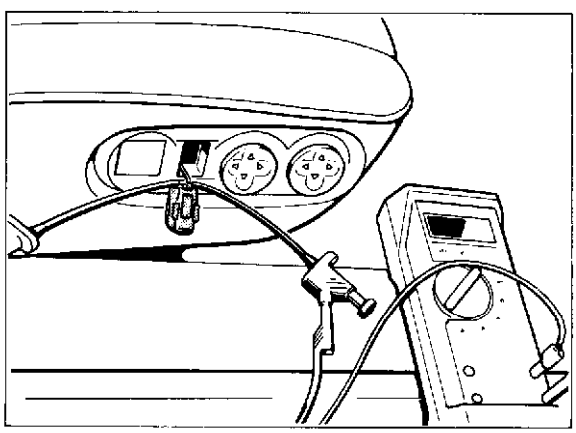
As of Model Year '89

1. Remove switch cover (4 screws).

2. Disengage seat heating switch and pull out switch (take care not to damage the wire).

3. Switch on ignition.

4. Connect voltmeter to term. 1 (positive) and term. 2 (negative).



1343 - 72

Display: approx. 5 V

Note

If no voltage is displayed, check power supply according to wiring diagram.

5. Connect voltmeter to term. 2 (negative) and term. 3 (positive).
   Display, depending on potentiometer setting: approx. 2 - 3 V

6. Push tip switch into "on" position and keep it in this position.
   Display: approx. 5 V

7. Push tip switch into "off" position and keep it in this position.
   Display: approx. 0 V

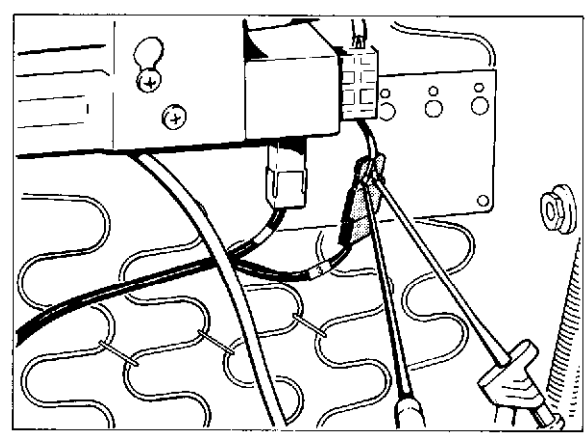
8. Turn knurled wheel of potentiometer all the way up.
   Display: approx. 3 V

9. Turn knurled wheel of potentiometer all the way down. The voltage must then drop to approx. 2 V.

10. Remove seat and connect to Special Tool 9269.

11. Switch on seat heating and set to maximum heating output.

12. Measure voltage at 2-pin connector marked with digit 3.



1344 - 72

When the seat heating is switched on, the voltage oscillates between 0 V and approx. 12 V (clocked voltage).

Printed in Germany – XXXI, 1993

Checking resistance of heater elements

Note

Use a digital ohmmeter for the measurements.

1. Disconnect connector marked with digit 3.

2. Zero out ohmmeter.

3. Connect ohmmeter on pin side.
   Display at 20° C ambient temperature:
   1.5 to 1.8 Ω

Printed in Germany – XXXI, 1993

PRECAUTIONS WHEN WORKING ON CARS WITH ELECTRONIC CONTROL UNITS

When working on cars with electronic control units, note the following:

Welding

If electric welding equipment is used, the plugs of electronic control units must be disconnected.

Painting

When painting cars, note that the max. long-term (approx. 2 hours) load for electronic control units is 80°C.

Charging battery

Disconnect battery from car electrics when charging.

Emergency start

Never use a fast charger to start the engine.

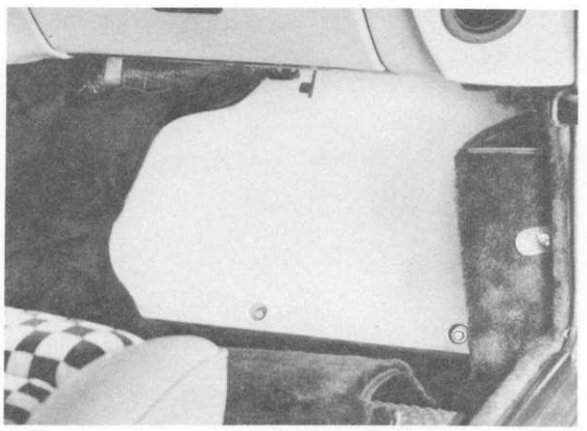
Plug-in connector

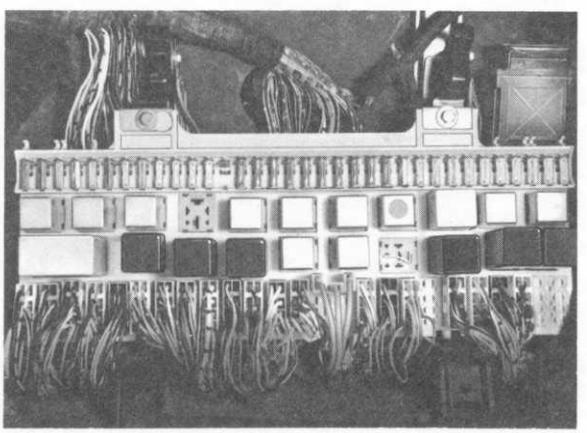
Only connect and disconnect plug-in connector of electronic control units with ignition switched off.

LOCATION OF RELAYS AND ELECTRONIC CONTROLS IN CAR

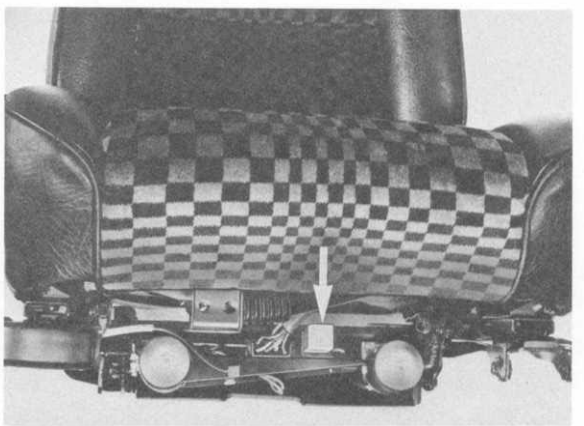
Central Fuse / Relay Plate

The central fuse/relay plate is accessible after removal of a cover in footwell of front passenger's side.





Relay for electric seat's forward movement is located underneath the seat on the adjusting frame.



Fuses are numbered consecutively from left to right and are designated S 1 through S 34 on the current flow diagram.

S 1 - Fog headlight

S 2 - Auxiliary headlight

S 3 - License plate light, engine compartment light

S 4 - Switch light (fog headlights, tail fog light, hazard light switch, rear window wiper, rear window defogger), light for cigar lighter

S 5 - Cigar lighter, instrument light

S 6 - Windshield wipers, cleaning solution pump

S 7 - Rear window wiper

S 8 - Sliding roof

S 9 - Backup light, mirror control

S 10 - Stop lights, tempostat cruise control, bulb control unit

S 11 - Instruments and indicator lamps in instrument cluster, left

S 12 - Instruments and indicator lamps in instrument cluster, right

S 13 - Not occupied

S 14 - Seat adjustment

S 15 - Two-tone horns, antenna, rear window wiper return

S 16 - Condenser blower for air conditioning

S 17 - Fresh air blower, magnetic coupling on compressor (air conditioning)

S 18 - Rear window defogger, outside mirror defogging

S 19 - Retractable headlight motor

S 20 - Headlight cleaner pump

S 21 - Window controls

S 22 - Fuel pumps, warm-up regulator, throttle bypass valve

S 23 - Clock, glove box lamp, inside lights, make-up mirror light

S 24 - High beam headlight, left; high beam indicator lamp

S 25 - High beam headlight, right

S 26 - Low beam headlight, left

S 27 - Low beam headlight, right

S 28 - Marker lights, left

S 29 - Marker lights, right

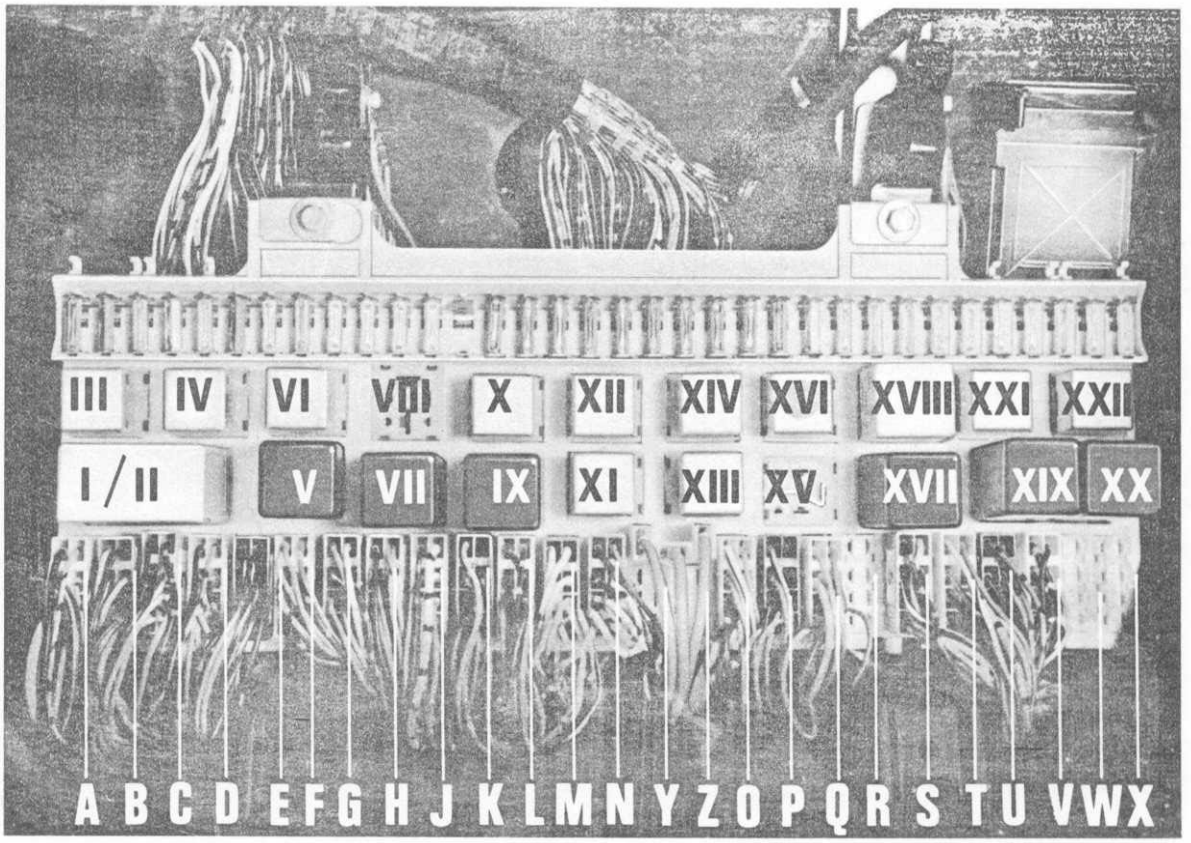
S 30 - Front turn signals, left

S 31 - Rear turn signal, left

S 32 - Front turn signals, right

S 33 - Rear turn signal, right

S 34 - Tail fog light



Relays - identified with Roman numerals I through XXII on central fuse /relay plate

I - II - Rear window defogger
III - Headlight motor
IV - Headlight main power supply
V - Turn signal flasher
VI - Power window
VII - Headlight washer pump
VIII - Not used
IX - Time relay (seat belts)
X - Horn
XI - A/C compressor (speed limiter)
XII - Fog lights
XIII - Headlight beam power supply
XIV - Headlight high/low beam
XV - Bridged for manual trans. (starter cut-out relay for automatic trans.)
XVI - Safety relay (headlights)
XVII - Fuel pump
XVIII - Radiator fan
XIX - Intermittent wiper
XX - Intensive cleaner pump
XXI - A/C and heater blower
XXII - Defrost fan

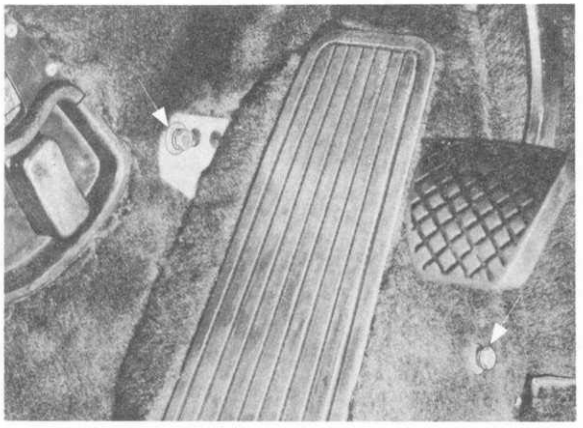
1 - Stop/tail light monitoring unit

Relay Plate Plug Receptacles

A	-	white	Instrument panel harness
B	-	blue	
C	-	red	
D	-	natural	
E	-	black	
F	-	white	
G	-	blue	
H	-	red	
J	-	natural	
K	-	black	
L	-	white	
M	-	blue	
N	-	red	
Y	(single wire)		
M	-	blue	Front harness
N	-	red	
O	-	natural	
P	-	black	
Q	-	white	
+	(single wire)		
S	-	red	Rear harness
T	-	natural	
U	-	black	
V	-	white	
R			Not used
W			
X			
Z			

Central Warning System

The central warning system is mounted underneath the footrest in the driver's footwell.





One of the 25-pin, black receptacles on the central warning system is marked with a yellow label. This label is to identify the respective receptacle terminal numbers (either yellow or black) when using the current flow wiring diagram.

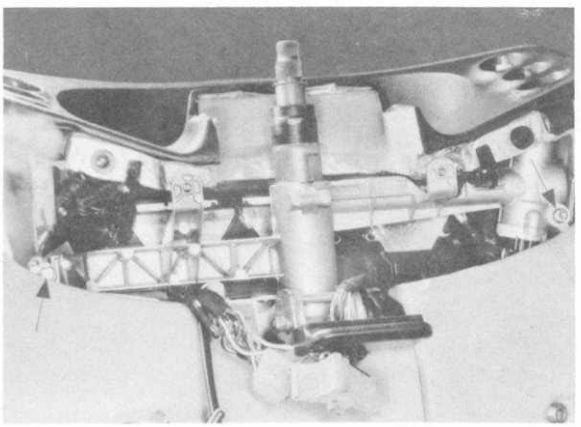
REMOVING AND INSTALLING INSTRUMENT CLUSTER

1. Disconnect battery ground lead.

2. Remove steering wheel.

3. Remove steering column switch.

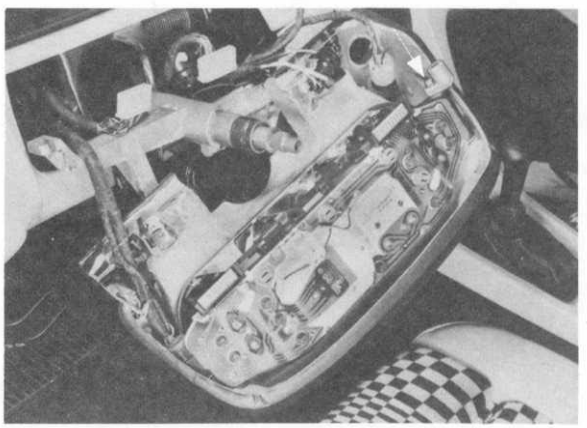
4. Remove instrument cover mounting screws.

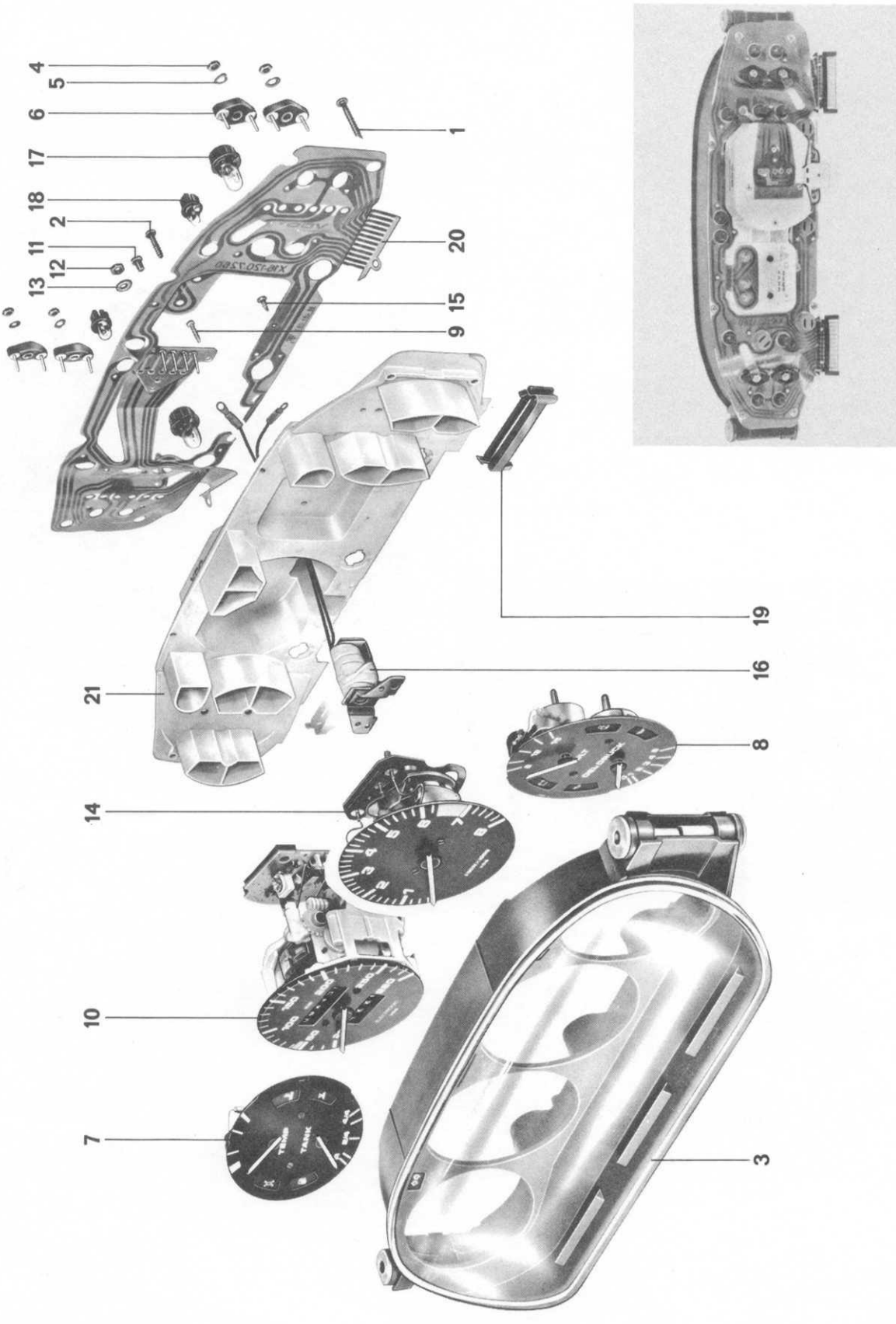


5. Remove rear window wiper and defogger switch.

6. Disconnect both 12-pin plugs at instrument cluster.

7. Lift instrument cover carefully and tilt it to the rear. Unscrew mounting bolt and remove instrument cluster.



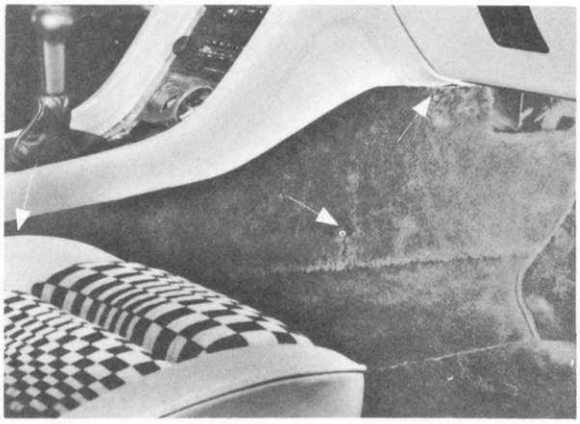

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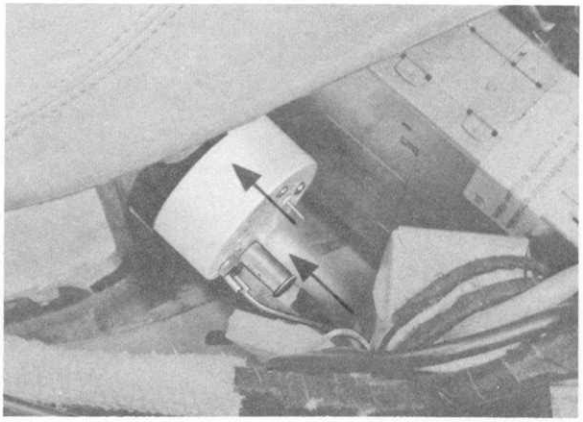
No.	Description	Qty.	Note When Removing / Installing	Special Instructions
1	Phillips screw (long)	4		
2	Phillips screw (short)	5		
3	Housing	1		
4	Nut	4		
5	Washer	4		
6	Connecting plug	4		
7	Temperature/fuel gauge	1		
8	Voltage/oil pressure gauge	1		
9	Phillips screw	4		
10	Speedometer	1	Remove carefully	
11	Allen head screw	2		
12	Nut	3		
13	Washer	3		
14	Tachometer	1		
15	Metal screw	2		
16	Solenoid	1		
17	Bulb with holder	4		3 W
18	Bulb with holder	11		1.2 W
19	Plug guide	2		
20	Conductor foil	1		
21	Instrument carrier	1		

REMOVING AND INSTALLING CLOCK

1. Disconnect battery ground lead.

2. Unscrew side trim (left or right) from center console (2 screws), pull off clip and press down trim.





3. Remove seat belt indicator lamp and hazard light switch.

4. Disconnect wires at clock.

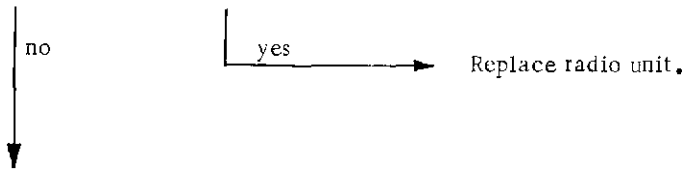
5. Unscrew both clock mounting screws with a short Phillips screwdriver.

TROUBLESHOOTING CAR RADIO

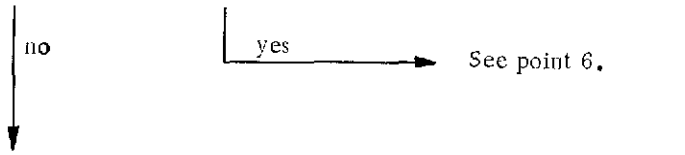
Test Requirements:

Charged battery, ignition key turned to radio position, antenna run out.

1. Are stations received only on some of the four wave ranges (MW, LW, SW, USW)?

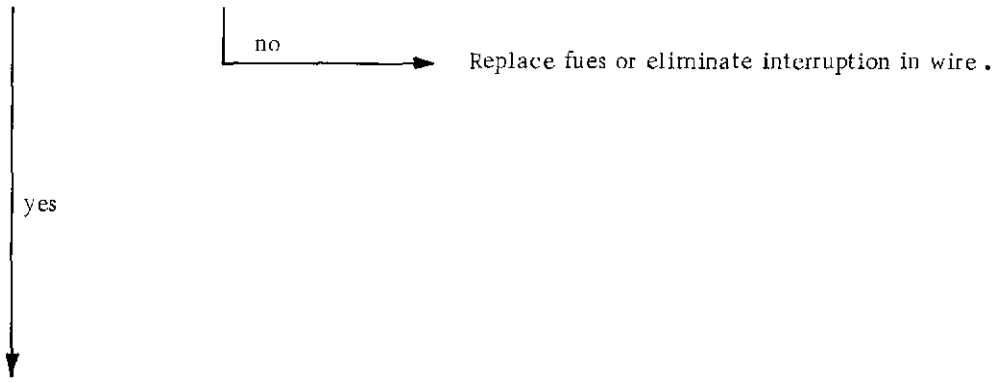


2. Are any stations at all received?



3. Check operating voltage at radio.

Is there 12 volts at radio housing?



yes

4. Turn loudness control on radio to full volume.
Is there loud noise in loudspeakers in all wave ranges?

no → Check loudspeaker connection and loudspeakers.
(Connect test loudspeaker.)
Is there loud noise now?

yes

yes → Replace radio unit.

no

5. Check antenna.

a. Measure resistance with ohmmeter between antenna base and battery minus pole.
Is resistance ca. 0?

yes

no → Make perfect ground connection between antenna base and fender (remove undercoating).

b. Measure resistance with ohmmeter between antenna tip and battery minus pole.
Is resistance more than 1 M-ohm?

yes

no → Replace antenna.

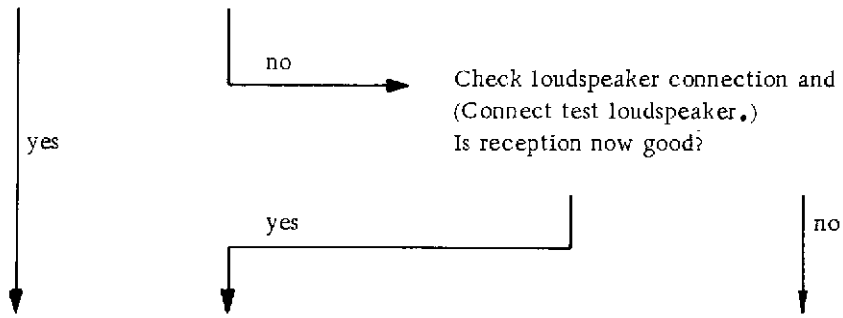
c. Connect separate antenna cable between antenna and radio outside of car.
Can stations be received now?

yes

no → Replace radio unit.

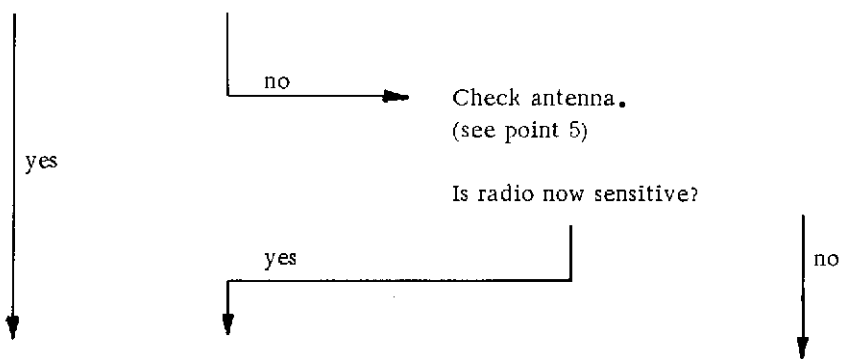
Replace antenna cable.

6. Is station reception clear and undistorted?



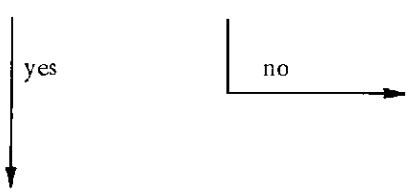
7. Is radio sensitive?
(Are remote stations received together with strong local stations?)
Note: Set sensitivity switch at position 1, see operating instructions.

Replace radio unit.

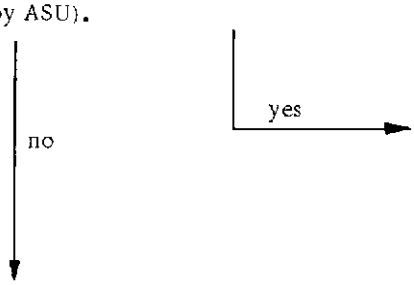


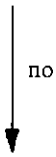
8. Can the stations be set exactly in all wave ranges?

Replace radio unit.

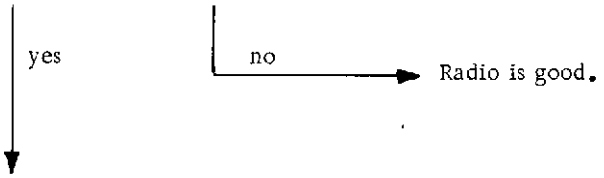


9. Is there interference when engine is not running?
Exceptions: high tension, lightening, street-car cables, street lamps (for USW reception eleminated by ASU).

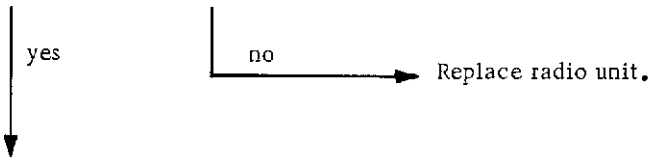




10. Is there interference when engine is running?



11. Connect new radio for testing. Is there still interference?



12. Check car shielding and, if necessary, replace shielding parts.

Typical Interference Noise

1. Interference from Ignition
Crackling noise depending on speed.
Run engine to speed of approx. 5000 rpm, turn off ignition and check whether interference noise stops.

2. Interference from Generator
Whistling noise depending on speed.
Remove generator belt and run engine briefly.
Whistling noise must not be heard.

3. Interference from Regulator
Clicking and crackling noise in certain speed ranges.
Switch on heavy-duty equipment (rear window defogger, headlights), which must change interference noise.

4. Interference from Tachometer
Clicking and crackling noise depending on speed.
Pull off plug receptacle G on central fuse/relay plate, which must cause interference noise to disappear.

5. Interference from Auxiliary Equipment (windshield wipers, blower etc.)
Howling and crackling noise.
Interference noise stops when equipment concerned is turned off.

6. Interference from Static Charge (in MW, LW and SW ranges)
Clicking and crackling noise at high road speeds and on dry road surfaces.
Interference noise stops when depressing the brake pedal.

Possible Interference Routes

Interference can basically make its way into a car radio via three different routes.

1. Interference via Antenna

   Turning the loudness control will also change the loudness of interference noise.

   Correction:
   a. Eliminate interference at its source by installing interference shields.
   b. Walk around car with a test antenna (or portable radio) and find the place on car radiating maximum interference. Eliminate interference at this point by installing ground straps (e.g. between engine hood and body) or tightening screws to have good connections between body parts.

2. Interference via Power Supply Line

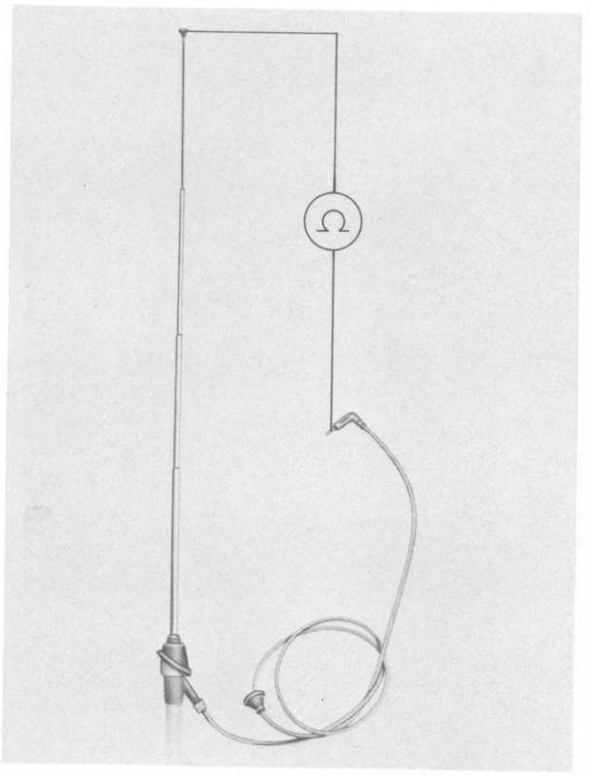
   Turning the loudness control will not change the loudness of interference noise.

   Correction:
   Install an interference suppressor in supply line.

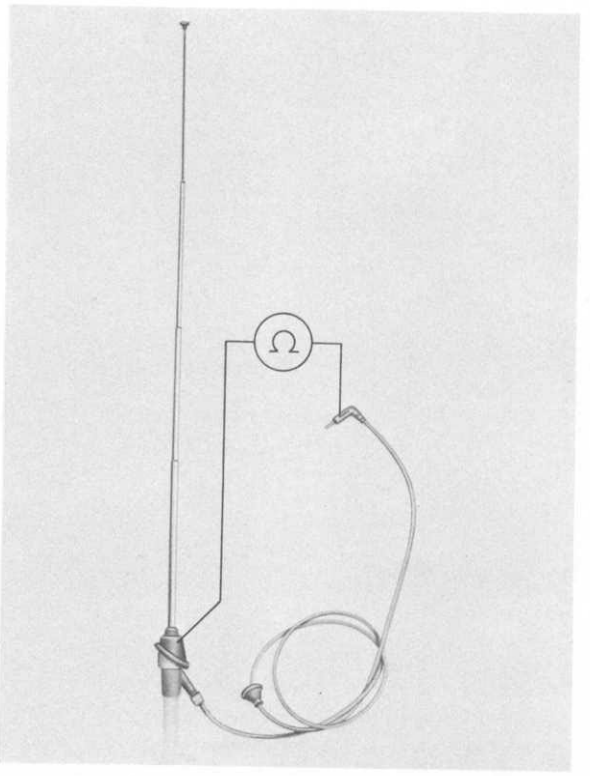
3. Interference via Loudspeaker Wires

   Correction:
   Route loudspeaker wires outside of radiation range of interfering lines and not parallel to to wire harnesses.

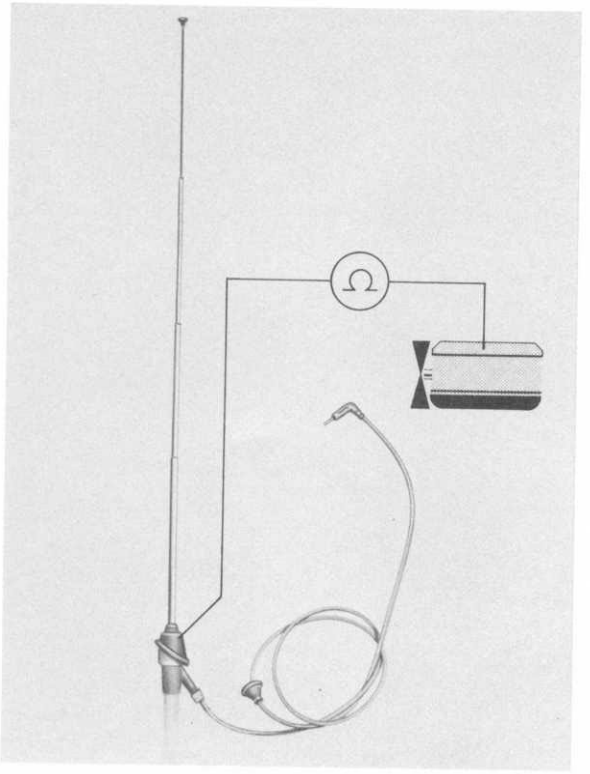
MEASURING RESISTANCE ON ANTENNA



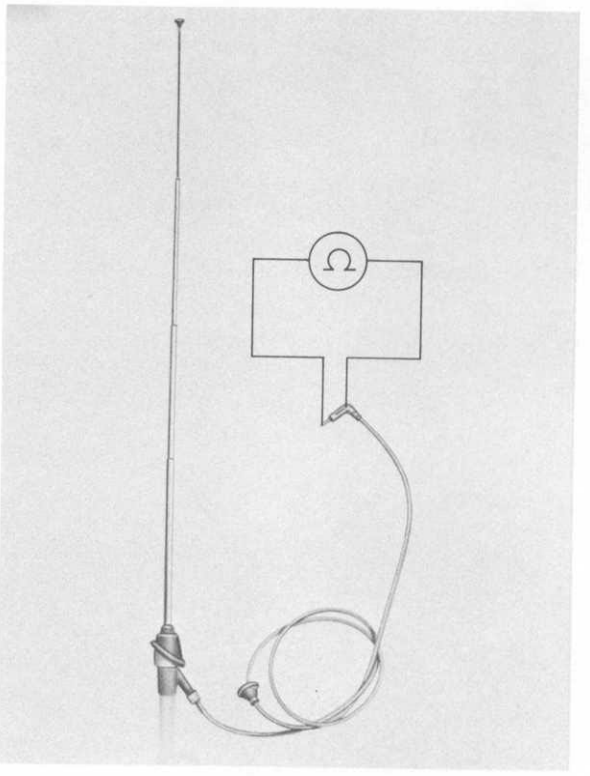
Through-flow = 0 to 3.5 ohms



Shielding = 0 ohms



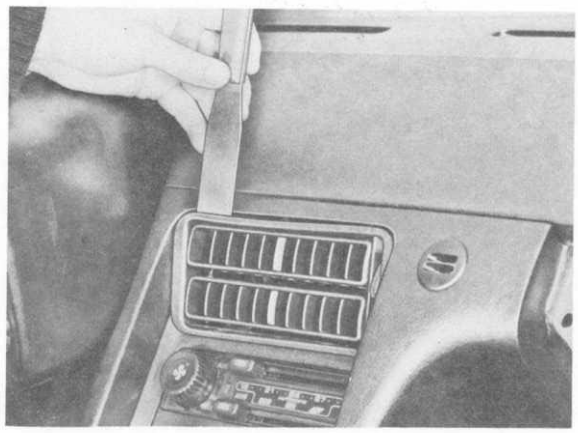
Basepoint ground to engine block = 0 ohms



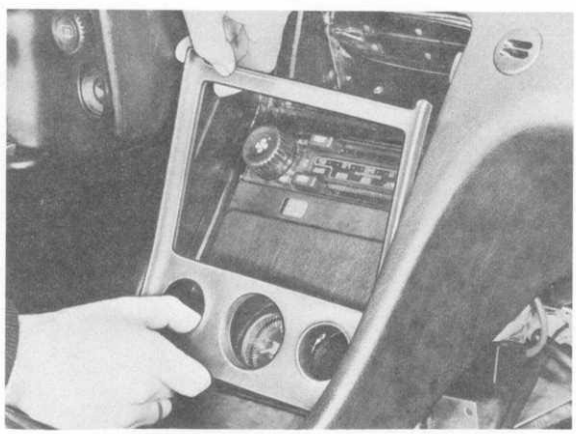
Insulation = at least 1 m-ohm

REMOVING MASK FOR RADIO OPENING

1. Push out center nozzle with a putty knife.

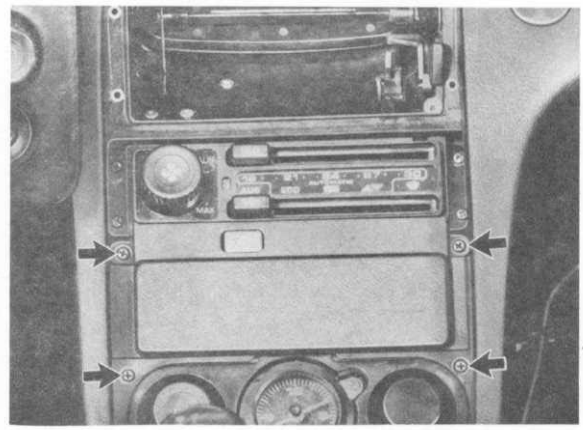


2. Pull off cover frame, starting at top.

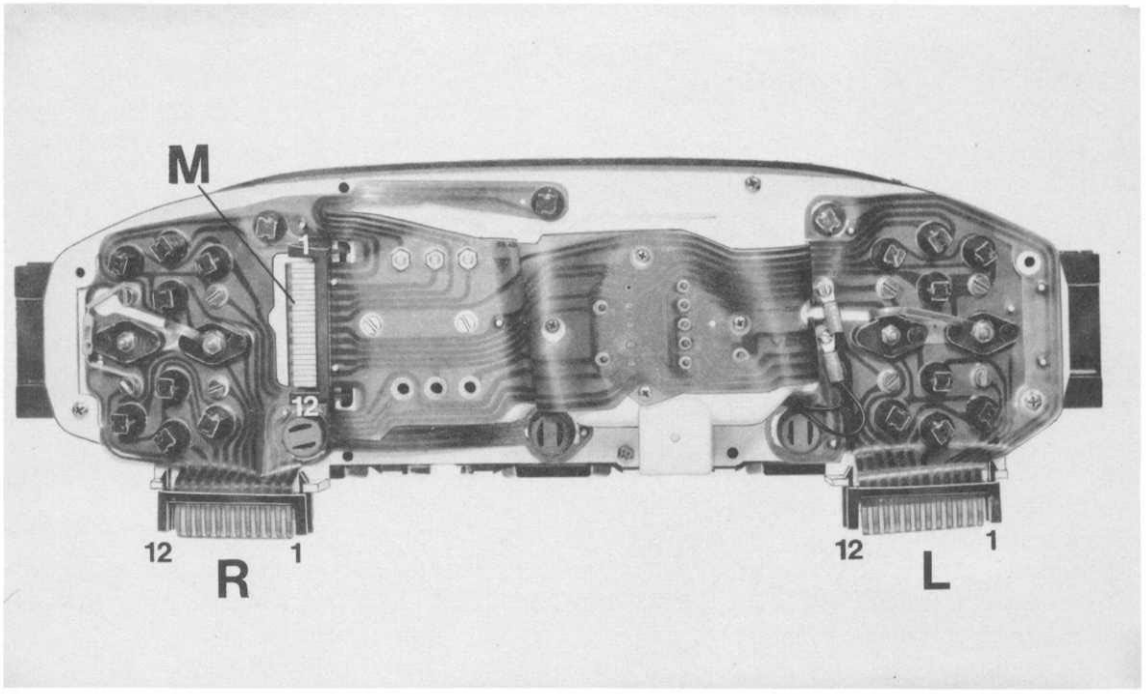


3. Disconnect and remove keyboard.

4. Remove mask.

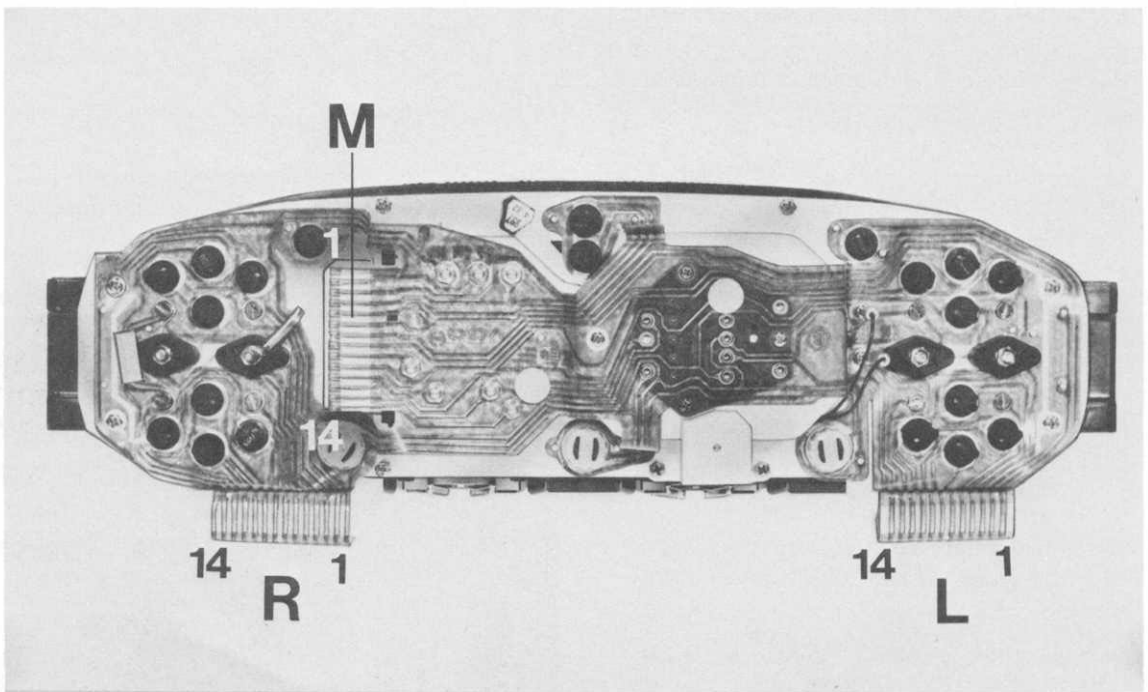


INSTRUMENT CLUSTER AS FROM 1979 MODELS



To operate the indicator lamps incorporated in the instrument cluster as from 1979 models, it was necessary to increase the number of wire connections. The three wire connection strips on the back of the instrument are designated R, M and L on the current flow diagrams.

INSTRUMENT CLUSTER AS FROM 1982 MODELS



Because of economy control (EC) the number of wire connections on the connection strips has been increased to 14 and plug connections are different.

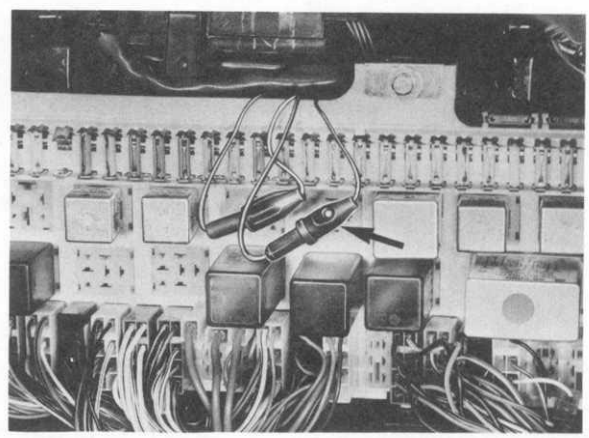
LOCATION OF FUSES AND RELAYS IN CAR - 1980 MODEL

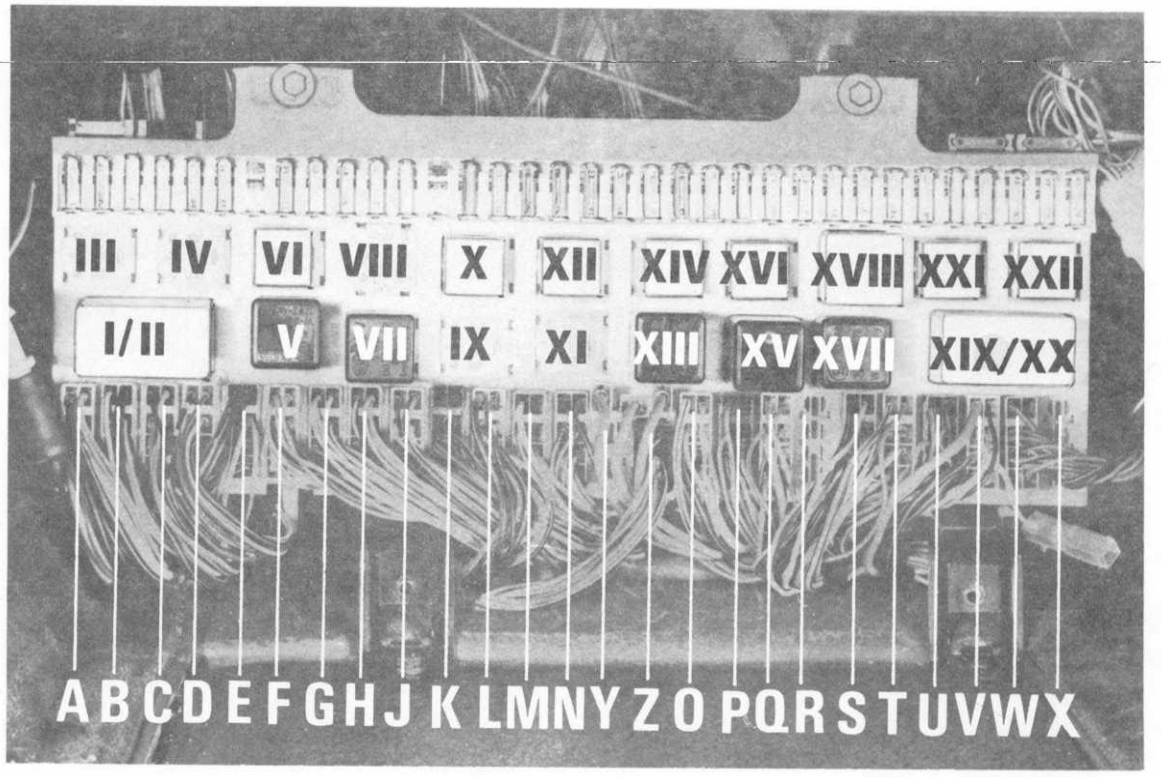
Fuses are numbered in order from left to right and appear on current flow diagrams as S 1 through S 34.

S 1 - Front fog lights
S 2 - Not used
S 3 - License plate lights, engine compartment light
S 4 - Switch lights (front fog lights, tail fog light, hazard lights, rear window wiper, rear window defogger), light for cigarette lighter
S 5 - Cigarette lighter
S 6 - Windshield wipers, pump for cleaning solution
S 7 - Not used
S 8 - Sunroof
S 9 - Backup lights, mirror control, rear window wiper, automatic air conditioner
S 10 - Stop lights, cruise control
S 11 - Instrument lights, light switch light, reset button light, selector lever light, clock light
S 12 - Instruments and indicator lamps in instrument cluster
S 13 - Not used
S 14 - Power seats
S 15 - Two-tone horns, power antenna, rear window wiper return action
S 16 - Condenser fan for A/C
S 17 - Fresh air blower, A/C
S 18 - Rear window defogger, outside mirror heating
S 19 - Retractable headlight motor
S 20 - Pump for headlight washer
S 21 - Window controls, central locking system
S 22 - Fuel pump, control pressure regulator, auxiliary air regulator
S 23 - Clock, glove box light, inside lights, vanity mirror light
S 24 - High beam left, high beam indicator
S 25 - High beam right
S 26 - Low beam left
S 27 - Low beam right
S 28 - Side marker lights left
S 29 - Side marker lights right
S 30 - Turn signals front left
S 31 - Turn signals rear left
S 32 - Turn signals front right
S 33 - Turn signals rear right
S 34 - Not used

Note

There are two 0.4 A fuses in inline fuse holders behind the central fuse/relay board for the central locking system.

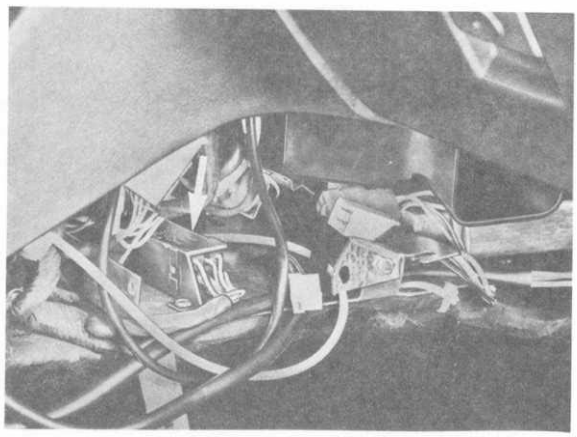




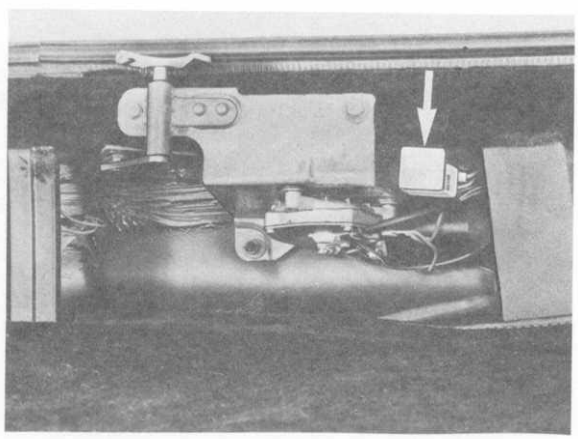
I + II	- Rear window defogger	XV	- Bridge (extra cleaning pump)
III	- Not connected	XVI	- AFC fuel injection
IV	- Not connected	XVII	- Fuel pump
V	- Hazard light/flasher	XVIII	- A/C condenser fan
VI	- Window control	XIX + XX	- Headlight combination
VII	- Headlight cleaner pump	XXI	- Fresh air blower
VIII	- Not connected	XXII	- Defroster
IX	- Not connected		
X	- Horn		
XI	- Not connected		
XII	- Front fog light		
XIII	- Wiper intermittent action		
XIV	- Bridge (start relay for automatic transmission)		

Note

Time action relay for seat belt warning system is located in center console in front of radio.

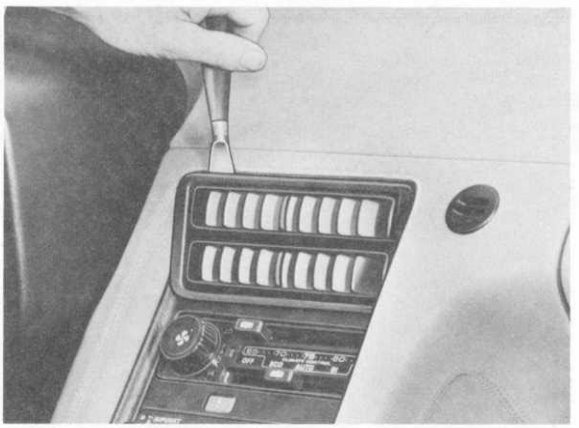


Rear window wiper relay is located on left side behind the tool plate at rear.

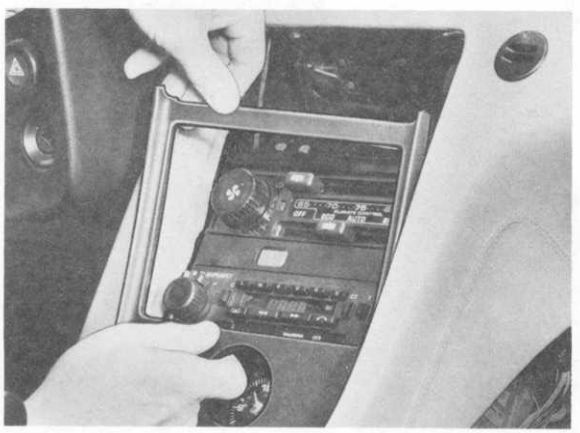


REMOVING AND INSTALLING RADIO (DIGITAL RADIO BAMBERG QTS)

1. Press out center vent with a putty knife.



2. Pull off cover beginning at top.

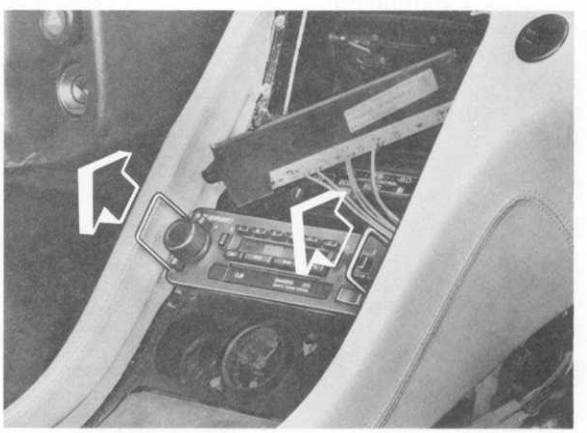


3. Unscrew and remove push button plate.

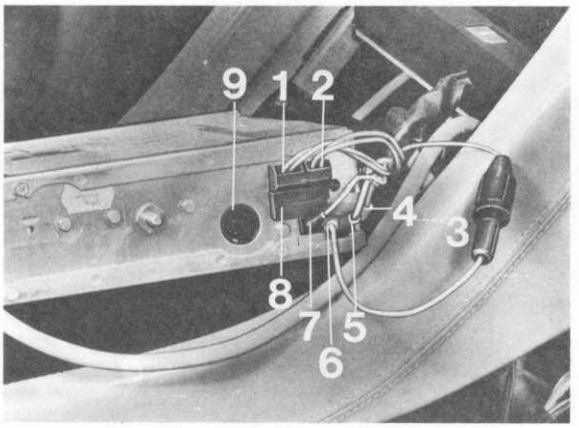


4. Unscrew tray underneath glove box and trim on side of center console.

5. Push assembly bar into openings of radio mask until it engages.
Pull radio out of center console.



6. Pull off plugs on radio.



1 – Speaker connection, right

2 – Speaker connection, left

3 – Fuse holder (2.5 A fuse)

4 – Ground connection

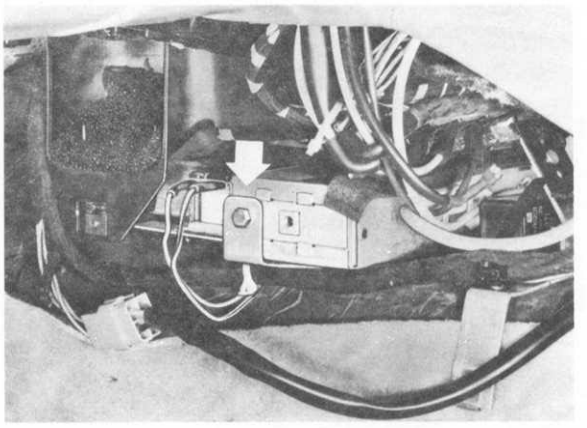
5 – Plus connection wired via fuse and ignition lock

6 – Plus connection term. 30 (digital clock and station memory)

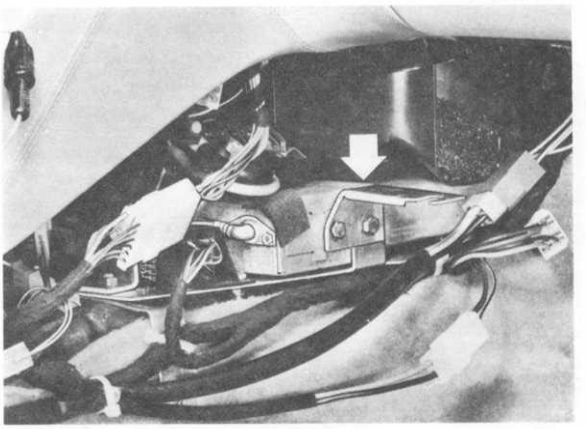
7 – Automatic antenna conn.

8 – Fuse 3.15 A (remove cap)

9 – Remote control connection



Unscrew radio mounting on right side and remove radio from left side.



7. Unscrew radio mounting on left side.

CHECKING FUEL CONSUMPTION INDICATOR

A F C

1. Check connecting wires and plug connections between AFC control unit and instrument cluster for good contact and breaks.

2. The sensor signal (duration of injection) can be checked with an oscilloscope on the central electric plug L, term. 5, or on the instrument cluster (center multiple-pin plug, term. 11). The square wave signal changes frequency when the engine speed changes.

3. If the instrument cluster receives the sensor signal, check the printed circuit and, if necessary, replace the instrument.

4. If there is excessive deviation in the upper range between displayed and actual consumption, check the speedometer signals on left multiple-pin plug term. 2 by turning the driven wheels.

5. If the fuel consumption indicator does not return to zero after switching off the ignition, check whether center multiple-pin plug term. 14 of instrument cluster has + 12 volts (check fuse no. 23).

TROUBLESHOOTING CENTRAL WARNING SYSTEM

Function:

The central warning system monitors the following functions in the car.

1 – Oil pressure

2 – Oil level

3 – Brake circuit failure

4 – Brake fluid level

5 – Parking brake

6 – Coolant level

7 – Coolant temperature

8 – Fuel reserve

9 – Washer fluid level

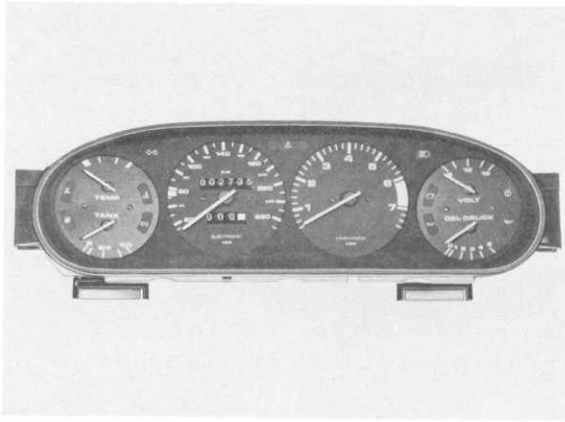
10 – Brake pad wear

11 – Stop lights

12 – Tail lights

Any deviation from specified condition or a defect will be displayed by the central warning lamp flashing or coming on, depending on priority, the acknowledgement button and the pertinent indicator lamp. Beginning with 1979 models the acknowledgement button comes on together with the central warning lamp.

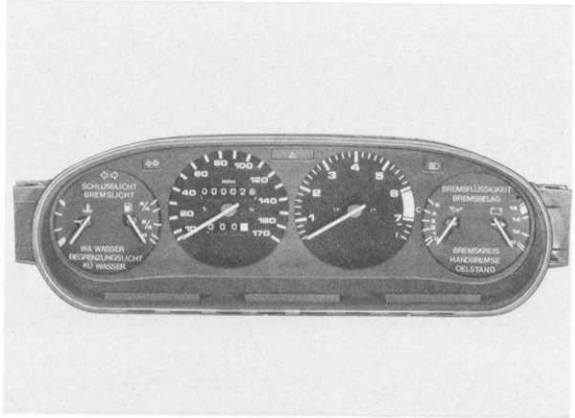
1978 Models



Indicator Panel for 1978 Models



Beginning with 1979 models

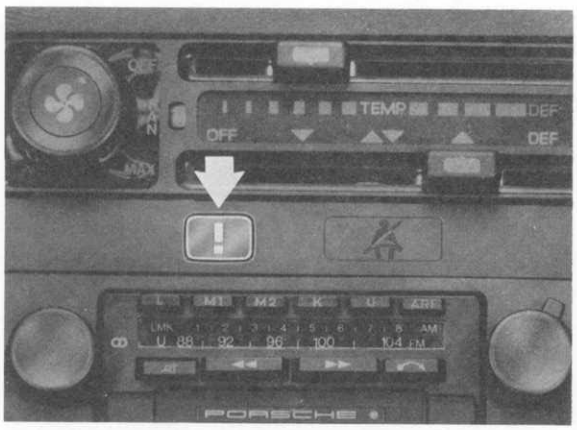


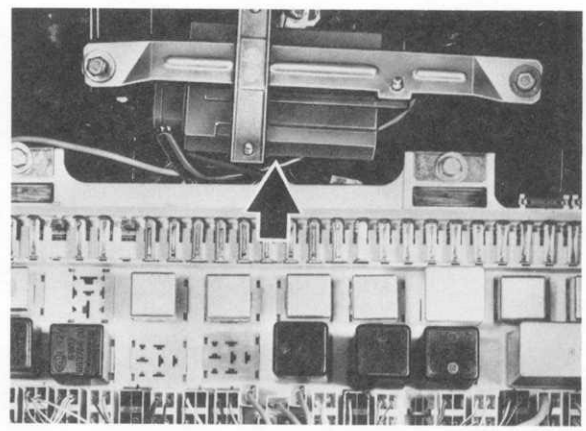
The central warning unit contains a "bulb check" function to check the light bulbs. All indicator lamps, the central warning lamp and the acknowledgement button lamp must come on after turning on the ignition.

Voltage is supplied to the central warning unit via term. 50 while starting the engine and cancels the "bulb check" function. All indicator lamps go out except for the stop light indicator (goes out when operating brake pedal first time) and parking brake indicator (when parking brake is applied).

Monitoring the tail lights and stop lights is accomplished with a bulb check control unit, which together with the central warning unit will activate the pertinent indicator lamp when a bulb is defective or a wire has a break.

Acknowledgement button beginning with 1979 models





Types of Defects

The following defects could occur in the central warning system.

1. Check lamp(s) do not come on when checking light bulbs.

2. Indicator lamp on continuously, instead of flashing (for functions 1 – 4).

3. Indicator lamp not on, even though monitored function is not okay.

4. Indicator lamp on, even though monitored function is okay.



CWL = Central Warning Lamp

ABL = Acknowledgement Button Lamp

IL = Indicator Lamp (or Sign Light)

FUNCTION TEST ON CENTRAL WARNING UNIT

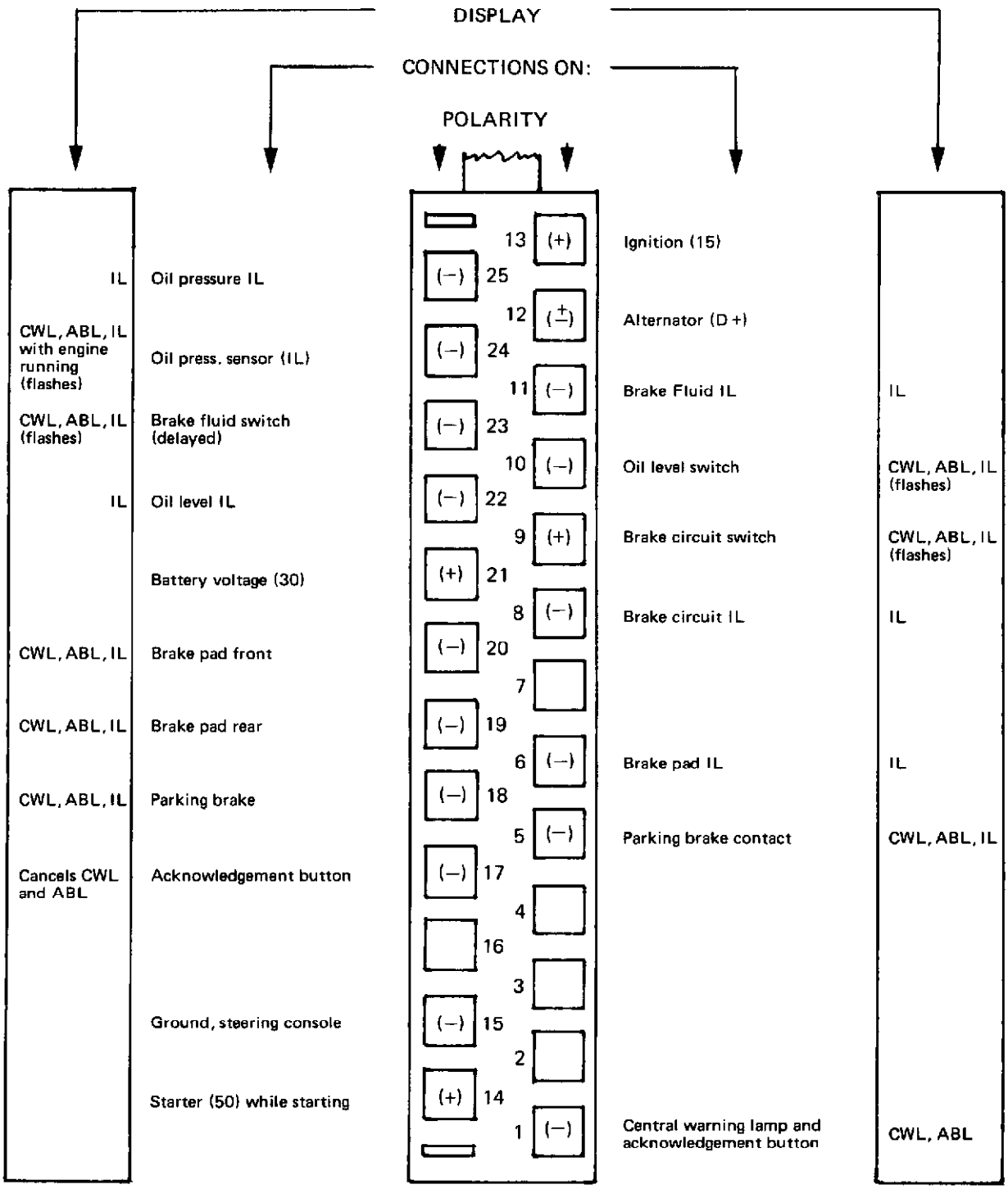
This test is applied to find a defect in the central warning unit itself.

Use a piece of wire to make connection between the connected multiple-pin plugs of the central warning unit and the pertinent polarity of the point being tested.

Refer to the central warning unit connection plan for designations and polarity.

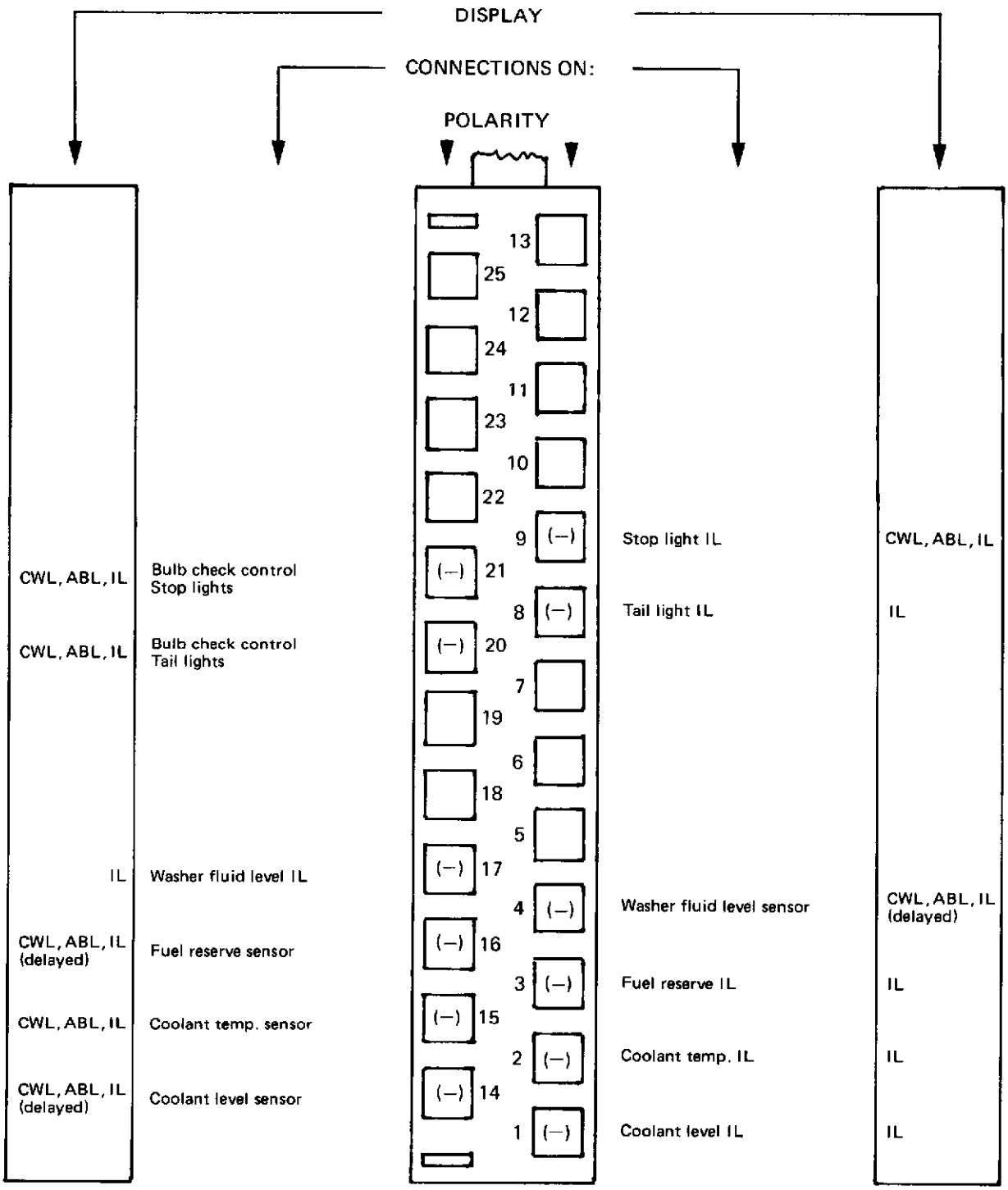
CENTRAL WARNING UNIT CONNECTION PLAN

BLACK PLUG



CENTRAL WARNING UNIT CONNECTION PLAN

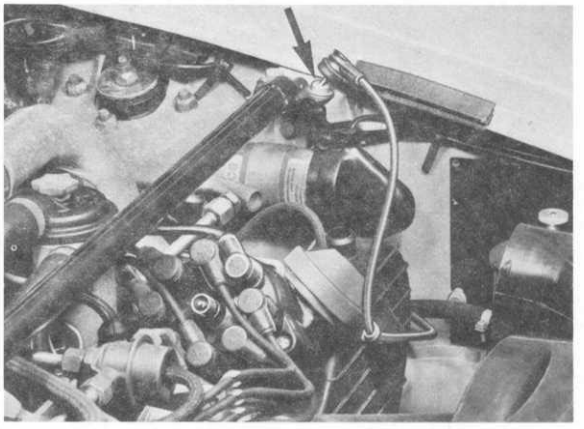
YELLOW PLUG



Single Component Function Test

Observe the following points when checking the wiring.

- Plugs must be connected correctly.
- Plug contacts must not be deformed or pushed back.
- Wires must be checked for breaks or shorts.
- Ground connections must not be loose or corroded.



Turn ignition on and operate starter briefly. All indicator lamps should go out with exception of stop light and battery charge indicator lamps. Operate brake pedal to cancel the stop light indicator lamp.

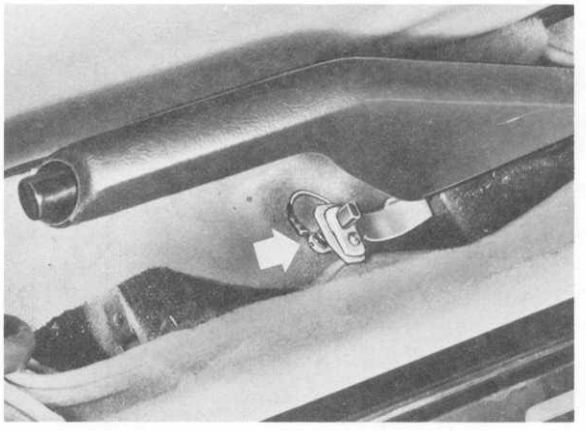
Note

To be able to test the single components on a stopped engine, voltage must be supplied from term. 50 to the central warning unit without having the engine start.

This is accomplished by pulling off term. 4 ignition wire on the distributor and connecting it on ground (engine cross member mounting bolt).

1. Parking Brake:

Pull up parking brake lever or connect parking brake contact with ground.



CWL, ABL and parking brake IL should come on. Lamps must go out when releasing the parking brake or disconnecting ground.

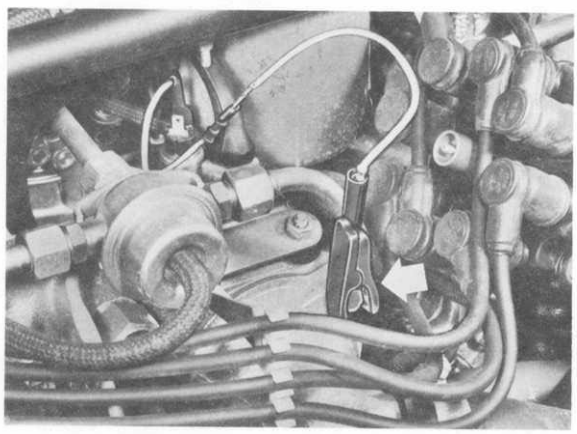
Switch Function:

Parking brake released = contact open
Parking brake applied = contact made

CWL, ABL and coolant temperature IL should come on. Press acknowledgement button, CWL and ABL should go out, while IL remains on.

2. Coolant Temperature:

Pull off flat female plug on sensor term. W (narrow female plug) and connect with ground.



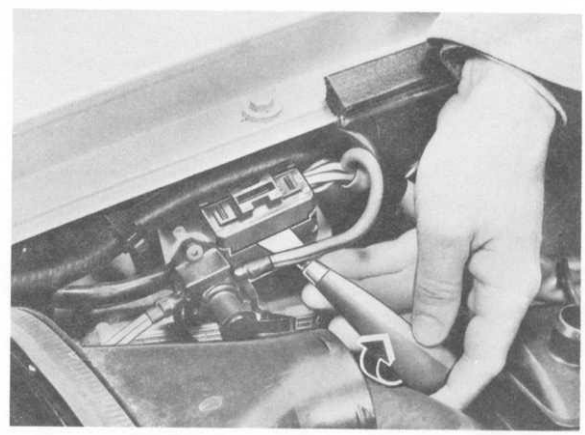
IL should go out when disconnecting ground.

Switch Function:

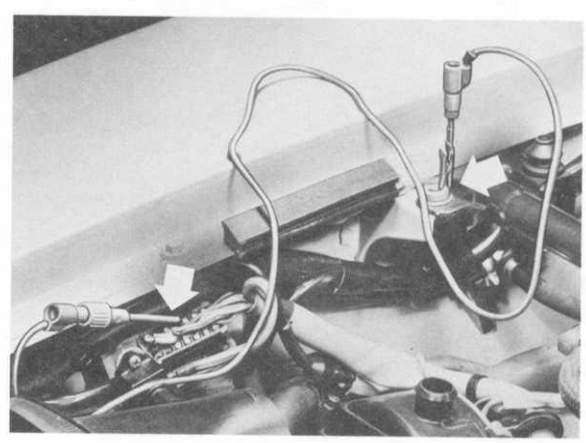
Temperature too high = contact made
Temperature normal = contact open

3. Oil Level:

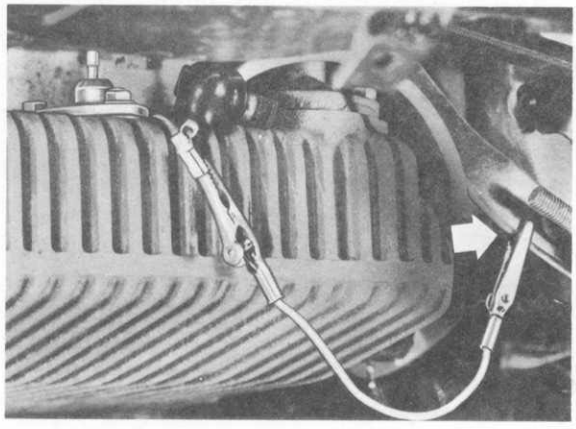
Remove cap on multiple-pin plug in engine compartment at front right side (do not disconnect plug).



Connect term. 6 with ground.



This test could also take place direct on the sensor. Pull off plug on sensor and connect with ground.

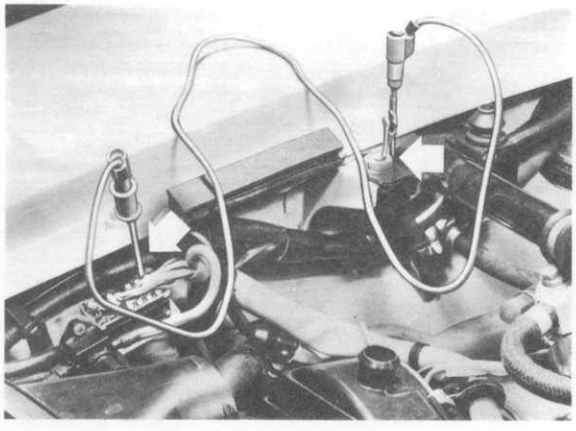


Switch Function:

Oil level too low = contact made
Oil level normal = contact open

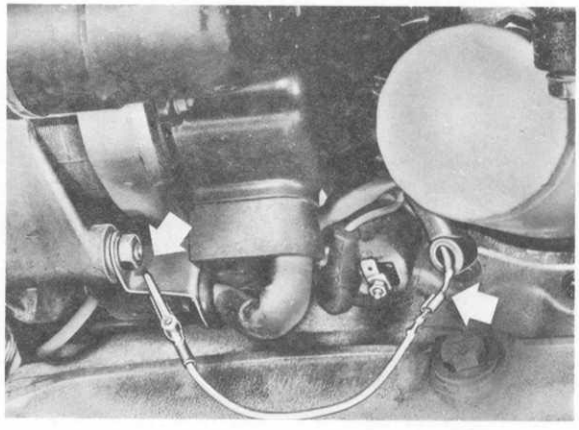
4. Oil Pressure:

Connect term. 2 of multiple-pin plug in engine compartment with ground.



CWL, ABL and oil pressure IL should start to flash after about 2 seconds. Press acknowledgement button, lamps should continue flashing. Disconnect ground on term. 2, lamps should go out.

Test on Oil Pressure Switch

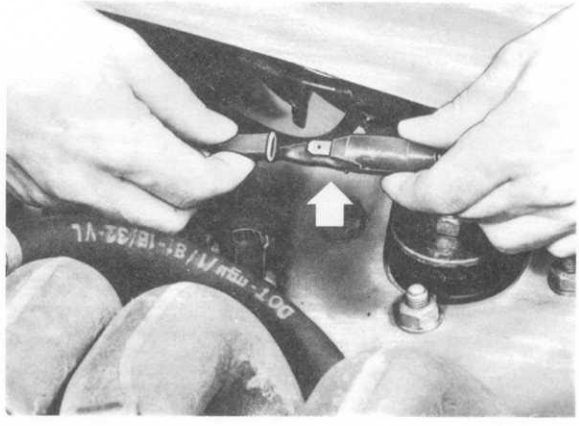


Switch Function:

No oil pressure = contact made
Oil pressure = contact open

5. Brake Pad Wear:

Disconnect one plug of pad wear control (e. g. in engine compartment at front left next to brake master cylinder).



CWL, ABL and brake pad IL should come on. Press acknowledgement button. CWL and ABL should go out, while IL remains on.

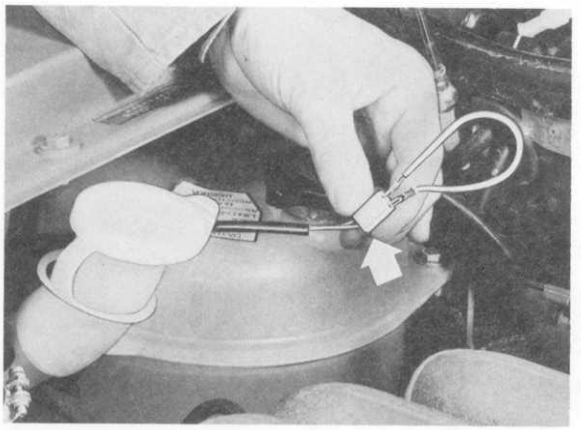
Function:

The wire connection will be broken and pad wear reported when the warning contact in one of the brake pads has been ground off.

The display can be cancelled by turning the ignition off.
The procedures described at the beginning of the function test will then be necessary for the following tests.

6. Coolant Level:

Pull off and bridge plugs on float switch.



CWL, ABL and coolant level IL must come on after approx. 20 seconds.
Press acknowledgement button. CWL and ABL should go out and IL must remain on.
Disconnect bridged plugs, IL should remain on.

Switch Function:

Coolant level too low = contact made
Coolant level normal = contact open

Indicator lamp goes out when turning ignition off.

7. Washing Fluid Level:

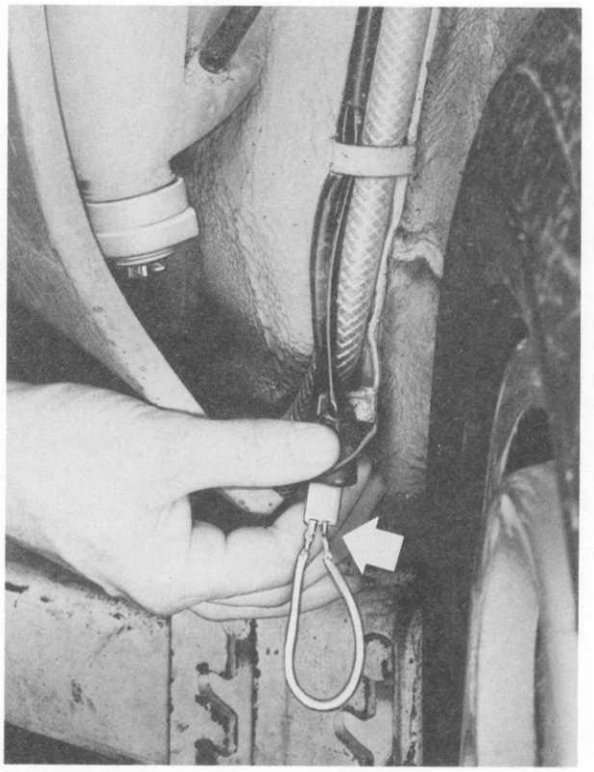
Open cover for central electric board in passenger's footwell.
Connect plug Q, term. 6 (green/blue) on ground with a piece of wire.

CWL, ABL and washing fluid IL should come on after approx. 20 seconds.
Press acknowledgement button. CWL and ABL should go out and IL must remain on.
Indicator lamp goes out when turning ignition off.

Switch Function:

Level too low = contact made
Level normal = contact open

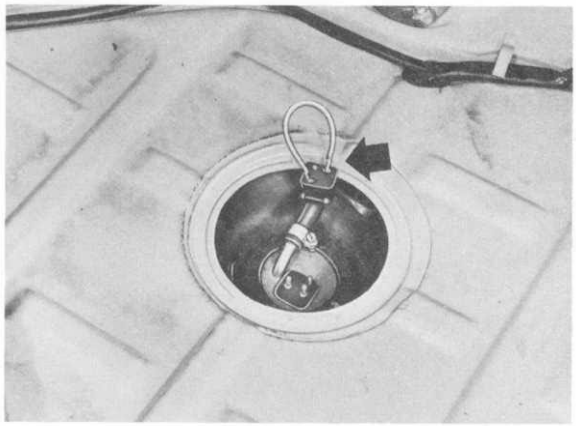
Testing on Float Switch



The float switch is located in the right wheel house behind the rear cover.

8. Fuel Tank Reserve:

Remove cover in trunk on right side. Pull off plug on transmitter and bridge term. W and T with a piece of wire.



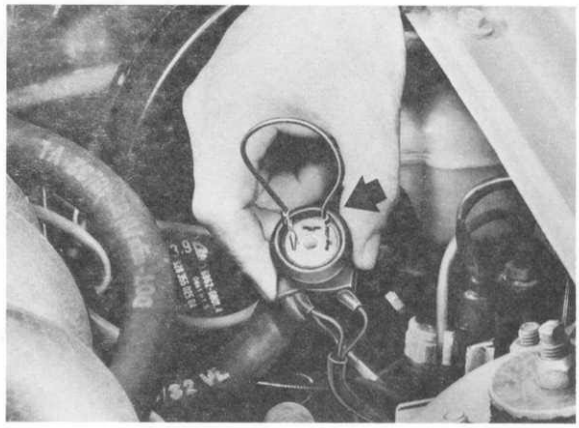
CWL, ABL and tank reserve IL should come on after approx. 10 seconds.
Press acknowledgement button. CWL and ABL should go out, while IL must remain on.
Indicator lamp will go out when turning ignition off.

Switch Function:

Reserve fuel level = contact made
Greater fuel level = contact open

9. Brake Circuit Failure:

Pull off plug on one stop light switch below brake master cylinder and bridge opposite female plugs (term. 81 and 82 a) with a piece of wire.



CWL, ABL and brake circuit IL must flash. Press acknowledgement button. All lamps should continue to flash. Disconnect bridge and connect plug on stop light switch. Lamps should continue to flash.

Note

Brake circuit failure indicators can only be cancelled by disconnecting battery briefly.

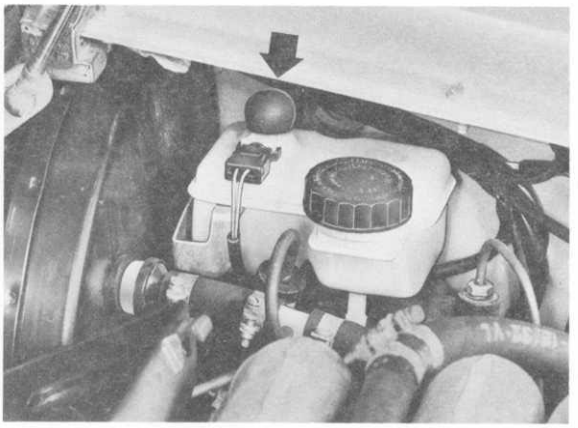
Switch Function:

No brake pressure = Term. 81 and 81 a made
Term. 81 and 82 a open

Brake pressure = Term. 81 and 81 a open
Term. 81 and 82 a made

10. Brake Fluid Level:

Press down and hold float switch above brake fluid tank at least 20 seconds or bridge plug.



CWL, ABL and brake fluid IL should start to flash after approx. 20 seconds.
Press acknowledgement button. Lamps should continue flashing.
Lamps will go out after switching ignition off.

Switch Function:

Fluid level too low = contact made
Fluid level normal = contact open

11. Tail Lights:

Turn parking lights on. Remove tail light bulb from one tail light assembly.

CWL, ABL and tail light IL should come on after approx. 4 seconds.
Press acknowledgement button.
CWL and ABL should go out. IL must remain on.
Tail light IL should go out after installation of light bulb.

12. Stop Lights:

Remove stop light bulb from one tail light assembly. Operate brake pedal.

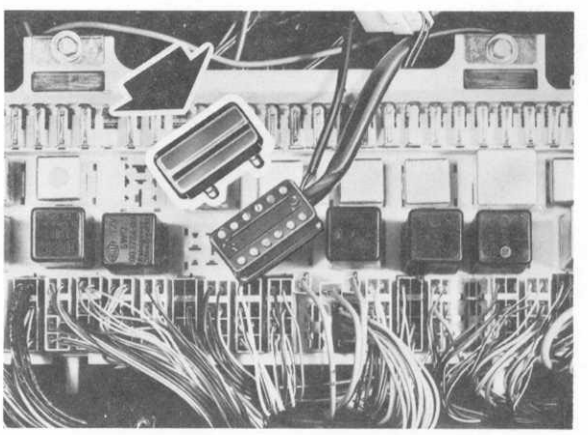
CWL, ABL and stop light IL should come on.
Press acknowledgement button. CWL and ABL should go out. IL must remain on. Install light bulb again. IL should go out only after operating the brake pedal again.

Note

Light bulbs of same wattage must be installed on both sides. If not, the indicator will be activated even when both bulbs are functioning. Should the tail light or stop light indicator lamps come on in spite of perfect condition tail light assemblies, the defect could be in the central warning unit or bulb check control.

When the bulb check control is defective, both tail lights and/or both stop lights could be malfunctioning.

An adapter, Part No. 928.641.610.00, could be installed in place of the bulb check control as an emergency solution. The adapter will bridge the concerned connections.



In this case no warning lamps would be activated for failure of a stop or tail light.

Note

The central warning system is only available as optional extra (M) equipment in Type 928 cars beginning with 1980 model.
An adapter is installed standard in the same housing instead of the central warning system.

The monitored functions are limited to:

1 – Oil pressure

2 – Brake circuit failure

3 – Brake fluid level

4 – Brake pad wear

5 – Parking brake

6 – Coolant temperature

7 – Fuel tank reserve

There is not a red acknowledgement button in the center console then.

ALARM SYSTEM 928

Description:

The alarm system is switched on and off when locking and unlocking the doors with the S key (long key).
Beginning with 1981 models the alarm system is also switched off by unlocking the tailgate and switched on by locking the tailgate by way of an additional locking movement with the S key.

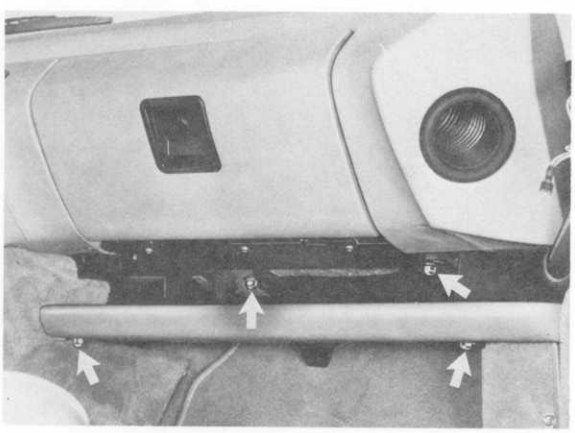
Using the auxiliary key will mean only mechanical locking and unlocking of both doors and the tailgate.

The alarm is set off by opening the doors, tailgate or engine hood.

After activation of the alarm system a separate alarm horn will sound off intermittently for about 30 seconds (uninterrupted sound for Swiss version) and can be reactivated by repeating the described actions.
The engine can also not be started.

Removing and Installing Alarm Control Unit

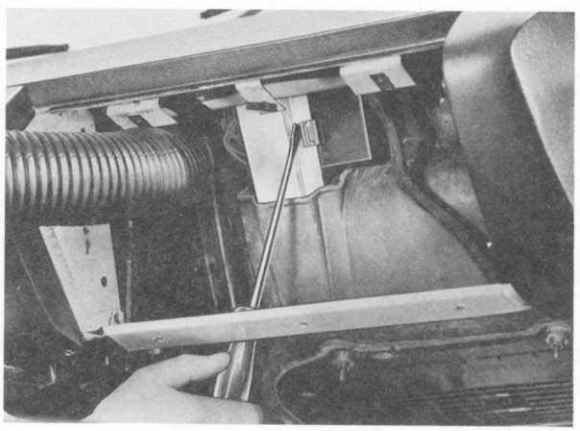
1. Unscrew tray underneath the glove box.



2. Disconnect two-pin plug underneath glove box on right side and remove glove box.

3. Pull off heating hose on right side.

4. Press alarm control unit off of brace at the retainer clamp with a screwdriver.



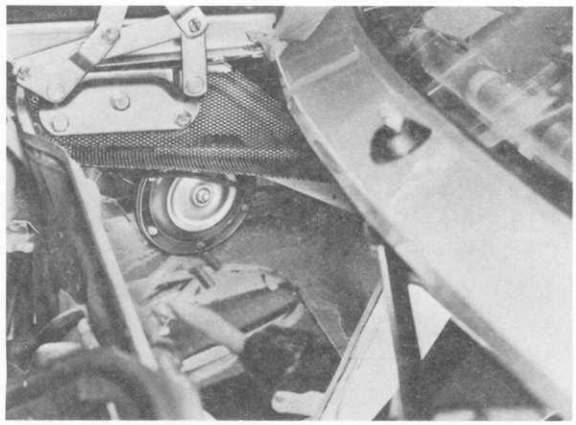
5. Pull off both plugs on alarm control unit.

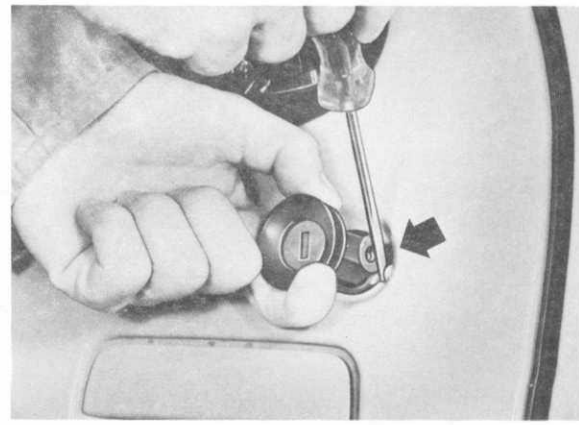
Removing and Installing Alarm Horn

1. Remove blower (see page 87 - 16 of this repair manual).

2. Unscrew right engine hood hinge and remove grill.

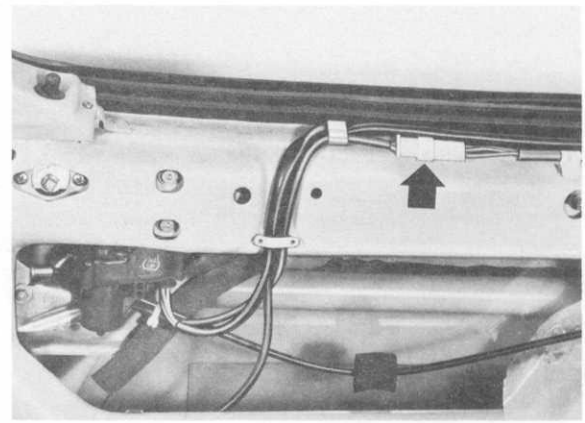
3. Detach connecting rod.





3. Unscrew alarm horn (M 10 hexagon nut, 17 mm wrench) and pull off wires.

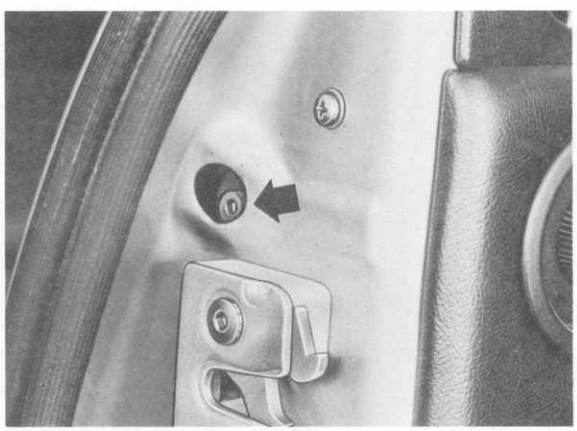
4. Disconnect plug and remove lock cylinder.



Removing and Installing Lock Cylinder

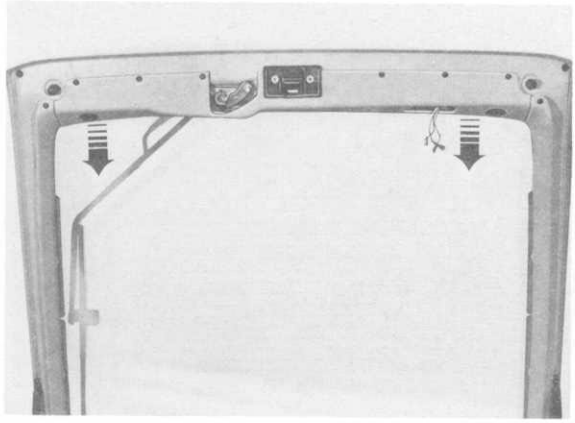
1. Remove door panel.

2. Unscrew mounting bolt.

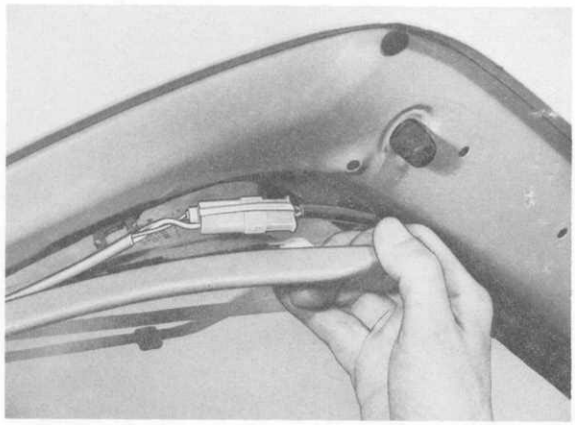


Removing and Installing Tailgate Lock Upper Section

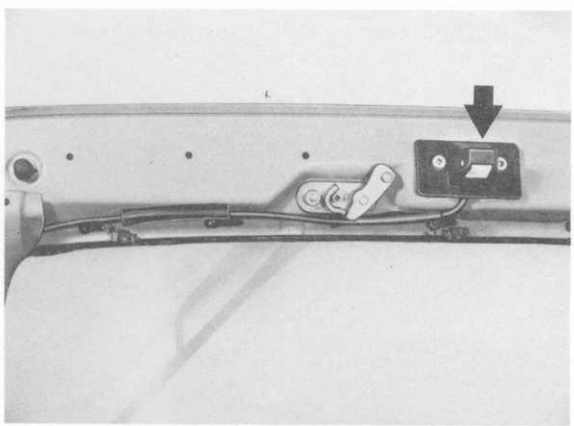
1. Remove trim panel on bottom of tailgate by pulling out spreader rivets and pressing trim panel forward out of retaining clips. Disconnect trunk light.



2. Disconnect trim panel on left side and remove plug of alarm switch.

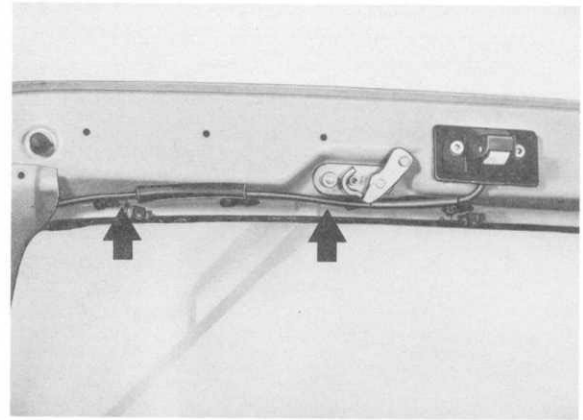


3. Unscrew and remove lock upper section.

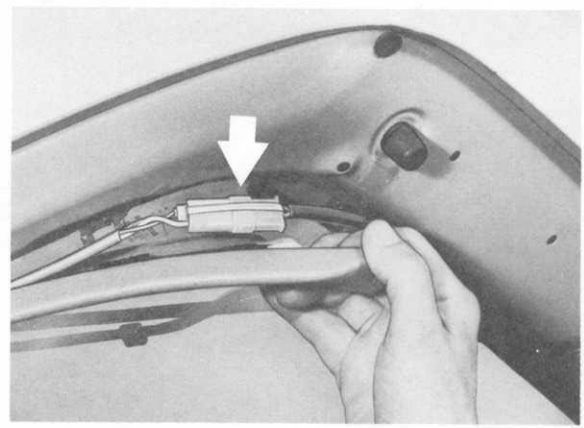


Note

Secure wires with adhesive tape in area of rear window wiper drive when installing.



Secure plug connection with adhesive tape to prevent unintentional disconnection.

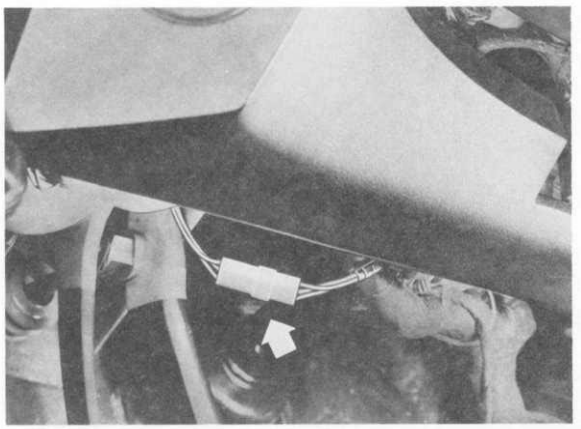


Troubleshooting Alarm System:

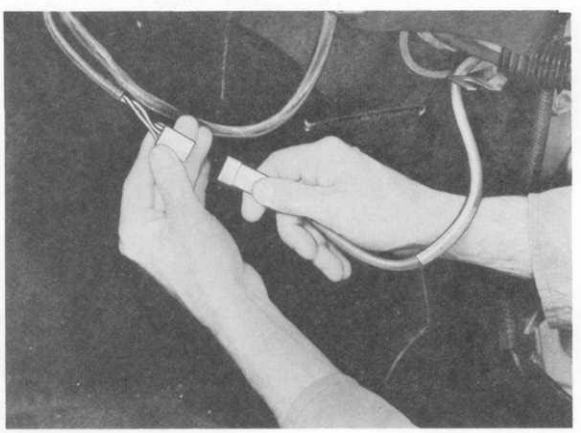
Check contact switch on lock cylinder.

1. Disconnect plug of lock cylinder contact switch being checked outside of door or tailgate.

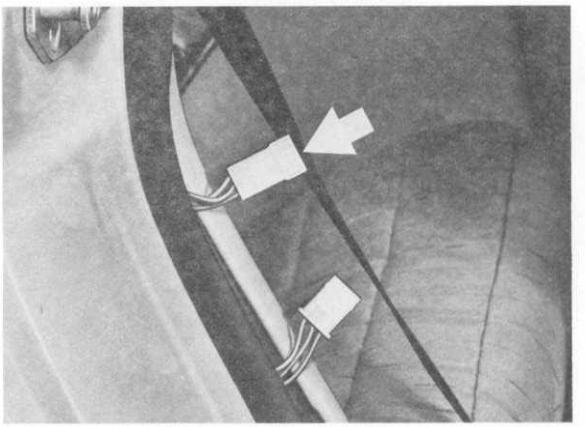
   – Plug for driver's door underneath instrument panel on left side.



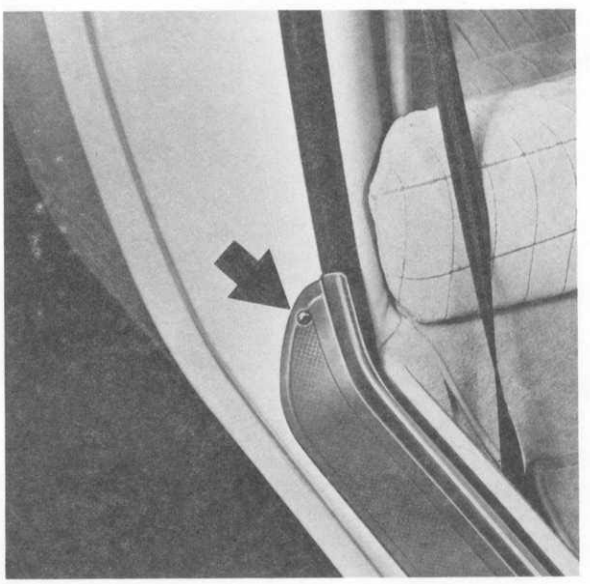
   – Plug for passenger's door underneath instrument panel on right side.



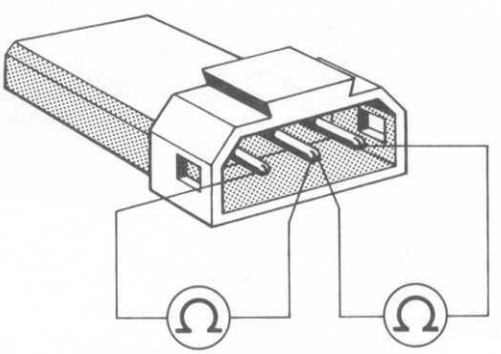
   – Plug for tailgate behind side panel trim on right side.



Disconnect door sill molding and side trim panel and press off carefully. Do not bend trim panel.



2. Connect ohmmeter on plug of wire leading to door.

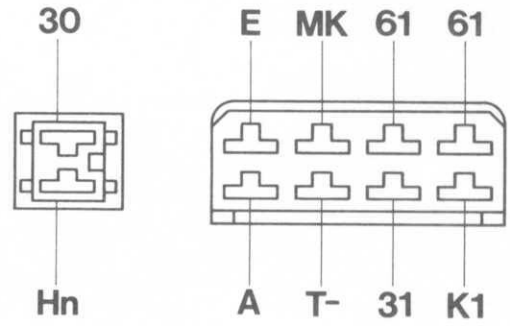


– Activating alarm system = connection of meter on brown and brown/red wires.

– Deactivating alarm system = connection on brown and brown/green wires.

3. Lock or unlock pertinent lock cylinder with the S key.

   Meter should not display resistance when switching the contact switch.



Note

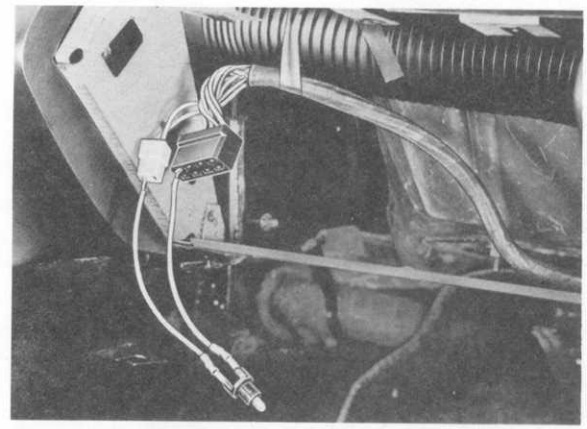
Contact switch can only be replaced together with the lock cylinder.

Checking Wires and Connections

1. Remove alarm control unit.
   Pull off both plugs on alarm control unit.

2. Connect test lamp (max. 3 W) on term. 30 and Hn of two-pin plug.
   When lamp comes on, there is battery voltage and wire to alarm horn and term. 31 on disconnected eight pin plug is okay.

3. Leave test lamp connected on term. 30 and make other connection on term. E.



Activate the alarm system with S key on both doors and the tailgate.
Lamp must come on briefly.

4. Connect test lamp on term. 30 and A.
   Deactivate alarm system on both doors and tailgate.
   Lamp should come on briefly.

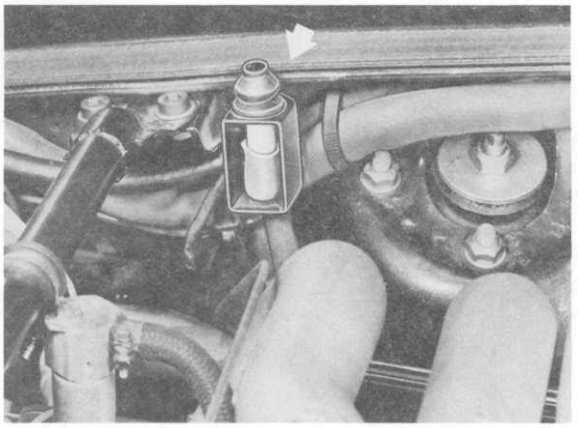
5. Connect test lamp on term. 30 and T. Open and close both doors and tailgate separately. Lamp should come on while opening.

6. Connect test lamp on term. 30 and MK. Open engine hood – lamp should come on.

Note

The switching point of the engine hood contact switch must be checked to prevent unintentional activation of the alarm system when car is shaken while alarm system is set.

Open engine hood slowly. Lamp should go out immediately before engagement in lock. Adjust switch if necessary.



7. Connect test lamp on term. 30 and 61 (connect on both term. 61 separately).

   – Lamp comes on and goes out when turning ignition on (connection via central electric board Z 6).

   – Lamp comes on and goes out after starting engine at high speed (connection via central electric board Z 1).

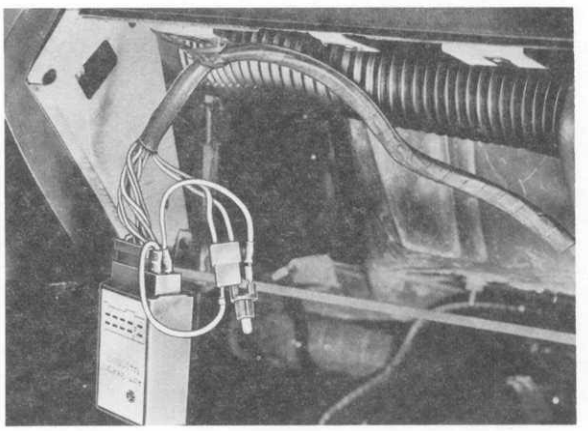
8. Connect test lamp on term. 30 and K 1. Lamp should come on.

Checking Function of Control Unit

The use of a test lamp instead of the alarm horn is recommended (noiseless).

1. Connect eight-pin plug on alarm control unit. Two-pin plug remains disconnected.

2. Connect term. 30 (red wire) on control unit with a piece of wire. Connect test lamp on term. Hn of control unit and red/white wire of two-pin plug.



3. Lock door with S key (set alarm system) and unlock door with the auxiliary key. Lamp should flash, i. e. alarm should be activated. Deactivate system – lamp goes out. Make test on both doors and tailgate.

4. Activate alarm on driver's door and do not deactivate. Lamp flashes about 30 seconds. Open engine hood. Alarm should be activated again.

5. Start engine when system has been activated. Engine should not start.

6. Disconnect test lamp and connect two-pin plug on control unit. Check function of alarm horn by activating alarm again.

If functions are not fulfilled, replace alarm control unit.

Note

A defect in the control unit could cause failure of the ignition or fuel pump under certain circumstances, even when the alarm system is not activated.

If a new control unit were not immediately available in this case, the following measure will provide help.

Pull off plug Z on central electric board and bridge terminals 1 and 6 on central electric plug.

This will stop function of the alarm system.

SERVICE INSTALLING BLAUPUNKT RADIO SQR 22 (COLOGNE, ATLANTA OR MONTEREY)

Applicable for cars up to and including 1982 models.

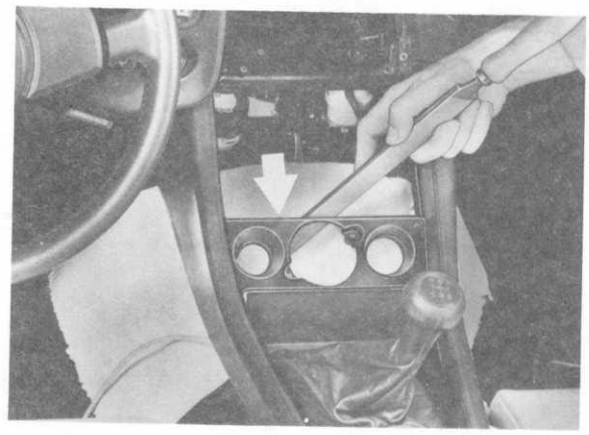
Parts of 1983 model required for installation:

- Mask, upper
- Mask, lower
- Digital clock

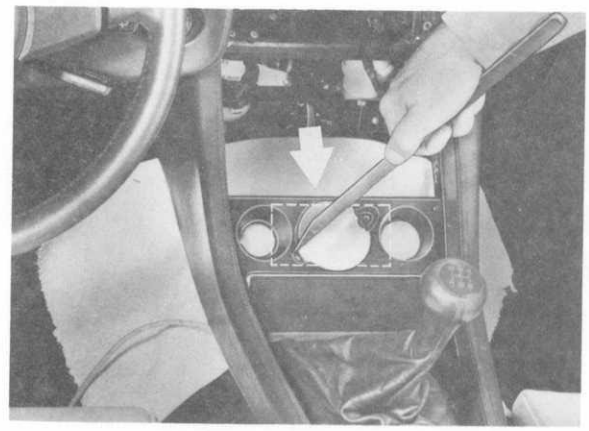
Additional Part Requirements:

- Two M 5 x 10 hexagon bolts with nuts and washers (for installation of solenoid valve plate)
- Six M 3.5 x 16 Allan screws

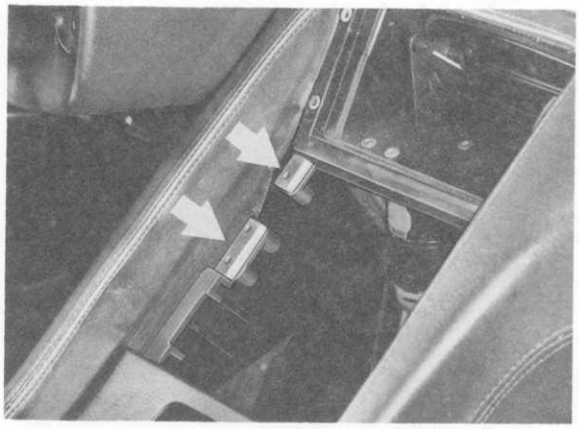
1. Remove shelf and trim on sides of center console.
2. Remove center vent and cover frame.
3. Remove control switches, display panel and clock.
4. File back radio opening at bottom to edge (approx. 2 mm), catching burrs with a rag.

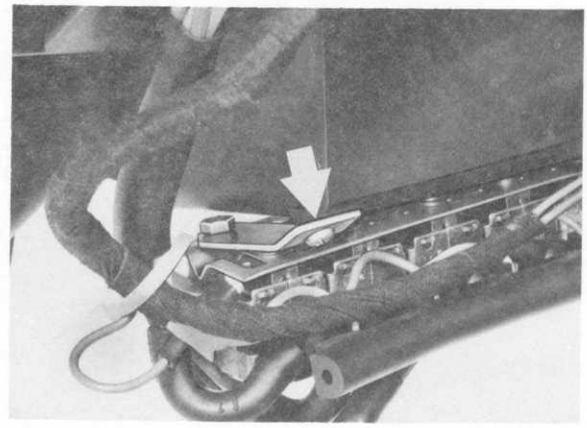


5. Mark location of opening for new digital clock and cut out opening with a suitable saw. Deburr edges.



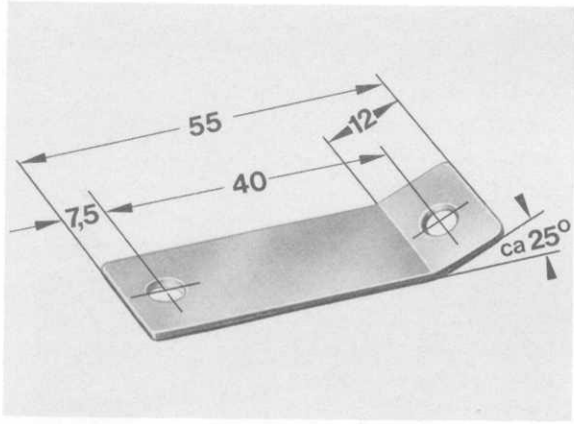
6. Control switch and display panel must be brought to same height as radio opening by using suitable material on bearing surfaces (e. g. plastic or modelling wood).

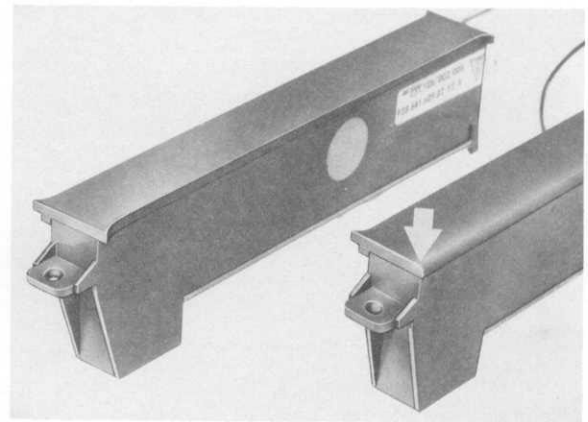




9. Make a radius on lower edge of display panel with a fine file.

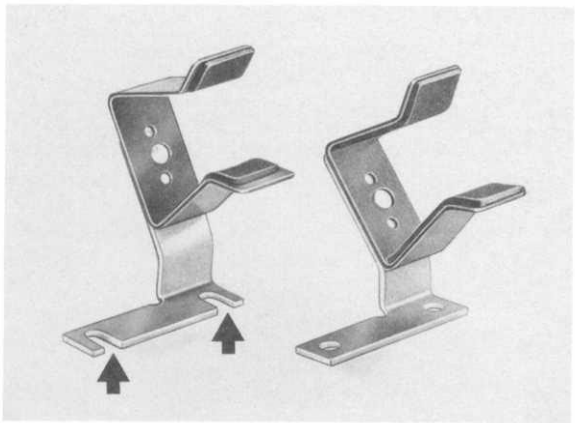
7. Solenoid valve plate has to be moved down because of greater installed depth of new radio.
Make up two sheet metal holders for this purpose.

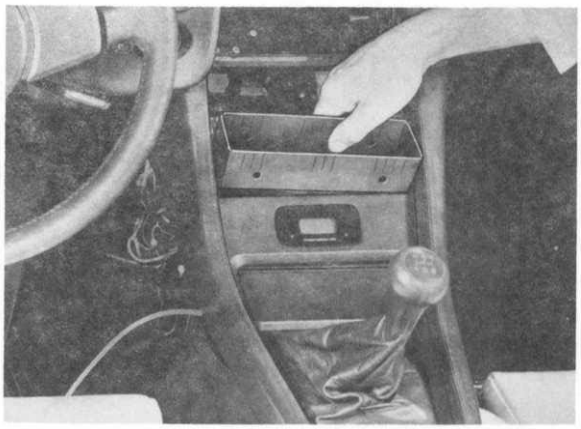




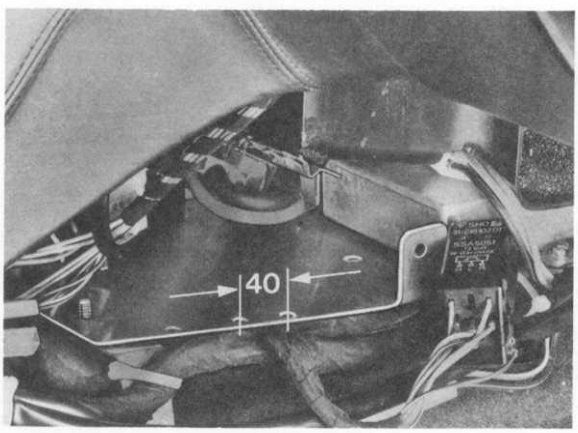
10. Saw slots in front radio holder and push holder forward as far as possible when tightening screws.

8. Unscrew solenoid valve plate and screw it on tight underneath the flap box with sheet metal holders.





11. Move relay for seat belt fasten sign forward by approx. 40 mm.
Drill new hole with an angled drill.



12. Insert lower mask frame with digital clock and connect digital clock.

13. Install holding frame for radio in opening and secure by bending tabs provided on holding frame.

14. Connect antenna, speaker, ground and feed wires on radio. Slide radio into opening until tabs on sides engage in holding frame.

15. Install upper mask frame and reinstall all removed parts.



16. Ashtray can be brought to correct height by using suitable washers on ashtray mounting points.

UPSHIFT INDICATOR (Only USA in Cars with Manual Transmission)

Description and Information on Troubleshooting

The upshift indicator is an illuminated arrow integrated in the tachometer.



The upshift indicator will light up when it is practical and economical to shift up into the next higher gear. It works in gears 1 through 4 and remains illuminated until the next higher gear is engaged or the operating condition causing illumination of the indicator is changed (e.g. coasting, full throttle, etc.).
The indicator lamp is designed to be very bright for clear visibility in daylight driving and less bright for night driving when main lights are switched on.

The electronic control is integrated in the tachometer and cannot be replaced separately, as also the indicator lamp.

Signals already available in the car are used to activate the indicator. Consequently there are no additional transmitters or sensors.

The Signals are:
- engine speed,
- engine temperature,
- road speed and
- injection time.

If the upshift indicator malfunctions, first check the following points.

1. Engine must be operating correctly and engine speed displayed on the tachometer.

2. Coolant (engine) temperature must be displayed correctly on the instrument.

3. Speedometer must display the road speed correctly.

If these points can be confirmed, the instrument cluster will be receiving signals on

- engine speed
- engine temperature and
- road speed

The injection time (ti) signal will be in the L-Jetronic control unit while the engine is running, but there could be a break or loose connection in the wiring between the control unit and instrument cluster.

The ti signal can be checked with help of an oscilloscope on central electric plugs L 5 and X 1 (plugs remain connected).
Ti signals have a rectangular pulse shape. The instrument cluster must be removed to check the ti signal wire for breaks.
This wire break test is made from instrument cluster term. 11 M to L-Jetronic control unit term. 11.

If signals are okay up to the instrument cluster, it will be necessary to check pertinent conducting paths on the printed circuit of the instrument cluster for breaks and good contact of connections.

If necessary, the tachometer must be replaced.

Checking burglar alarm

Note

The alarm control unit is located behind the glove compartment.

The following signals must be present at the alarm control unit terminals:

Input signals

1. Terminal 31: Ground

2. Terminal 30: Battery voltage

3. Terminal 15: Battery voltage with ignition switched on

4. Terminal 61: Battery voltage with engine running

5. Terminal T: Ground with doors open or rear hood open.

6. Terminal MK: Ground with engine hood open or radio removed.

7. Terminal A : Ground with key in lock cylinder (doors or rear hood) turned in "open" direction.

8. Terminal E ; Ground when lock cylinder turned towards "closed".

Output signals

1. Terminal 87a: Battery voltage with ignition switched on.

2. Terminal Hn: Battery voltage with burglar alarm primed and triggered (permanently in Swiss vehicles).

Note

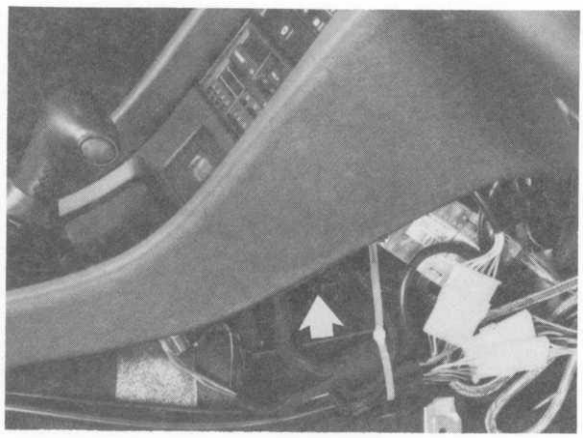
There is a relay in the central console of USA vehicles which operates fog lamps and brake lamps as an visual warning in addition to the alarm horn.

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Check auxiliary control unit - burglar alarm

Note

The auxiliary control unit is accommodated in the central console.



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Input signals

Remove the relay and check the input signals at the base.

1. Terminal 1: Ground with rear hood open or for as long as the internal lighting is switched on by means of the time-lag relay.

2. Terminal 3: Ground

3. Terminal 4: Battery voltage (terminal 30).

4. Terminal 8: Ground with the key in the lock cylinder (doors or rear hood) turned towards "closed" (only for as long as the lock cylinder is held in this position).

5. Terminal 9: Ground when the lock cylinder is turned towards "open".

Output signals

The output signals may only be checked with the relay fitted.

1. Terminal 2: Ground if

a) ground at terminal 8

b) burglar alarm primed after closing the rear hood approx. 25 seconds after the internal lighting has gone out (short pulse of approx. 0.5 seconds only).

2. Terminal 6: Ground if ground at terminal 9.

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Backlit instrument cluster, removing and installing

From Model 89 onwards

1. Disconnect battery.

2. Remove steering wheel.

3. Remove cover under the instrument cowling (2 screws).

4. Undo fastening screws (2) for instrument cowling.

5. Remove steering-column switch.

6. Remove ignition-lock cover.
(Procedure is described on page 94 - 4).

7. Disconnect plugs (4) from instrument cluster, turn both locking levers outwards for this.

Note

The plugs are coded and cannot be confused.

8. Lift instrument cowling carefully and tip to the rear.

9. Pull instrument cluster from bracket.

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Advancing the odometer reading of the backlight instrument cluster

Note

Advancing the odometer reading is performed within the the scope of the instrument cluster diagnosis under menu item "Specific functions" and is required to adjust the odometer reading after replacement of the instrument cluster. This function is only available as of software level K 26.

1. Select Specific Functions (SF)
   (refer to Service Information: Diagnosing the instrument cluster).

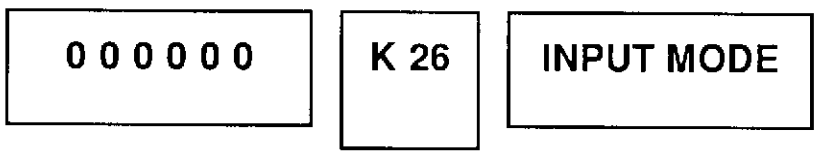
2. Select "Preset tot. Counter"

3. Pulling the operating lever selects input mode.

Note

The input mode is only accessed at a mileage below 256 kms or 256 miles, respectively.

Upon start of the input mode, the following display appears



4. Use the operating lever to enter the rightmost position

– up: + 1

– down: – 1

– press: entered position moves 1 position to the left

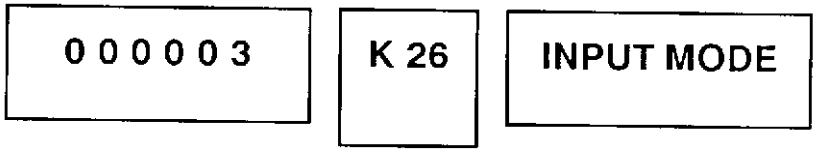
– pull: entered position moves 1 position to the right
(only required for fault correction).

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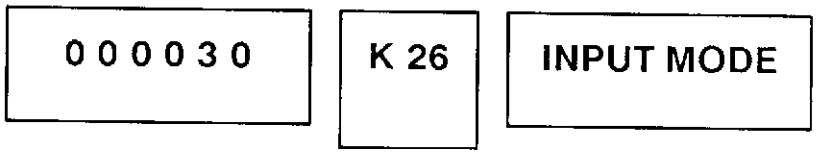
Example: input 3840 km



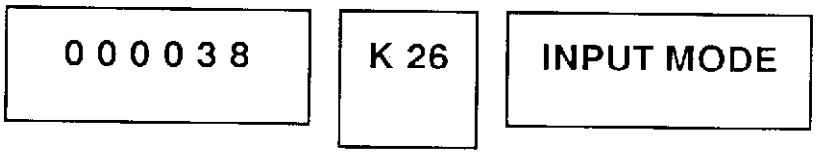
Operating lever is moved up three times



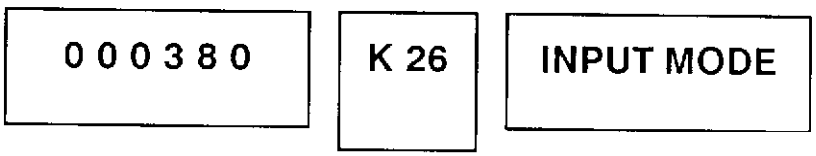
Press operating lever



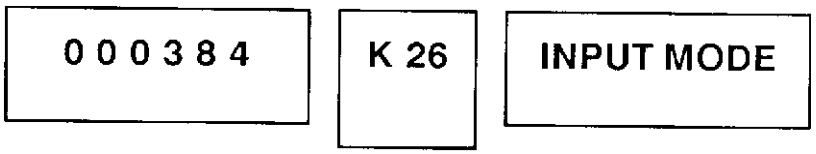
Operating lever is moved down twice



Press operating lever



Operating lever is moved up four times



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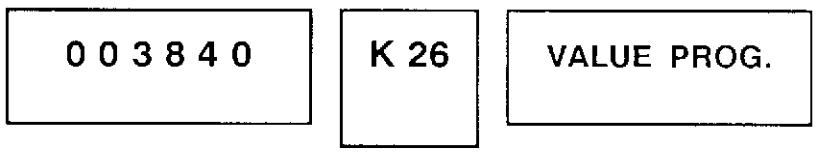
Press operating lever



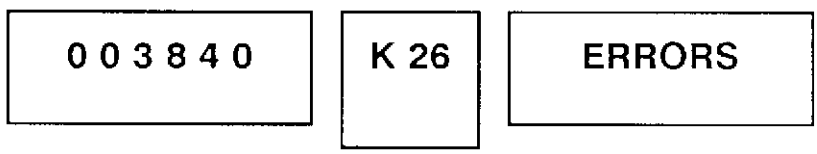
To store the new value, the trip mileage reset button must be pressed without interruption for more than 14 seconds.

If the button is released prematurely, the function is aborted without the new odometer reading being stored

After 14 seconds have elapsed, the following display appears:



If storing is not possible (e.g. due to low battery voltage), the following fault message is displayed:



In this case, abort the function and repeat advancing the odometer reading after having corrected the fault (charge battery). To access the selection mode of the instrument cluster again, the operating lever must be moved up again.

Note

If a value above 256 kms is entered, repeated access to the enter mode is denied and the odometer cannot be advanced again.

After terminal 30 has been disconnected, the total mileage indicated may deviate by +/- 8 kms.

Printed in Germany – XXVII, 1991

Facilities for subsequent telephone installation

M 195 Cellular telephone system

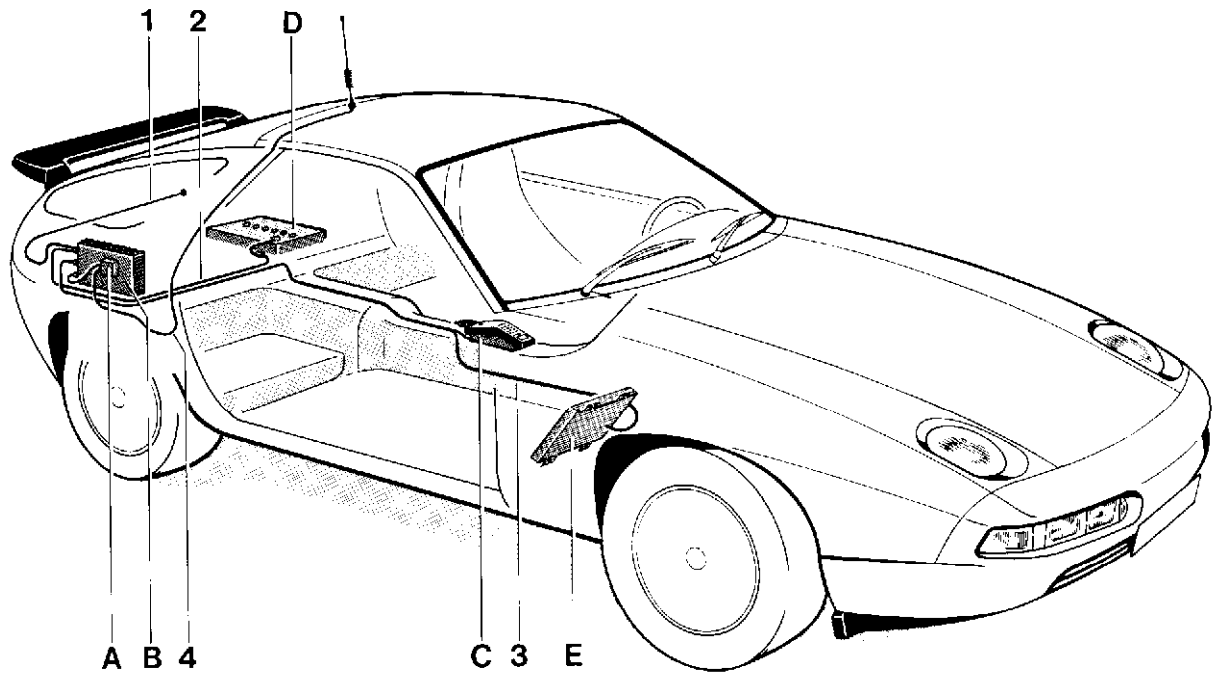
M 496 C-Net telephone system

As from Model 88, all 928 vehicles may be fitted with facilities for subsequent telephone installation.

This preliminary equipment embraces all cable harnesses required, the brackets for the radio and operating unit as well as the telephone antenna.

Printed in Germany – XX, 1988

Laying the cable harnesses in the vehicle



66/91

A - Antenna separation filter

B - Transceiver unit

C - Operating unit

D - Battery

E - Central electric system

1 - Terminal 31

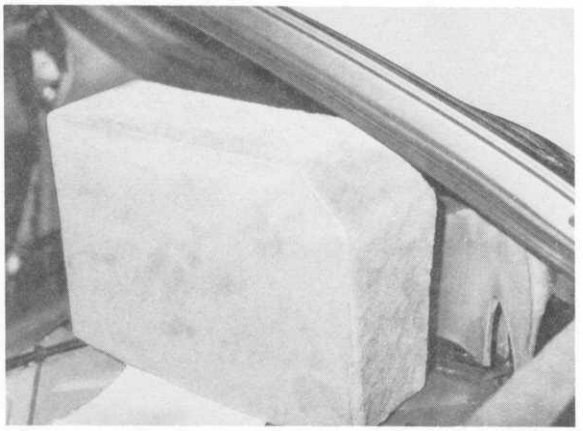
2 - Terminal 30

3 - Terminal 15

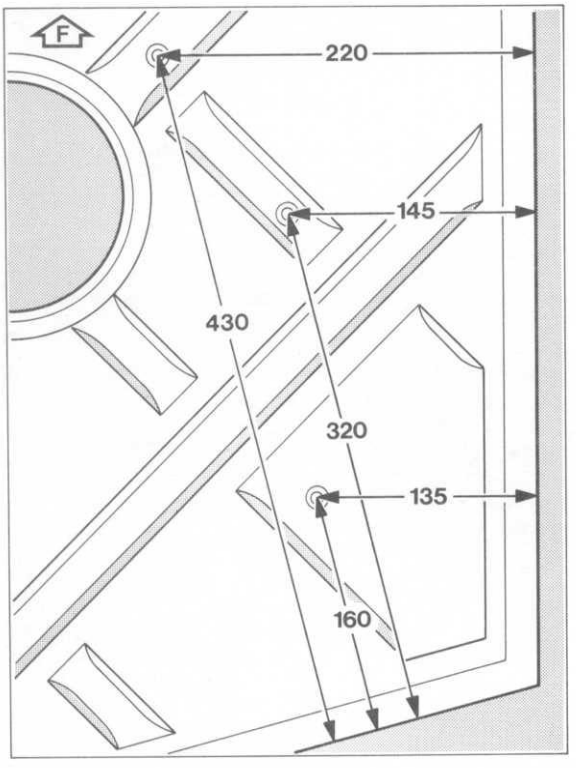
4 - Antenna cable

Installing the transceiver unit

The transceiver unit is installed under a cover panel on the right- hand side of the trunk.



1.1 Fastening points for the C-Net baseplate

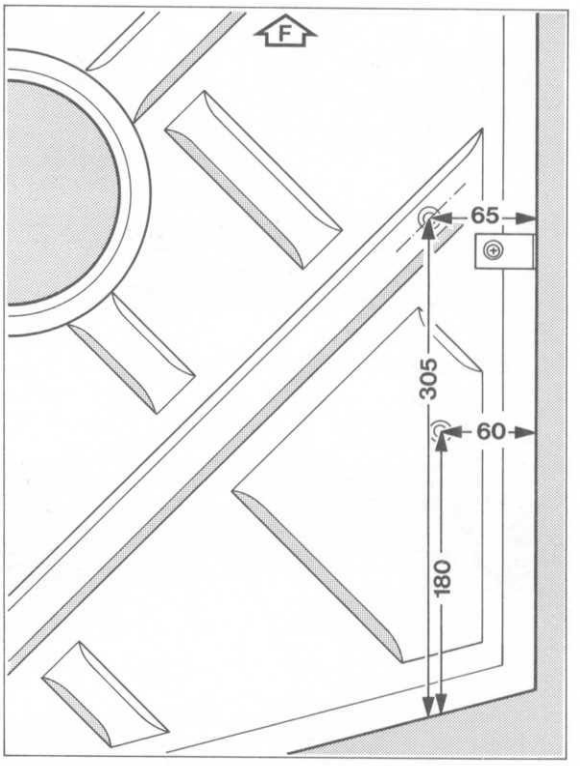


F = Direction of travel

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The baseplate can be fitted with longitudinal slots to compensate for any irregularities.

1.2 Fastening points for the Cellular baseplate.

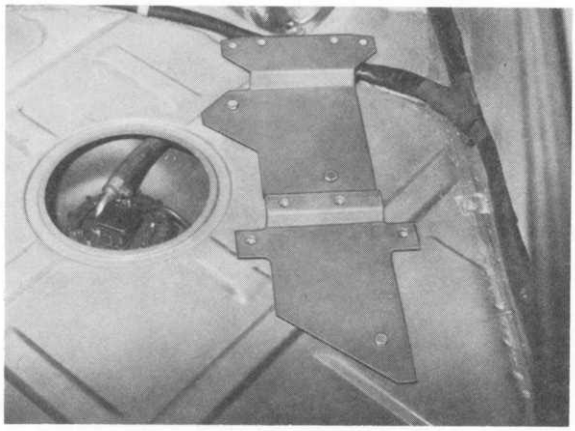


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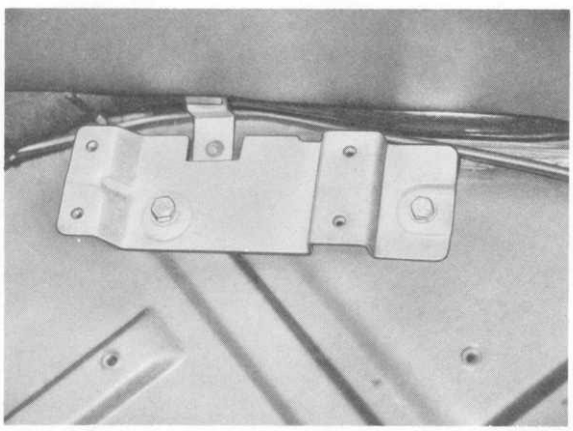
Note

The riveted blind nuts are all situated in molded beads. When drilling, bear in mind that the fuel tank is directly below.

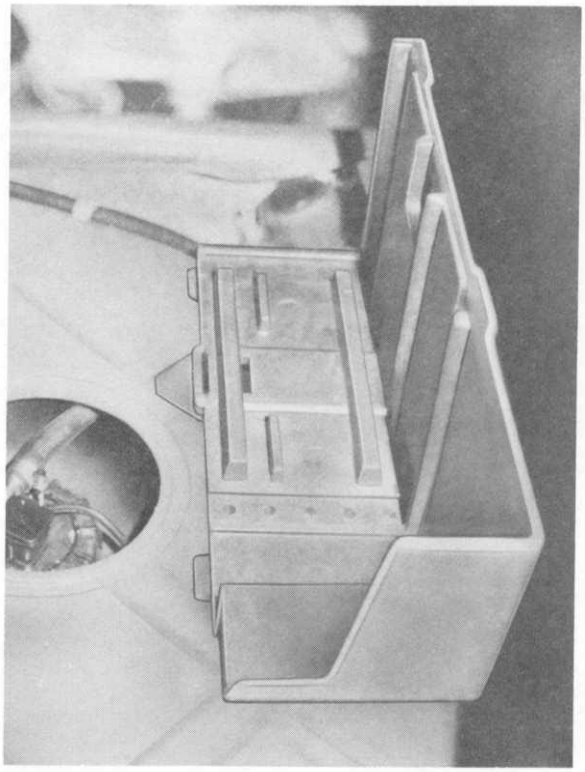
2.1 Installation of the C-Net baseplate



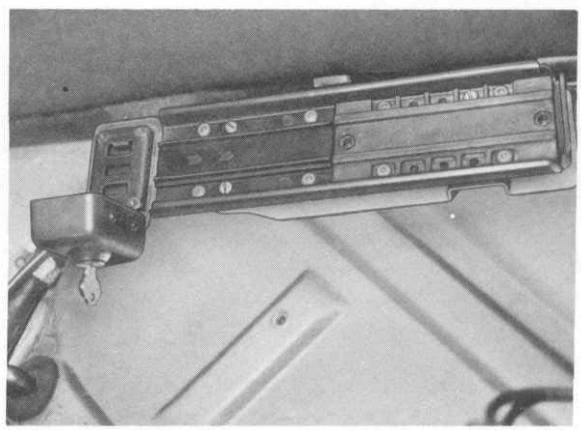
2.2 Installation of the Cellular baseplate



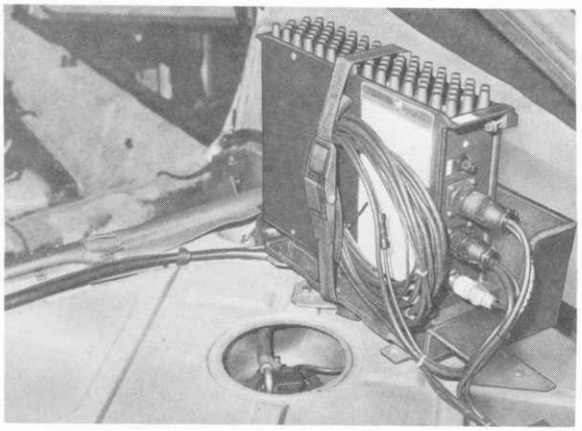
3.1 Bracket for the C-Net transceiver unit.



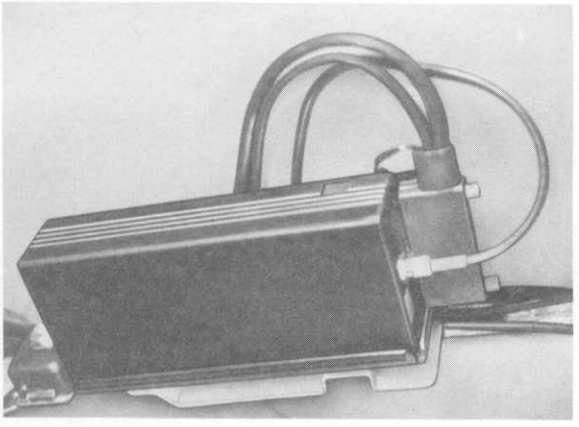
3.2 Bracket for the Cellular transceiver unit.



4.1 Installation of the C-Net transceiver unit with accommodation of the excess length of the cable harness.

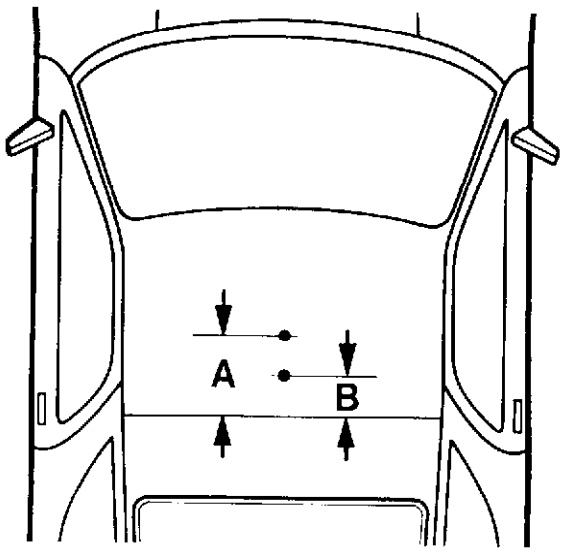


4.2 Installation of the Cellular transceiver unit



Installation of the antenna

The telephone antenna is mounted on the roof.



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Dimension A: Without sun roof
– 105 mm from the rear edge

Dimension B: With sun roof
– 40 mm from the rear edge

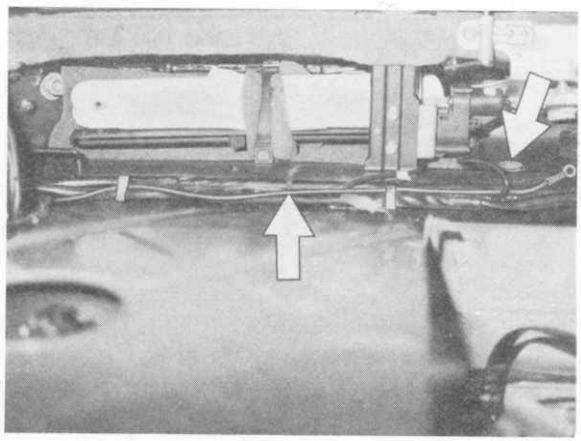
Installation of the antenna separation filter

The antenna separation filter is only installed for C-Net telephone systems.

The separation filter is mounted on the right-hand side of the transceiver unit.

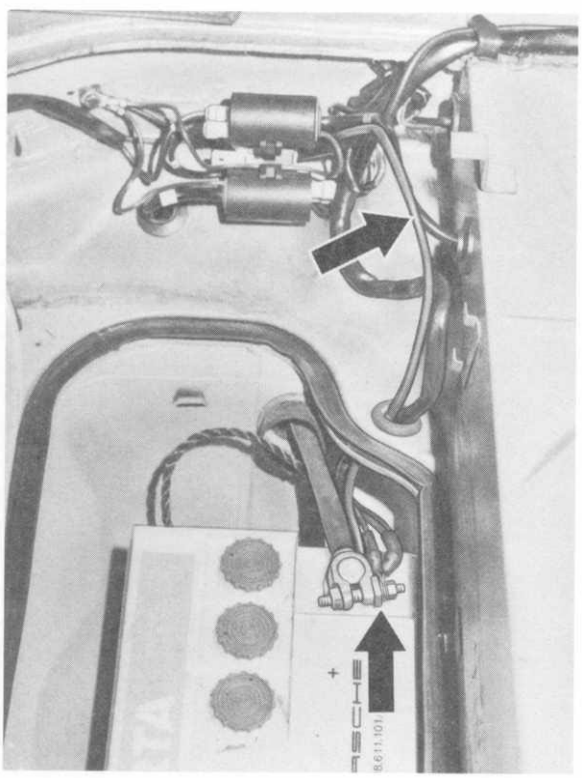
Installing power supply lines

1. Ground wire

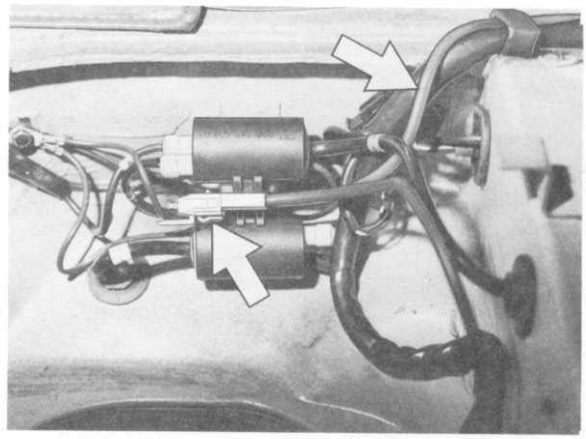


The ground wire is run along the rear wiring harness to the ground point.

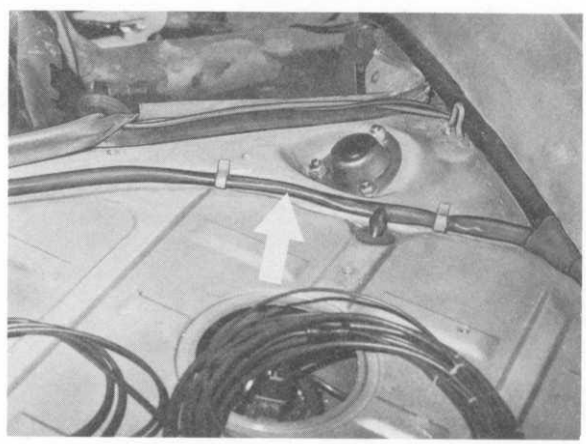
2. Positive supply, terminal 30



The positive terminal 30 line is run from the positive pole of the battery to the fuse in the spare wheel well.



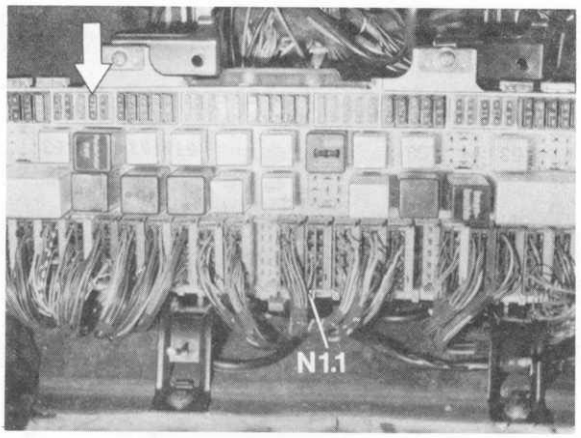
From the fuse, the line continues along the trunk floor to the transmitter-receiver stage.



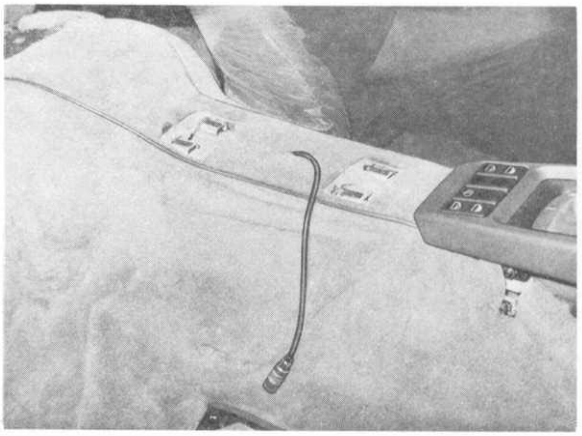
3. Positive supply, terminal 15

The positive terminal 15 line is run from fuse No. 9 to plug N 1.1. From 1990 models on it runs from fuse 43 to plug N 2.4 (already wired).

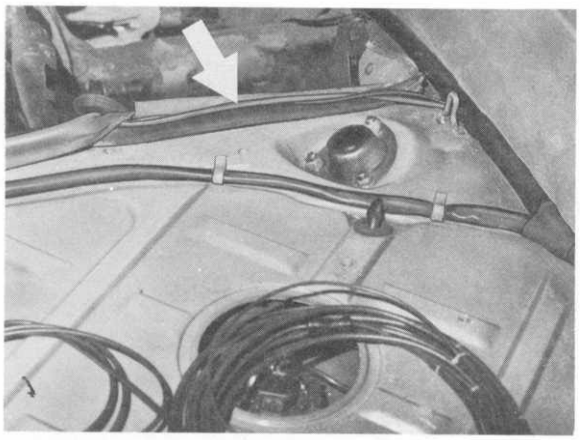
Printed in Germany – XXV, 1990



From plug N 1.1 (N 2.4 from 1990 models on) along the tunnel between the rear seats and to the transmitter-receiver stage in the trunk.



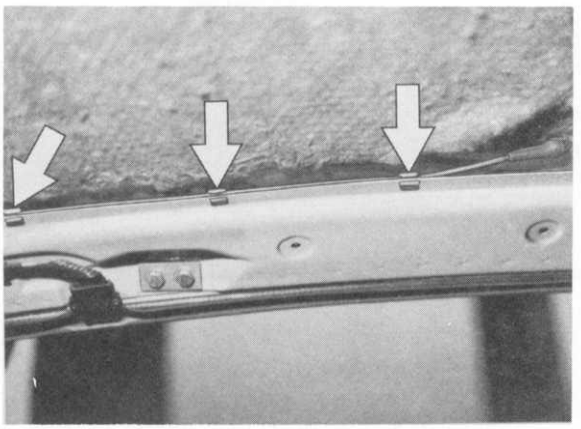
This line is run from the transmitter-receiver stage parallel to the terminal 15 power supply line as far as the control stage.



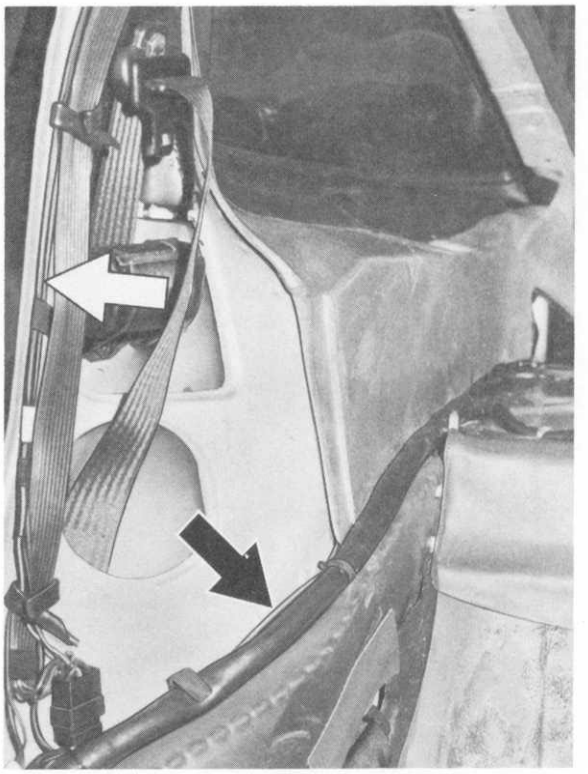
4. Line from transmitter-receiver stage to control stage.

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5. Antenna cable



The antenna cable is fastened in the area of the roof support with 3 clips. It is laid from the antenna along the roof support to the B column on the right, down to the door seal and along the rear harness to the antenna separation filter.



Retrofitting CD player from Model 89 onwards

Vehicles with radio equipment or sound packet

Loudspeakers, amplifier and cables are installed into these vehicles.

1. Install retaining frame for radio.

2. Connect CD player.

Note

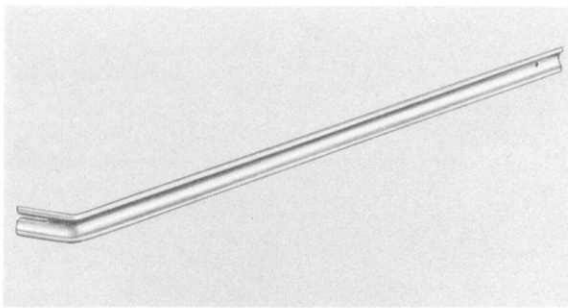
The connector assignment is specified on the CD player.

3. Slide in CD player and latch.

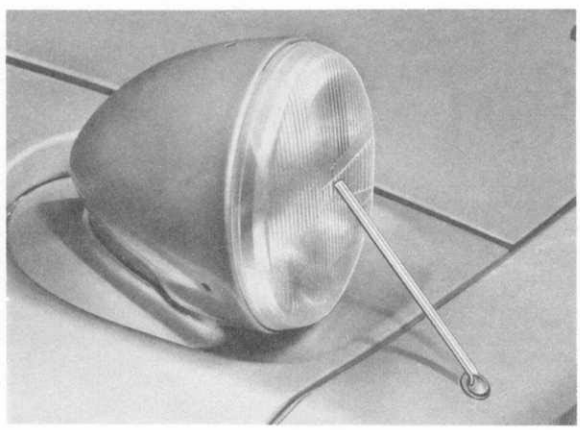
Printed in Germany – XXII, 1989

ADJUSTING HEADLIGHT CLEANER JETS

Special Tool 9135

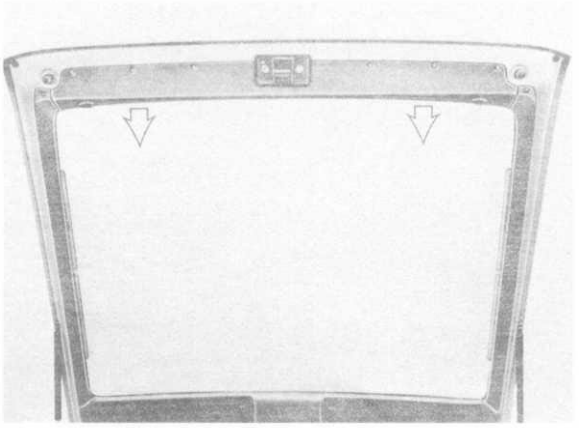


Insert tool into spray jet and turn jet insert so that long arm of tool points to center of lens.

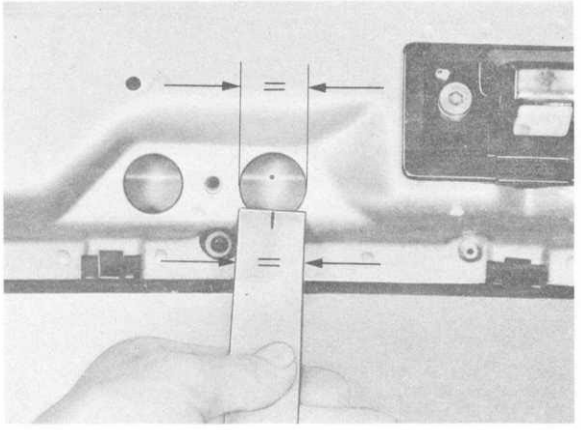


SERVICE INSTALLING REAR WINDOW WIPER

1. Remove trim from rear lid at bottom, pulling out spreader rivets and pushing trim forward out of holding clips.



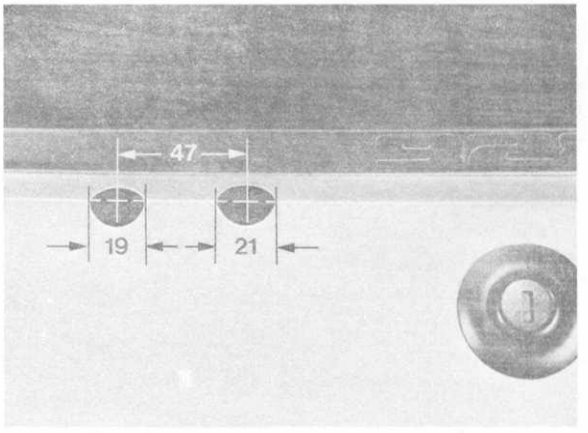
2. Mark hole for wiper mount on inside of panel seam with a scribe and suitable template, e. g. a cardboard strip, whose width equals the hole' s inside diameter.



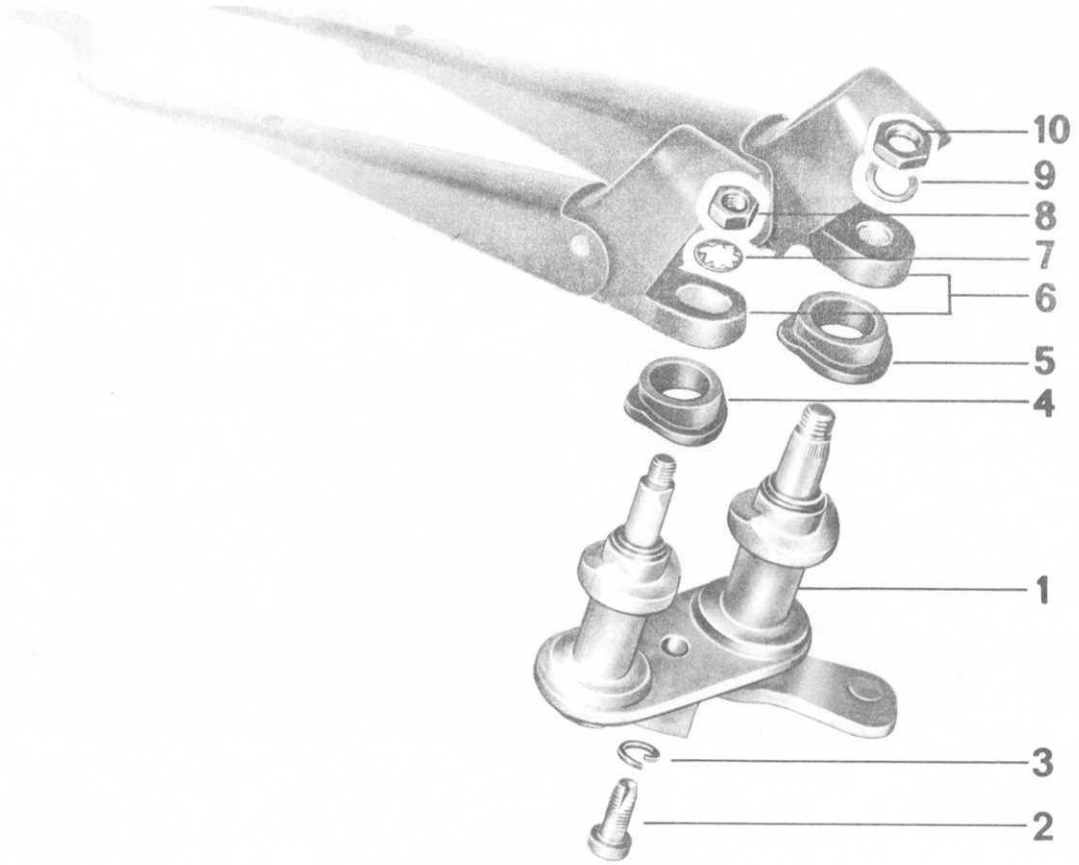
3. Drill hole from inside.

4. Mark second hole outside (distance 47 mm) and also drill. To prevent damage, the surface being drilled should be covered with tape.

5. Open up both holes with a hole saw . Make sure that holes don' t have runout. Remove burrs.

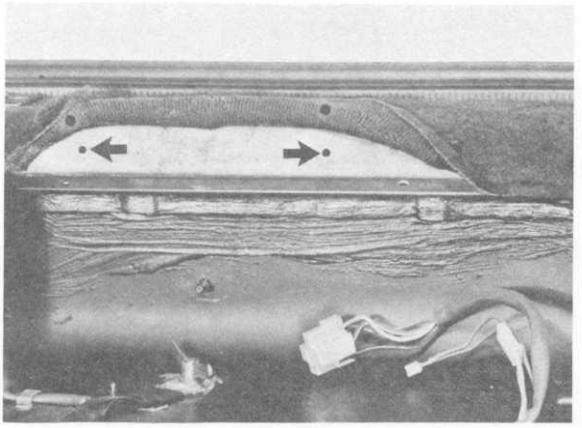


6. Touch up edges of holes with rust protection paint and body paint. Insert rubber seal for wiper mount with a sealing compound and bolt wiper mount on rear lid.



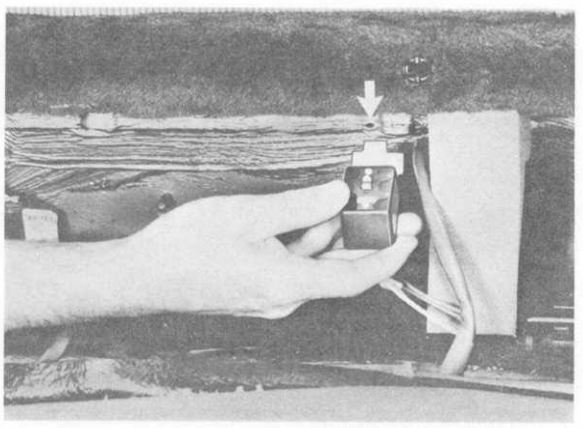
No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Wiper mount, upper	1			
2	Bolt M 6 x 15	1			
3	Lockwasher	1			
4	Rubber bushing	1		Install with body sealing compound	
5	Rubber bushing	1			
6	Wiper arm	1			
7	Lockwasher	1			
8	Nut M 6	1			
9	Washer	1			
10	Nut M 8	1			

7. Remove access plate.
Detach carpet on lock cross member. Cut out small holes in carpet for mounting bores of motor console. Glue carpet down again.

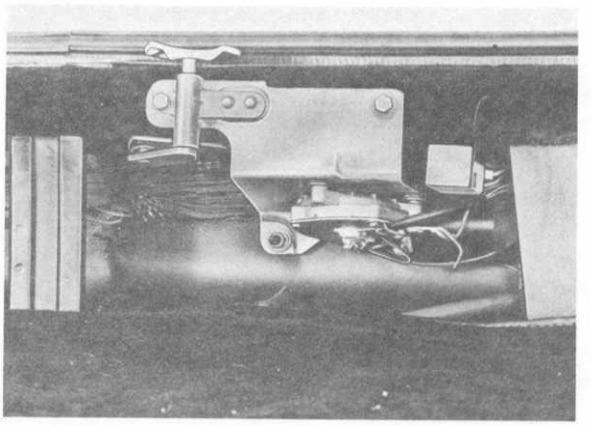


8. Remove foam rubber part behind the access plate. Install (glue) new foam rubber part with opening.

9. Connect relay with four-pin plug and insert in hole below the lock cross member.

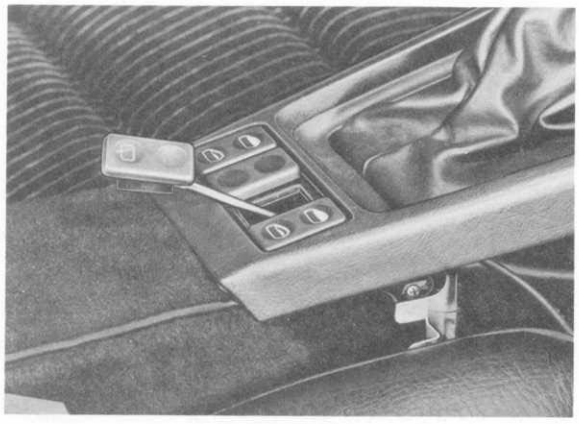


10. Connect two-pin plug and ground on wiper motor and bolt motor console at the provided points. Adjust motor console in the slots until output shaft of console is aligned with shaft of cover bearing.

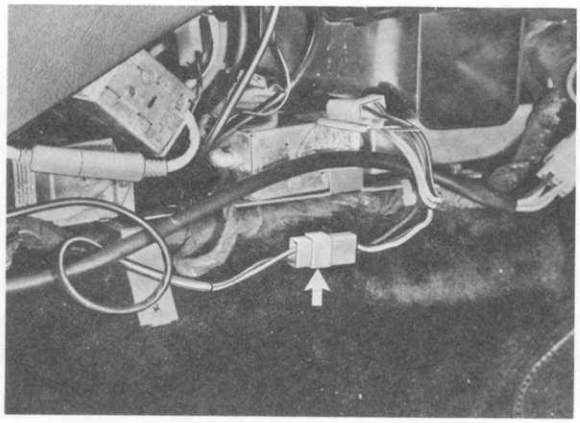


11. Turn lever on upper wiper mount clockwise against the stop. Bolt wiper arm so that distance to left frame of rear lid is approx. 2 to 3 cm.
Torque for nut M 8 = 12 Nm (8 ft lb) and for M 6 = 10 Nm (7 ft lb).

12. Remove right side trim panel from center console.
Remove switch plate in center console. Unscrew right rear center console mounting screw and lift center console enough that two-pin plug for switch can be pushed through forward.



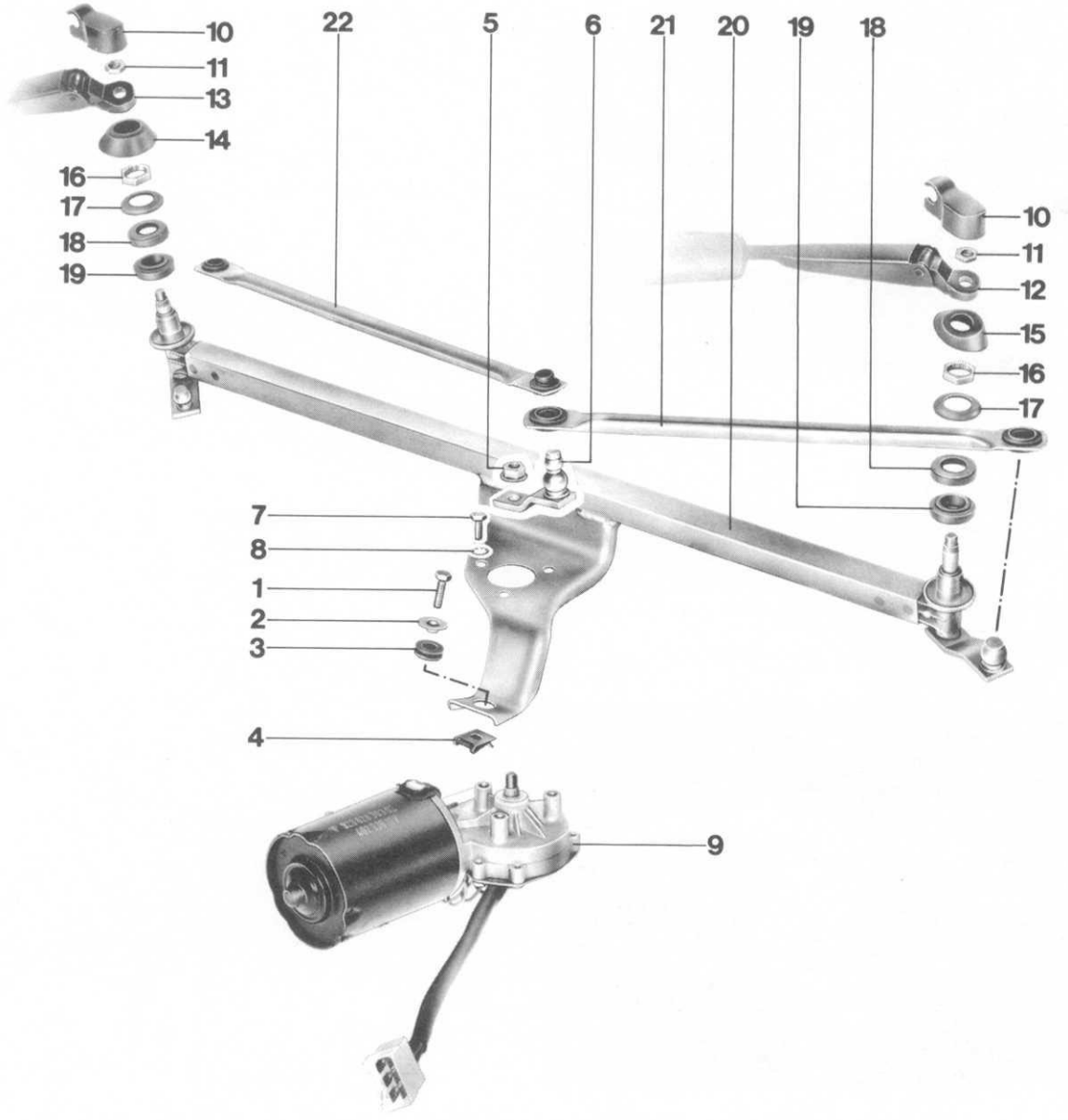
13. Connect two-pin plug of switch with standard plug.



14. Close rear lid and wet down rear window. Turn on ignition and operate rear window wiper. Rear window wiper should wipe four times and then return automatically to OFF position.
Check wiped area, correcting if necessary by changing wiper arm on shaft.

15. Mount trim panel on center console and rear lid. Replace access plate by a new one.

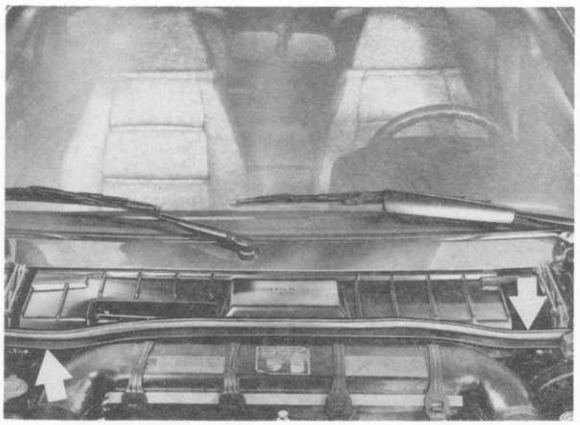
REMOVING AND INSTALLING WINDSHIELD WIPERS
BEGINNING WITH 1983 MODELS



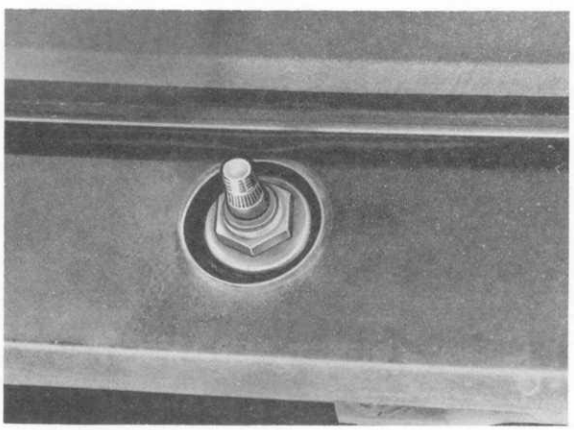
No.	Description	Qty.	Note When: Removing	Note When: Installing	Special Instructions
1	Screw M 6 x 18	1			
2	Washer	1			
3	Grommet	1			
4	Nut	1			
5	Lock nut	1		Torque: 25 Nm (18 ftlb)	
6	Crank	1			
7	Screw M 6 x 12	3		Torque: 11 Nm (8 ftlb)	
8	Lock washer	3			
9	Wiper motor	1			
10	Cap	2			
11	Nut	2		Torque: 14 Nm (10 ftlb)	
12	Wiper arm, driver's side	1			
13	Wiper arm, passenger's side	1			
14	Cap, right	1			
15	Cap, left	1			
16	Nut	2			
17	Washer	2			
18	Rubber bushing	2			
19	Rubber bushing	2			
20	Crank drive	1			
21	Connecting rod, left	1			
22	Connecting rod, right	1			

REMOVING AND INSTALLING WINDSHIELD WIPERS BEGINNING WITH 1983 MODELS

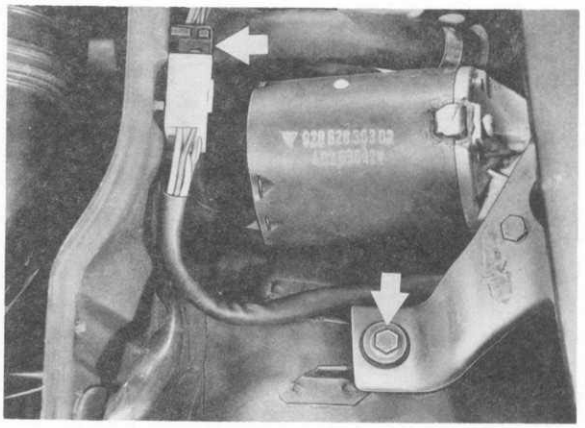
1. Pull off seal for fresh air chamber and pull cover out forward.



2. Remove wiper arms and wiper arm bases. Hexagon nut of left base can be removed with a flat, straight closed wrench.



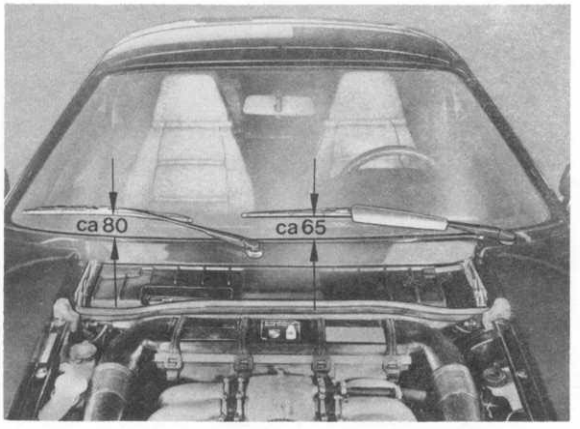
3. Remove connection in fresh air chamber. Disconnect plug and disengage plug socket for easier installation on wall.



4. Remove wiper assembly to the right, while swinging up wiper motor at same time.



5. Check installed position of wiper arms.



BULB CHART

Location	Watts	Shape	Base	Remarks
Fog light H 3	55 W	YC	PK 22 s	
Main headlight Sealed beam (7 inch)	60/50 W			
Turn signals, front + rear Stop light Backup light	32 cp	SAE	1073	
Parking light, front Side marker lights, front + rear	5 W	R 19-5	BA 15 s	
Tail light, rear	6 cp	SAE	89	
License plate light	5 W	L	SV 8,5 - 8	

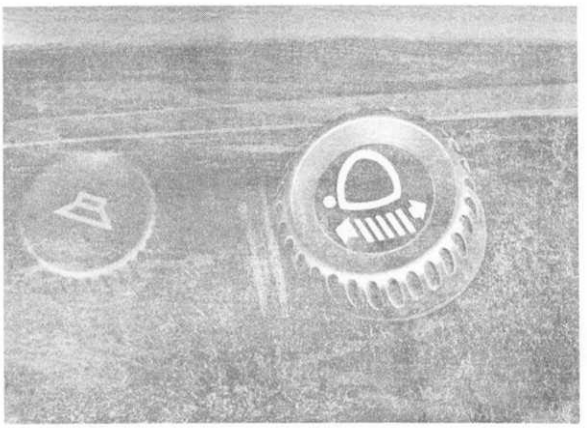
AIMING HEADLIGHTS

Requirement:

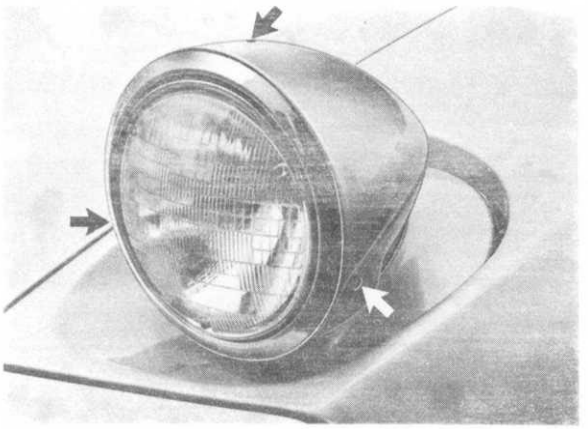
Tire pressure correct, fuel tank full, driver's seat occupied by a person or weight of approx. 70 kg (155 lb).

Note

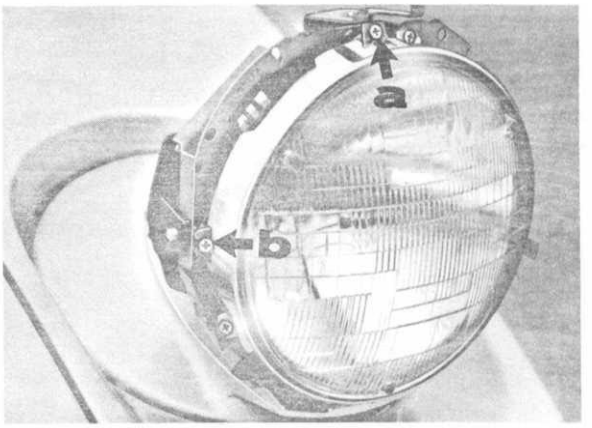
If equipped with headlight beam adjuster, turn adjuster knob so that white dot on knob faces forward (audible click).



1. Turn on ignition.
2. Turn on headlights (low beams). Clean lenses.
3. Remove 3 Phillips screws (arrows) and take off headlight cover and trim ring.



4. Aim headlights with optical aiming equipment.



Adjusting screw A = vertical adjustment
adjusting screw B = lateral adjustment

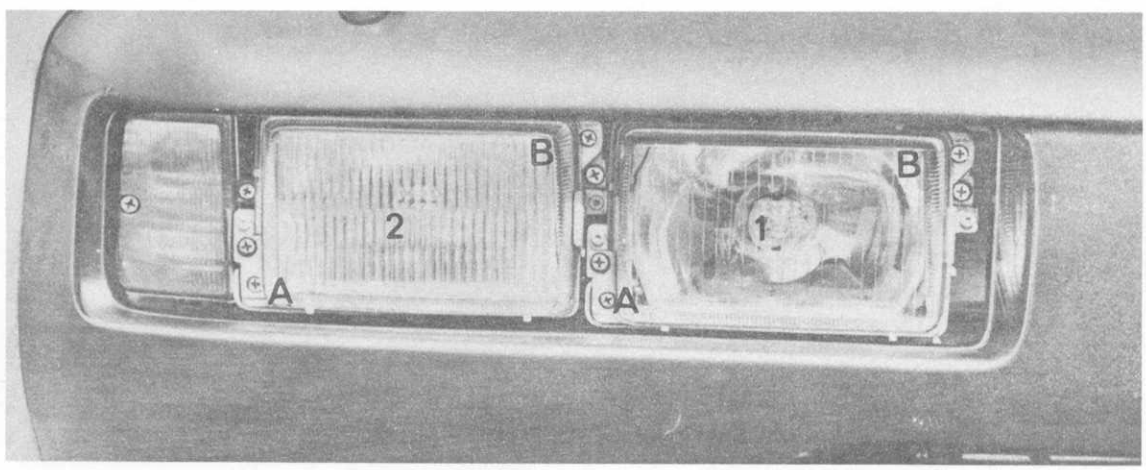
5. Reinstall trim ring and headlight cover.

ADJUSTING FOG LIGHTS

Requirements:
Correct tire pressures, full fuel tank, one person or 70 kg/154 lb weight on driver's seat.

Pull trim off of lights.

1 - Fog light
2 - Parking light



Adjust fog lights with an optical headlight aimer.

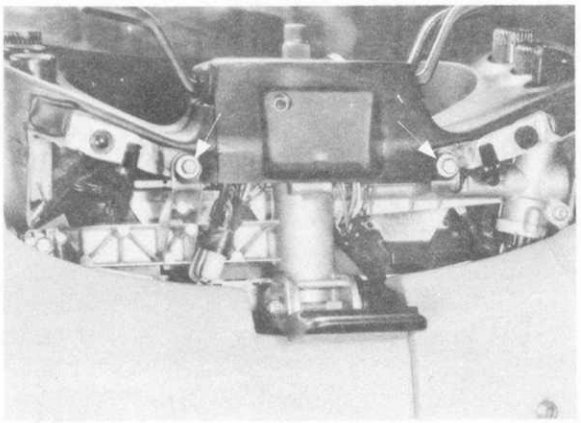
A - Vertical adjustment
B - Lateral adjustment

REMOVING AND INSTALLING STEERING COLUMN SWITCH

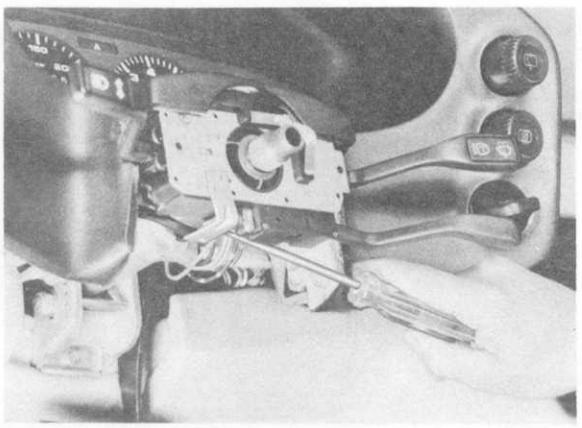
1. Disconnect battery ground lead.

2. Remove steering wheel.

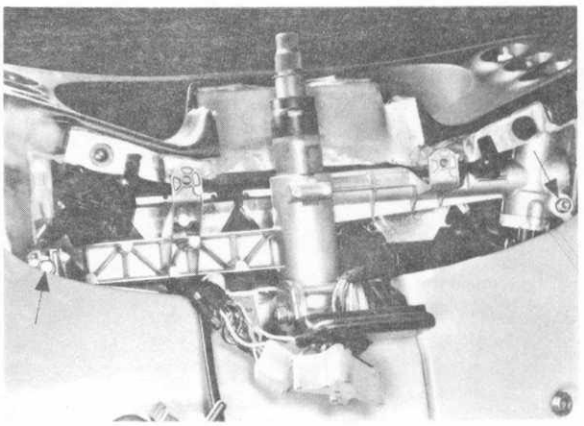
3. Unscrew cover underneath steering column switch.



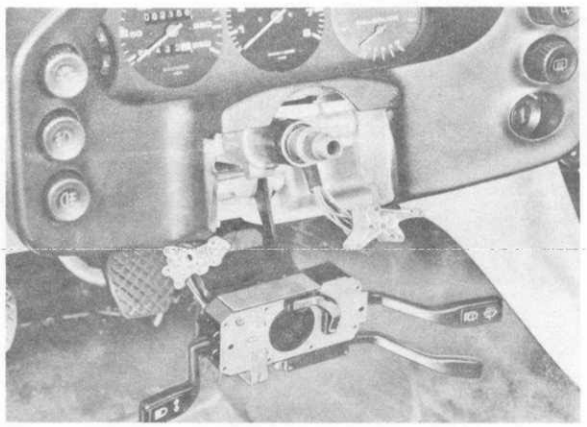
4. Loosen steering column switch mounting screw.



5. Loosen instrument cover mounting screws.



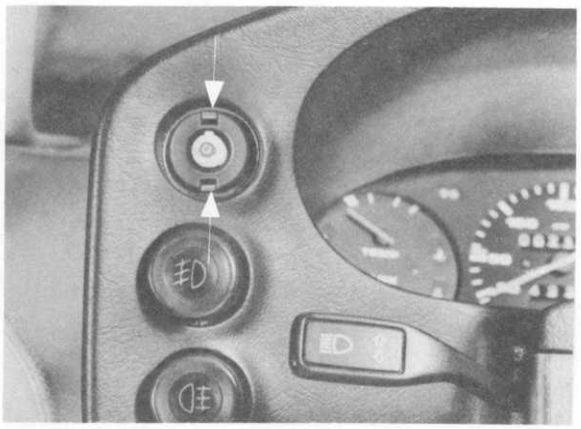
6. Lift instrument cover, pull off plugs and remove steering column switch.



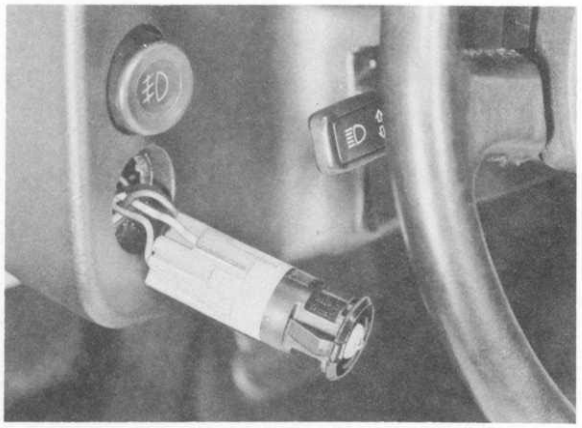
REMOVING AND INSTALLING SWITCH IN INSTRUMENT COVER

1. Pull off switch knob.

2. Compress both retaining springs.



3. Pull out switch and detach plugs.



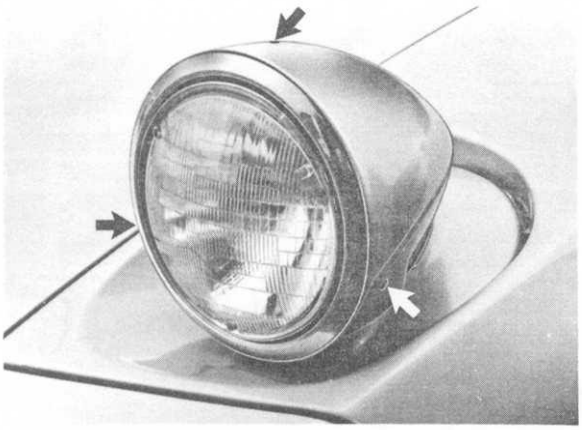
REMOVING AND INSTALLING SEALED BEAM HEADLIGHT UNITS

1. Turn on ignition.

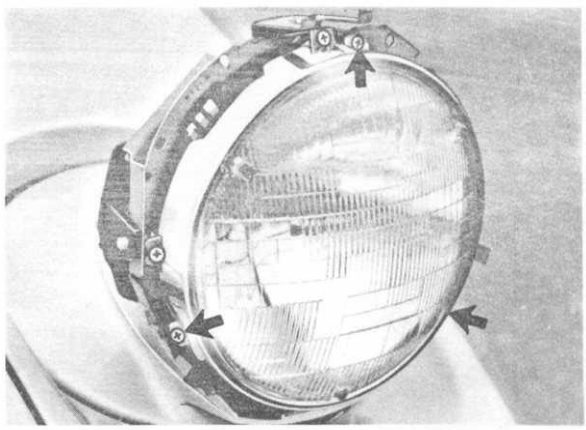
2. Turn light switch to position 2 (headlights raised).

3. Turn ignition off.

4. Remove 3 Phillips screws (arrows) and take off headlight cover and trim ring.



5. Remove 3 small Phillips screws (arrows) from sealed beam securing ring and remove ring.



6. Unplug connector, replace sealed beam unit and plug in connector.

7. Reinstall sealed beam securing ring.

8. Check lights.

9. Reinstall trim ring and headlight cover.

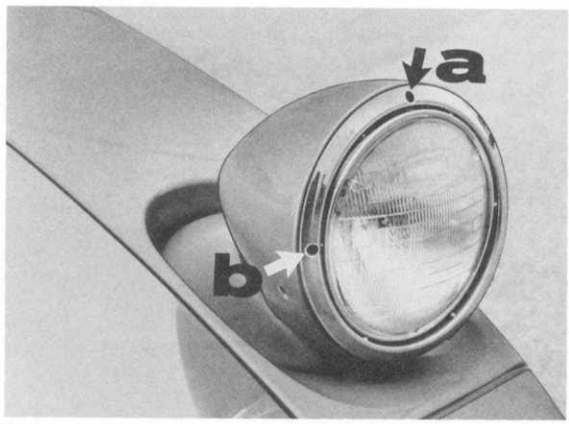
AIMING MAIN HEADLIGHTS – USA
(since 1980 Models)

Headlights must be aimed with an optical headlight aimer.

Requirements:

Tire pressure correct, fuel tank full, driver's seat occupied by a person or weight of approx. 70 kg (155 lbs.).

Adjusting screws



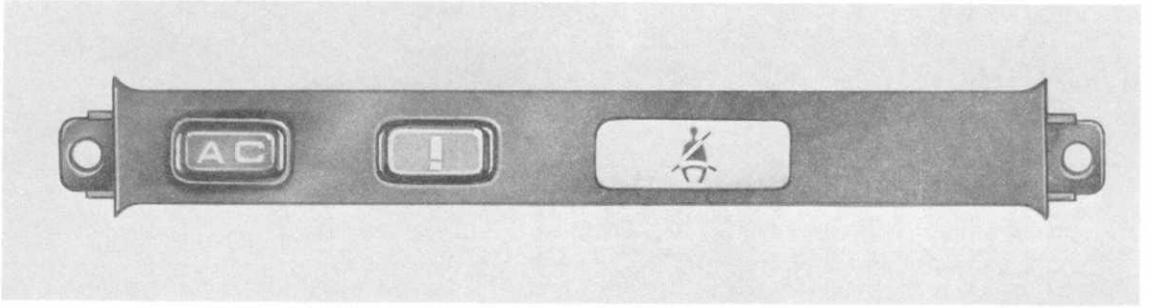
Screw "a" – vertical adjustment

Screw "b" – lateral adjustment

BULB CHART

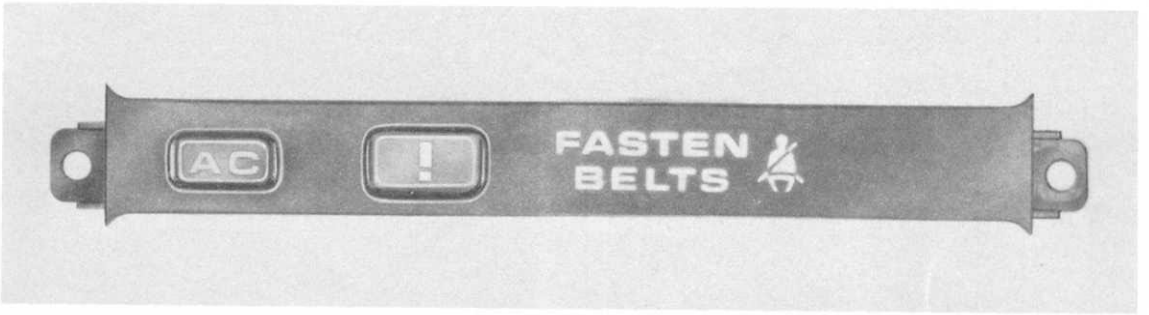
Location	Watts	Shape	Base	Remarks
Engine compartment light	10 W	F	BA 15 s	
Inside light Luggage compartment light	10 W	K	SV 8.5 - 8	
Glove box light	3 W	M	SV 7 - 8	
Vanity mirror light	5 W	L	SV 8.5 - 8	
Battery charge indicator Instrument cluster light	3 W	WT 10 - 3 (VA)	W 2.1x9.5 d	
Ashtray light Heater/ventilation switch light	2 W	J	BA 7 s	
All other bulbs (instrument light, indicator lamps etc.)	1.2 W	WT 5 - 1.2 (W)	W 2x4.6 d	

CONTROL PANEL VARIATIONS - 1980 Models



+	+	With manual air conditioner and central warning light
–	+	With automatic air conditioner and central warning light

CONTROL PANEL VARIATIONS - early 1980 Models



+	+	Standard (manual air conditioner and central warning light
–	+	With automatic air conditioner and central warning light

Note

Control panels will be replaced by different versions during course of model year 1980 (see page 96 - 2).

Page

Instruments, Fuel Gauge, Alarm System

Diagnosis / trobleshooting alarm system . . . . . D90 - 1

Wiring

Ground points on car 97-01
Correction to circuit diagrams, models 87 and 88, sheet 7 97-03
Additional electrical equipment 97-05
Repairing wiring harness no. 121 97-07
Current flow diagram, symbols and explanation 97-1
Current flow diagram 97-3

Printed in Germany – XXXI, 1993

Diagnosis / troubleshooting alarm system

The alarm control unit is diagnosable. It can be read out only with System Tester 9288.

The menu includes the following functional groups:

- Fault memory
- Drive links
- Input signals
- Country codes
- Results
- System check

Note

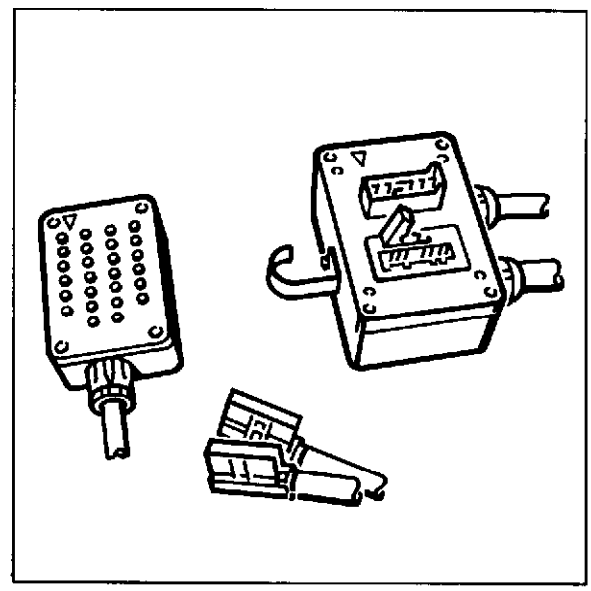
For some of the faults, two types of causes must be distinguished:

- The fault displayed is an actual fault that has to be remedied.
- The fault displayed is a fault condition that has been caused deliberately, e.g. by leaving the open glove compartment open.

Troubleshooting requires that the person performing the tests

- is familiar with the location of components, function and technical relationship of the systems being tested (refer to Model Information)
- is able to read and evaluate Porsche wiring diagrams
- knows the functions of circuits and relays
- is capable of using testers and of evaluating the test results.

Tools required for troubleshooting:
Special Tool 9540



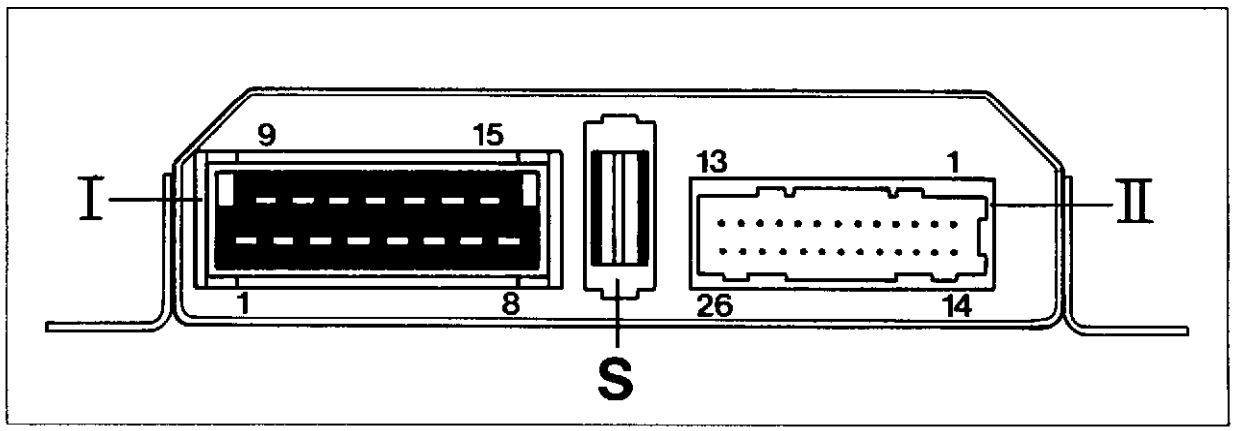
1079-90

Note

The Special Tool is required because connector II is fitted with miniature terminals.
To avoid damaging the terminals, always use the Special Tool for the tests.
When checking for continuity, attach connector to wiring harness only.
When checking signals and voltages, attach connector to wiring harness and control unit.

Printed in Germany – XXIX,1992

Pin assignments of alarm control unit connector



Connector I

Terminal:

1 – Term. 30
2 – Term. 31 (Ground)
3 – Term. 30
4 – Anti-drive off feature
5 –
6 – Term. 15
7 – Interior light
8 – Turn signal left
9 – Turn signal right
10 – Horn
11 – Motor „Closed" Actuator door lock
12 – Motor „Open" Actuator door lock
13 –
14 – LED front passenger's door
15 – LED driver's door

S – Fuse

Connector II

Terminal:

1 – Activate / closed
2 – Deactivate / open
3 – Rear lid contact
4 – Tailgate lock
5 – Hood contact
6 – Speedo signal Term. A
7 – Input 1
8 – Input 2
9 – Radio 2
10 – Central locking system position switch „Open"
11 – Central locking system button
12 – Central locking system position switch „Closed"
13 – Radio 1
14 – Diagnosis „L"
15 – Diagnosis „K"
16 – Glove compartment contact
17 – Input 3
18 – Term. 15
20 – Central locking system button light
21 – Door contacts
23 – Term. 61
24 – External electronics

Printed in Germany – XXXI,1993

Fault memory

Overview of possible displays

Control unit defective	Glove comp. open during activation
Voltage failure Term. 30 with active alarm system	Input 2 to ground during activation
Voltage failure during alarm output	Central lock button closed during activation
Position of the drives unplausible	Input 1 to ground during activation
Door(s) open during activation	Input 3 to positive during activation
Engine compartment open during activation	Position switch on drive closed during activation
Luggage comp. open during activation	Position switch on drive open during activation

Printed in Germany – XXIX,1992

Radio (closed loop) interrupted during activation

Radio contact to ground during activation

Tailgate lock switch closed during activation

Printed in Germany – XXIX,1992

Fault, Fault Code	Possible Causes, Elimination, Remarks

Note

After a fault in the alarm system has occurred and after it has been remedied, the fault memory **must** be erased.

Test Point 1

Control unit defective

- Replace control unit.

Test Point 2

Voltage failure Term. 30 with active alarm system

- Check battery.
- Check fuse at control unit.
- Check wiring according to wiring diagram.

Test Point 3

Voltage failure during alarm output

- Refer to Test Point 2.

Test Point 4

Position of the drives unplausible

This fault is also stored if, for example, the driver's door is open when the key is used to actuate the central locking system from the passenger's door.

- Disconnect plug II from control unit. Attach Special Tool 9540 at wiring harness.
  With the doors unlocked, ground must be present at pin 10.
  At the same time, no ground must be present at pin 12.
  With the doors locked, ground must be present at pin 12.
  At the same time, no ground must be present at pin 10.
- If required, check wiring according to wiring diagram.

  Note

  The T6 (driver's door) and T 22 (passenger's door) connectors are located inside the doors, i.e. the door trim must be removed if the connectors are to be checked.

Test Point 5

Doors(s) open during activation

- Check LH and RH door contact switches for shorts to ground.
- Check wire from alarm control unit plug II terminal 21 to the door contacts for short to ground, using Special Tool 9540.
- Check wire from rear cover unlocking actuator for short to ground across connector T 19.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
	– Check wire from relay base of central relay terminal D for short to ground. – Check wire to window winder/sunroof control unit plug I, terminal 5, for short to ground.
Test Point 6 Engine compartment open during activation	– Check engine hood contact switch for short to ground. – Check wire from alarm control unit plug II, terminal 5, to engine hood contact switch for short to ground using Special Tool 9540. Note The wire is routed across connector T 33. – Check socket side of wire from connector T 33 terminal 5 to engine compartment light for short to ground. – Check pin side of wire from connector T 33 terminal 5 to cooling air control plug II, terminal 6, for short to ground.
Test Point 7 Luggage comp. open during activation	– Check tailgate contact switch for short to ground. – Check wire from alarm control unit plug II, terminal 3, to contact switch for short to ground, using Special Tool 9540. Note The wire is routed across connectors T 19 and T 9.
Test Point 8 Glove comp. openm during activation	– Check glove compartment switch and glove compartment light for short to ground. – Check wire from alarm control unit plug II, terminal 16, to contact switch for short to ground, using Special Tool 9540. Note The wire is routed across connector T 1.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Test Point 9

Input 2 to ground during activation

Note

The fault display may appear if auxiliary systems (e.g. interior monitor) have been fitted.

- Check auxiliary system of input 2.
- Check wire from alarm control unit plug II, terminal 8, to auxiliary system for short to ground, using Special Tool 9540.

Test Point 10

Central lock button closed during activation

- Check central locking system button.
- Check wire from alarm control unit plug II, terminal 11, to button for short to ground, using Special Tool 9540.

Test Point 11

Input 1 to ground during activation

- Check auxiliary system of input 1.
- Check wire from alarm control unit plug II, terminal 7, to auxiliary system for short to ground using Special Tool 9540.

Test Point 12

Input 3 to ground during activation to positive

- Check auxiliary system of input 3.
- Check wire from alarm control unit plug II, terminal 17, to auxiliary system for short to ground using Special Tool 9540 check for short to positive.

Test Point 13

Position switch on drive closed during activation

- Check triggering of actuators.
  Ground must be present at connectors T6 and T22, terminals 11 and 12, in the quiescent state.

  Note

  Conectors T6 (driver's door) and T 22 (passenger's door) are located inside the doors; i.e. the door trim must be removed when the connectors are to be checked.
  Positive voltage must be present at terminal 11 when the actuator is triggered in the „open" direction.
  Positive voltage must be present at terminal 12 when the actuator is triggered in the „closed" direction.

  Note

  The actuators are only triggered for several milliseconds.

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Fault, fault code	Possible causes, remedies, notes
	– Check wires from alarm control unit plug I, terminals 11 and 12, to the acutators for continuity. – Check position switch at actuator (refer to Test Point 4).
Test Point 14 Position switch on drive open during activation	– Refer to Test Point 13.
Test Point 15 Radio (closed loop) interrupted during activation	– On radios that do not have this contact, radio 1 input is wired to ground. Check wire from alarm control unit plug II, terminal 13, for continuity to ground.
Test Point 16 Radio contact to ground during activation	– Check insulating strip on radio. – Check wire from alarm control unit plug II, terminal 9, to radio plug, terminal 6, for short to ground. – Check alarm contact at radio or bracket, respectively.
Test point 17 Tailgate lock switch closed during activation	– Check tailgate release lock switch. – Check wiring from alarm control unit connector II, terminal 4, to tailgate release lock switch for short to ground.
	Note The wire is routed across connector T42.

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Drive links

This function allows the following components to be triggered:

- Function display in lock buttons
- Lock
- Alarm horn
- Turn signals
- Interior light
- Button light in central locking system button
- External output

```
Function display
1 = on
3 = off
Return :              N
```

If the function display is turned on, the doors are locked and the LEDs light up permanently. The „on" display flashes on the tester.
If the function display is turned off again, the LEDs are turned off as well. The doors are unlocked again when the user returns to the menu.

```
Lock
1 = closed
3 = open
Return:               N
```

Lock closed: Doors are locked.
Lock open: Doors are unlocked.

```
Alarm horn
1 = on
3 = off
Return:               N
```

Alarm horn on: Alarm horn is triggered continuously (continuous sound).

```
Turn signals
1 = on
3 = off
Return:               N
```

Turn signals on: All turn signals are triggered continuously (continously lit).

```
Interior light
1 = on
3 = off
Return:               N
```

The interior light must be in the door contact position.

```
Button light
1 = on
3 = off
Return:               N
```

Button light on: The light in the central lock system button is triggered.

```
External output
1 = on
3 = off
Return:               N
```

The external output is used to trigger other control units, e.g. ultrasonic monitoring of the interior.

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Possible fault displays

1.

```
No activation
Door(s) open !

Return:              N
```

– Close doors

– Check door contact wires to alarm control unit plug II terminal 21 for short to ground.

2.

```
No activation
Engine running!

Return:              N
```

– Turn off engine, only switch on ignition.

3.

```
No response
Signal unplausible !

Return               N
```

– Replace control unit.

4.

```
No activation
Fault summary!

Return:              N
```

Note

Fault summary is displayed if several drive links (actuators) are triggered simultaneously, e.g. if turn signals are on while the function display is checked.

– Check wiring to alarm control unit plug I, terminals 8, 9, 10, 11, 12, and plug II, terminal 20, for short to positive.

– Check wiring to alarm control unit plug II, terminal 24 (if connected) and terminal 7, for short to ground.

5.

```
No activation
Fault summary !
Position switch ?
Return:              N
```

– Refer to item 4.

– Also check position switch (refer to page D 90- 5).

6.

```
Activation
correct.
Position switch?
Return:              N
```

– Check position switch (refer to page D 90 - 5).

7.

```
No response
Signal unplausible !
Position switch ?
Return:              N
```

– Check position switch (refer to page D 90 - 5).

– Replace control unit.

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8.

```
Unknown
response code!

Return:              N
```

- Check following ground points:
- 1. GP VII: Battery to body
- 2. GP VIII. Body to engine
- 3. GP V: Body to alarm control unit

Input signals

This function allows the following input signals to be checked:

- Door contacts
- Engine compartment switch
- Luggage compartment switch
- Position switches at drive motors
- Central locking system button
- Glove compartment button
- Radio closed loop
- Alarm contact radio bracket
- Tailgate lock button
- Microswitch for activation of alarm
- Microswitch for deactivation of alarm
- Input 1 (auxiliary system)
- Input 2 (auxiliary system)
- Input 3 (auxiliary system)
- Speedo signal
- Term. 15
- Term. 61

1.

```
Door(s)

- open -
Return:              N
```

Open is displayed if at least one door is open. Closed is displayed if both doors are closed. If required, check wiring to alarm control unit for open circuit or short to ground according to wiring diagram.

2.

```
Engine compartment

- open -
Return:              N
```

Open is displayed if engine hood is open. Closed is displayed if engine hood is closed. If required, check wiring to alarm control unit for open circuit or short to ground according to wiring diagram.

3.

```
Luggage compartment

- open -
Return               N
```

Open is displayed if tailgate is open. Closed is displayed if tailgate is closed. If required, check wiring to alarm control unit for open circuit or short to ground according to wiring diagram.

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4.

```
Position switch
open: - closed -
closed:  - open -
Return                N
```

This display appears if both lock buttons are in the „open" position.

4a.

```
Position switch
open: - closed -
closed:  - closed -
Return:               N
```

This display appears if one lock button is in the „open" and one lock button is in the „closed" position.

4b.

```
Position switch
open: - open -
closed:  - closed -
Return:               N
```

This display appears if both lock buttons are in the „closed" position. If required, check position switch (refer to page D 90 - 5)

5.

```
Central locking
system button
-  open -
Return:               N
```

Open is displayed if the central locking system button has not been pressed down. Closed display appears if the central locking system button is pressed down.

6.

```
Glove compartment

- open -
Return:               N
```

Open is displayed if glove compartment is open. Closed is displayed if glove compartment is closed.

7.

```
Radio
(closed loop)
- closed -
Return:               N
```

The closed loop must be closed. On radios that do not have this contact terminal, terminal 13, plug II, is wired to ground.

– If the closed loop is open, check wiring from alarm control unit, terminal 13, to ground point V or to radio for open circuit.

8.

```
Radio contact

- open -
Return:               N
```

If Radio contact closed is displayed:

– Check insulating strip on radio.

– Check wiring from alarm control unit plug II, terminal 9, to alarm contact at radio bracket or to alarm contact at CD player for short to ground.

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9.

```
Tailgate lock

- open -
Return:              N
```

Note

The spare key is needed for the checks acc. to items 9 to 11 since the ignition must be engaged during the check.
Open is displayed if tailgate lock has not been actuated. Closed is displayed if tailgate lock is actuated.

10.

```
Activate
button
- open -
Return:              N
```

Use the spare key to turn the locks of the driver and passenger doors in the „closing" direction. The display must switch from open to closed.

- If closed is displayed in the off position, check wiring from lock cylinders to alarm control unit plug II, terminal 1, for proper grounding according to wiring diagram.
- If display remains in the open position after the lock cylinders have been actuated, check wiring for continuity according to wiring diagram.

11.

```
Deactivate
button
- open -
Return:              N
```

Use the spare key to turn the locks of the driver and passenger doors in the „opening" direction. The display must switch from open to closed.

If closed is displayed in the off position, check wiring from lock cylinders to alarm control unit plug II, terminal 2, according to wiring diagram for short to ground.

If display remains in the open position after the lock cylinders have been actuated, check wiring for continuity according to wiring diagram.

12.

```
Input 1

- open -
Return:              N
```

In the standard configuration, this input is not used. Auxiliary systems may be connected to this input.
Open is displayed if input is not used.
If required, check auxiliary systems according to manufacturer's instructions.

13.

```
Input 2

- open -
Return:              N
```

Refer to item 12.

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14.

```
Input 3

- open -
Return:              N
```

Refer to item 12.

15.

```
Speedo signal

present
Return:              N
```

Display is not present if vehicle is stationary.
Display is present if vehicle is moving.
If required, check wiring from alarm control unit plug II, terminal 6, to speedometer according to wiring diagram.

16.

```
Term. 15

present
Return:              N
```

If display is not present, check wire from alarm control unit plug II, terminal 18, to central electrical system according to wiring diagram.

17.

```
Term. 61

present
Return:              N
```

Note

If present is displayed although the engine is not running, this may be due to a summary fault (refer to item 4, Drive links functional group). In this case, start by remedying this fault.
If display is not present although the engine is running, check wire from alarm control unit plug II, terminal 23, to generator according to wiring diagram.

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Country codes

The System Tester 9288 may be used to encode three pre-set alarm versions

1. RoW (Rest of world)
2. CH (Switzerland)
3. USA

Alarm output

RoW

- Alarm horn max. 30 sec. interval.
- Turn signals max. 5 min.
- Interior light flashes in an asynchronous manner with turn signals (if in door contact position).

CH

- Alarm horn max. 30 sec. continuous.

USA

- Alarm horn max. 4 mins. interval.
- Turn signals max. 8 min.
- Interior light flashes in an asynchronous manner with turn signals (if in door contact position).

Alarm system encoding

When replacing the control unit, activate one of the preset country codes according to the national C number.

RoW

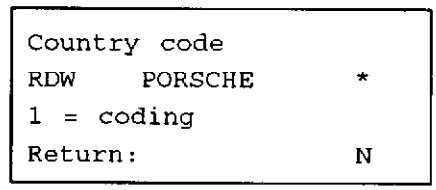
C numbers: 00, 05, 07, 09, 11, 12, 13, 14, 16, 17, 19, 20, 21, 22, 27, 28, 99.

CH

C number: 10.

USA

C numbers: 02, 04, 06, 08, 15, 18, 23, 24, 26, 31, 32, 36.



The Country code menu displays the coded version in the top left corner, e.g. RoW; the center displays Porsche or Workshop, depending on where the system has been coded. The asterisk on the right is displayed for versions that include the interior lights in the alarm emission.

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Result memory

The result memory registers triggering of an alarm, the contact that triggered the alarm as well as the type of activation. A maximum of 10 results may be stored. If another result is stored, the oldest result stored is deleted. The result with the highest number is the most up-to-date result.
Alarms may be triggered by contacts at the following components:

- Doors
- Engine compartment
- Luggage compartment
- Glove compartment
- Radio

Additional alarm triggering options:

- Term. 15 on after system has been activated
- Signal to input 1
- Signal to input 2
- Signal to input 3
- Position switch
- Open circuit of closed loop (radio).

Note

Up to three alarms may be triggered across input 2.

The following types of activation are to be distinguished:

- **normal**, i.e. locking the doors with the key, thus activating the central locking system
- **locking three times**, i.e. locking one of the door locks rapidly for three consecutive times
- **System check**

The type of activation may be invoked with button 1 on the below display:

```
Alarm:          - x -
activated by
xxxxxxxxxxxxxx
```

Note

Erase the result memory whenever the alarm system has been checked.

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System check

The System check menu item may be used to check all components triggering an alarm (except Term. 15). In this case, the alarm horn is only triggered twice for a short interval.

The following display appears after the System check menu item has been called:

```
System check !

Continue:            >
```

The individual alarm-triggering components that may trigger an alarm (except Term. 15) can now be checked. E.g. if a door is opened, an alarm
is triggered. At the same time, triggering of the alarm is stored in the result memory. After the check has been completed and the > key has been pressed, the following display appears:

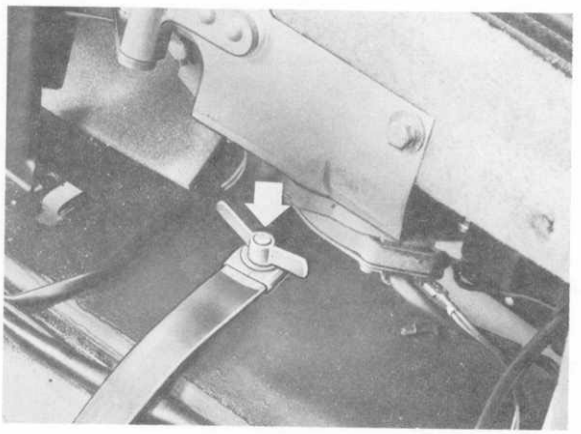
```
Note:
Erase result
memory !
Return:              N
```

The result memory **must** be erased since the check has been stored in the memory.

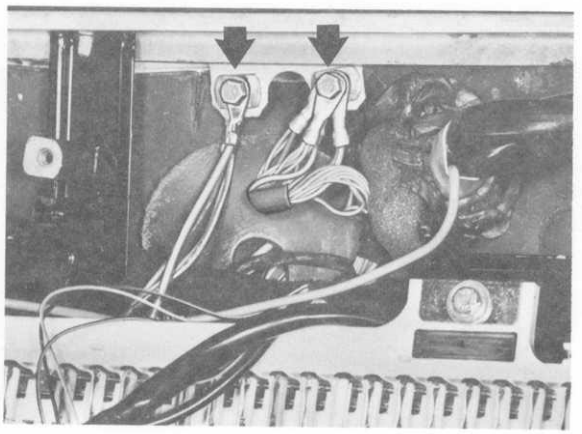
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GROUND POINTS ON CAR

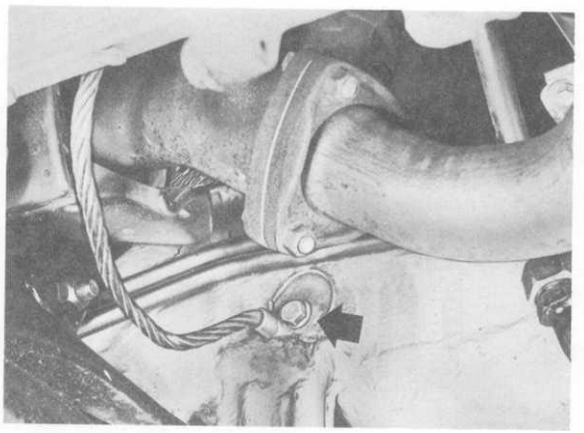
1. Battery negative pole to body in trunk at rear left.



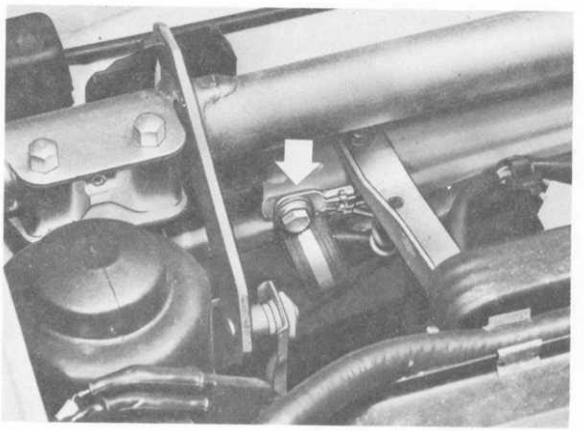
2. Ground points above central electric board.



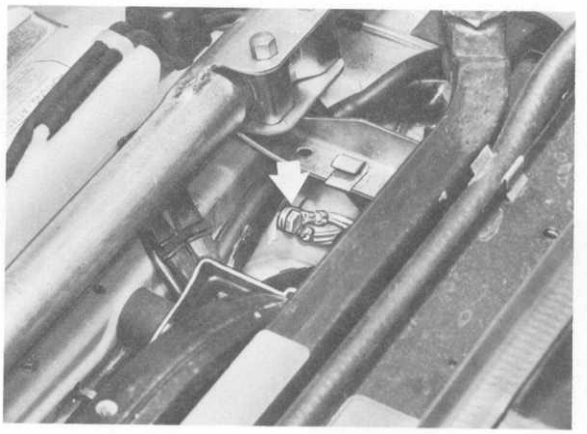
3. Engine ground to body on right side member.



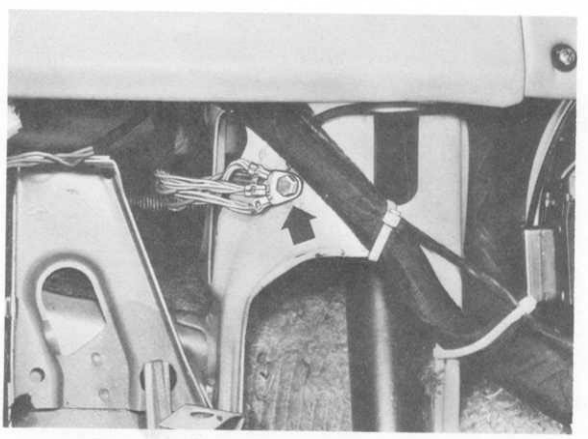
4. Ground point on front left cross member.



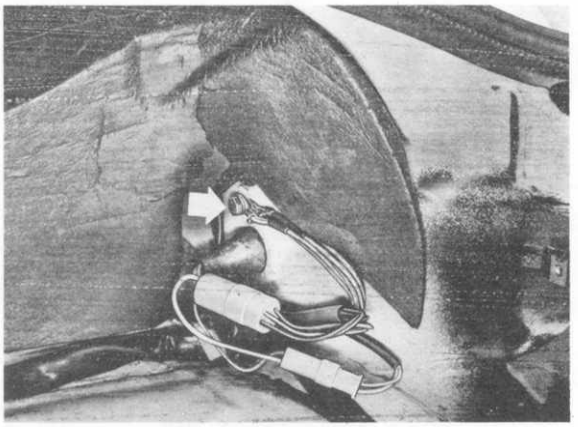
5. Ground point on front right cross member.



6. Ground point underneath instrument panel next to steering column.



7. Ground point in trunk at rear right underneath side trim panel.



Side trim panel has to be removed to make this ground point accessible.

Correction to circuit diagrams, Models 87 and 88, Sheet 7

The cable colors on connectors 3, 6 and 7 on the control unit to adjust the seating position are not correct. The correct assignments are:

Pin 1: brown

Pin 2: blue

Pin 3: red

The cable color at connector 11, pin 2 is green / brown (GN/BR), and not grey / brown (GR/BR) as given.

Additional electrical equipment

Note

Additional electrical equipment is only to be connected to the points described below.

Terminal 30, no fuse protection:

Screw connections to central electrics supply line

Terminal X, no fuse protection:
Leading to fuse 33

Terminal 15, no fuse protection:
Leading to fuse 43

Terminal 31:
Ground point V (above central electrics)

Provision for fuses

Note

Additional electrical equipment must be protected against overloads if the above connection facilities are used.

1. Fuse 32:
   The fuse must be wired to (for example) plug R inside the central electrics.

2. Separate fuses

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Repairing wiring harness no. 121

Note

As of Model Year '93, the combination wirings for ABS, BVA (brake pad wear indicator) and RDK (tire pressure monitoring system) are incorporated into the wiring harness. If the wiring is damaged, the integral wirings can be cut off and may be replaced by repair wires. Carry out the following functional check after the repair:

- ABS: Check with ABS tester.

- BVA: The warning lamp must go off when the engine is running and if the pads are o.k.

- RDK: The warning lamp must go off within the specified air pressure range.

Joints

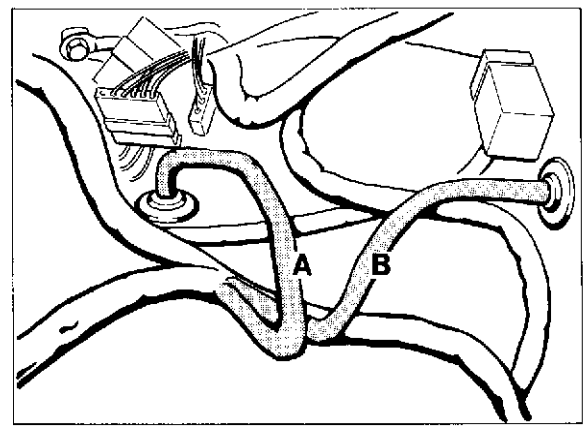
Rear: Inside the spare wheel well
Left-hand front: Inside the wheel housing
Right-hand front: Behind the Central Electrical System

Rear

1. Disconnect battery.

2. Remove spare wheel.

3. Cut open the insulating tube of wiring harness No. 121 from the rubber grommets to the outgoing wire and remove the tube.



A - Left-hand combination wire 1318-97
B - Right-hand combination wire

4. Remove PVC insulating tape.

5. Remove shrink-fit caps from joints.

6. Cut off connector.

7. Remove combination wires.

8. Install repair wires from wheel carriers towards spare wheel well.

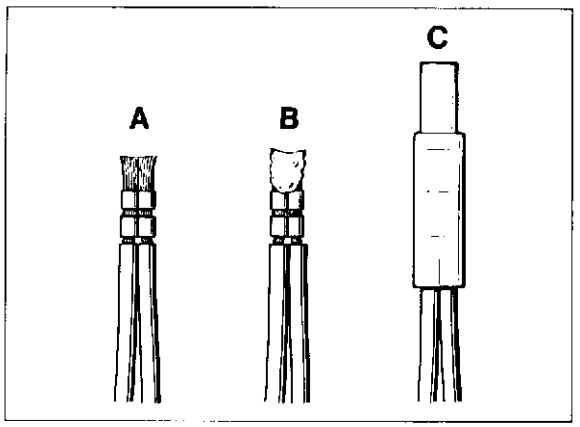
Note

Use correct repair wires. The right-hand and left-hand repair wires are of different lengths.

9. Strip wires on a length of 10 mm.

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10. Conect wires according to table using crimp connectors and standard crimping tool (A).



1316-97

Combination wire		Wiring harn. no. 121
Color	**Length**	**Color**
		rear left
br/ge	60 mm	br/ge
br/rt	90 mm	br/rt
br/bl	120 mm	ws/sw*
br/ws	150 mm	ws*
br	180 mm	br
br/gn	210 mm	sw
br/sw	240 mm	ws
		rear right
br/ge	60 mm	br/ge
br/rt	90 mm	br/rt
br/bl	120 mm	ge/sw*
br/ws	150 mm	ge*
br	180 mm	br
br/gn	210 mm	sw
br/sw	240 mm	ge

* screened wires

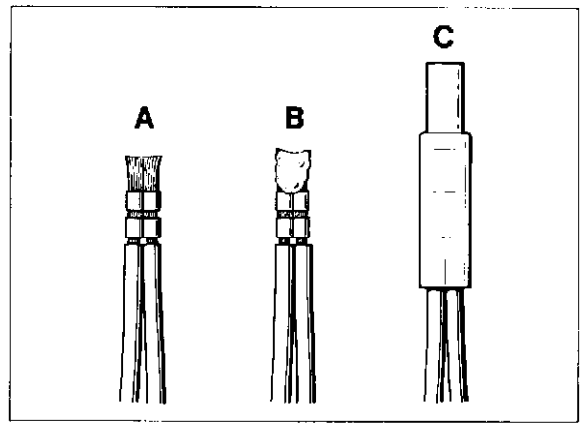
br - brown
sw - black
ge - yellow
rt - red
bl - blue
ws - white
gn - green

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11. Solder tips after crimping the connectors (B).

12. Fit shrink-fit caps and shrink them into place using a hot air gun (C).

13. Wrap up entire connection joint area using commercially available PVC tape.



1316-97

Left-hand front

1. Disconnect battery.

2. Unbolt left-hand front wheel.

3. Remove left-hand front wheel housing liner.

4. Cut off combination wire 300 mm from outgoing wire and remove wire.

5. Remove insulating tube along a length of 240 so that only 60 mm remain until the outgoing wire.

6. Cut wiring to correct length according to table.

7. Install repair wire.

8. Route repair wire in connection area parallel to wiring harness No. 121.

9. Strip wirings over a length of 10 mm.

10. Connect wires according to table using crimp connectors and standard crimping tool (A).

Combination wire		Wiring harn. no. 121
Color	**Length**	**Color**
		left-hand front
br/ge	60 mm	br/ge
br/rt	90 mm	br/rt
br/bl	120 mm	rt/sw*
br/ws	150 mm	rt*
br	180 mm	br
br/gn	210 mm	sw
br/sw	240 mm	rt

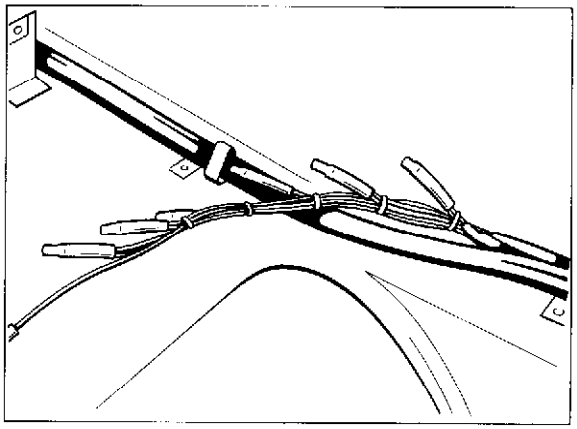
* screened wires

br - brown
sw - black
ge - yellow
rt - red
bl - blue
ws - white
gn - green

11. Solder tips after crimping the connectors (B).

12. Fit shrink-fit caps and shrink them into place using a hot air gun (C).

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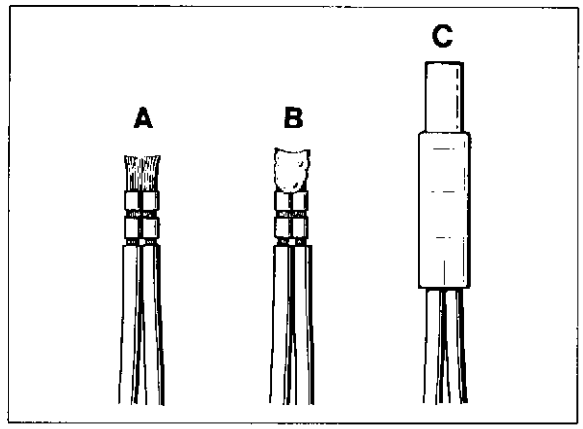


1317 - 97

13. Wrap up entire connection joint area using commercially available PVC tape.

Right-hand front

1. Disconnect battery.
2. Remove right-hand front wheel.
3. Remove right-hand front wheel housing liner.
4. Cut off combination wire at the wheel housing grommet and remove combination wire.
5. Undo Central Electrical System and move out of the way towards the rear.
6. Pull wire (above Central Electrical System) inwards.
7. Cut open insulating tube up to the connecting points.
8. Remove shrink-fit caps from connecting points.
9. Cut off connector.
10. Install repair wire, starting from the wheel housing end.
11. Strip wires along a length of 10 mm.
12. Connect wiring according to table, using crimp connectors and standard crimping tool (A).



1316 - 97

Combination wire		Wiring harn. no.121
Color	**Length**	**Color**
		right-hand front
br/ge	60 mm	br/ge
br/rt	90 mm	br/rt
br/bl	120 mm	gn/sw*
br/ws	150 mm	gn*
br	180 mm	br
br/gn	210 mm	sw
br/sw	240 mm	gn

* screened wires

br - brown
sw - black
ge - yellow
rt - red
bl - blue
ws - white
gn - green

Printed in Germany – XXXI, 1993

13. Solder tips after crimping the connectors (B).

14. Fit shrink caps and shrink them into place using a hot air gun.

15. Wrap up entire connection joint area using commercially available PVC tape.

Note

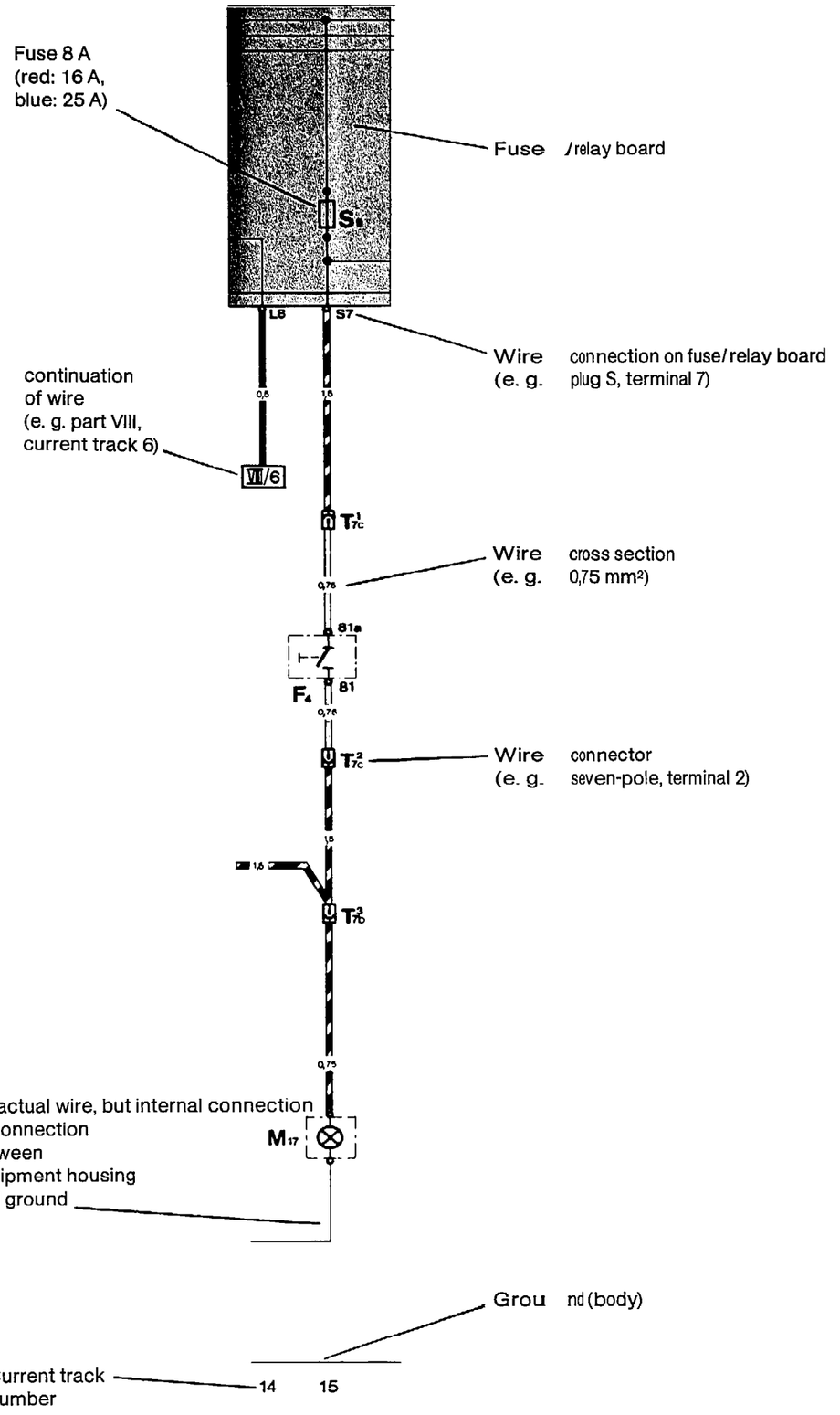
Route excess wire length above Central Electrical System.

Printed in Germany – XXXI, 1993

Current Flow Diagram, Type 928 USA, Symbols and Explanation

Current Flow Diagram, Type 928 USA, Symbols and Explanation

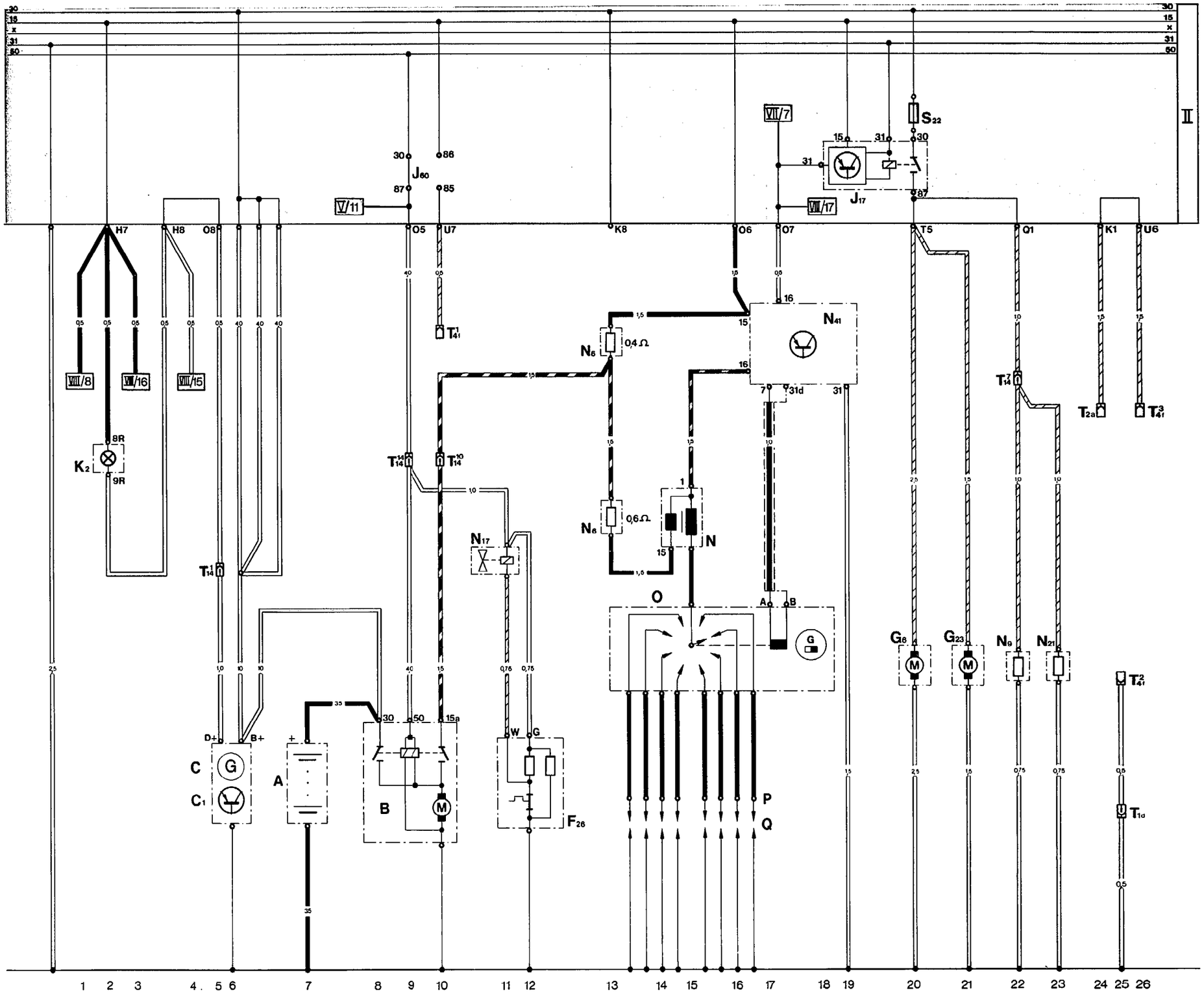
- Switch, open
- Switch, closed
- Sequence switch
- Tip switch
- Switch (tip switch), manually operated
- Switch (tip switch), mechanically operated, e. g. limit switch
- Temperature switch
- Pressure switch
- Temperature switch (thermal overload protection)
- Float switch
- Motor
- Generator
- Meter, indicator
- Solenoid
- Relay
- Solenoid valve
- Resistor, heating element
- Fuse
- Bulb
- Potentiometer
- Resistor sender unit
- Inductance, coil
- Horn
- Loudspeaker
- Antenna
- Equipment border line
- Solid-state circuit
- Spark gap
- Diode
- Battery cell
- Wire connection, permanent
- Wire connection, detachable
- Shielded wire



Current Flow Diagram, Type 928 USA, Part I

Description		Current track
A	– Battery	7
B	– Starter	8, 9, 10
C	– Generator	6
C^{1}	– Regulator	6
F^{26}	– Thermo-switch for cold start valve	12
G^{6}	– Fuel pump 1	20
G^{23}	– Fuel pump 2	21
J^{17}	– Fuel pump relay	19,20
J^{60}	– (Starter blocking relay, cars with automatic transmission only) connection between terminals 30 and 87	9, 10
K^{2}	– Generator charge indicator light	2
N	– Ignition coil	15
N^{6}	– Resistor	13
N^{9}	– Warm-up regulator	22
N^{17}	– Cold start valve	11
N^{21}	– Supplementary air valve	23
N^{41}	– Transistor ignition unit	17,19
O	– Distributor	13 . . . 18
P	– Spark plug connector	15
Q	– Spark plug	15
S^{22}	– Fuse	20
T^{1d}	– Wire connector in spare wheel well	25
T^{2a}	– Wire connector, two-pole, behind accelerator pedal	24
T^{4f}	– Wire connector, four-pole, in spare wheel well	10, 25, 26
T^{14}	– Wire connector, fourteen-pole in engine compartment, near ignition unit	5, 9, 10, 22

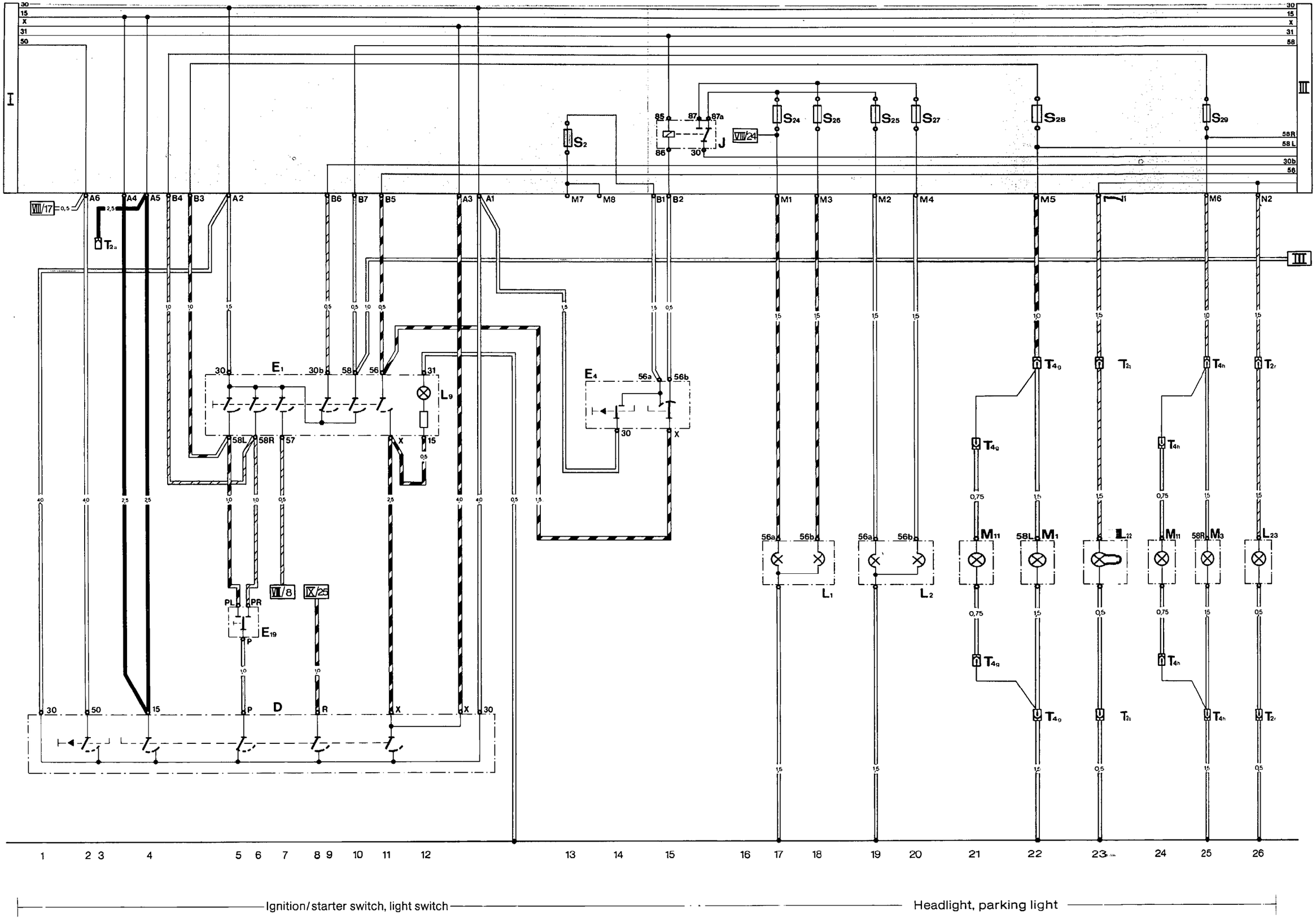
Current Flow Diagram, Type 928 USA, Part I


30
15
x
31
50
II
J60
30
86
87
85
V/11
VII/7
S22
15
31
30
31
87
J17
VII/17
H7
H8
O8
O5
U7
K8
O6
O7
T5
Q1
K1
U6
VIII/8
VIII/16
VIII/15
K2
8R
9R
T41
N6
0,4 Ω
N41
16
15
31d
T14/7
T14/14
T14/10
T2a
T41/3
N6
0,6 Ω
N
N17
T14
O
A
B
G
G6
G23
N9
N21
T41/2
T1a
C
G
C1
D+
B+
A
B
M
30
50
15a
W
G
F26
P
Q
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Power supply, starter
Ignition
Fuel pumps

Current Flow Diagram, Type 928 USA, Part II

Description		Current track
D	– Ignition/starter switch	1 . . . 12
E[1]	– Light switch	5 . . . 12
E[4]	– Dimmer/headlight flasher switch	13, 14
E[19]	– Parking light switch	5
J	– Headlight dimmer relay	15
L[1]	– Left headlight	17, 18
L[2]	– Right headlight	19, 20
L[9]	– Light switch illumination	12
L[22]	– Left fog light	23
L[23]	– Right fog light	26
M[1]	– Left parking light	22
M[3]	– Right parking light	25
M[11]	– Front side marker light	21, 24
S[2]	– Fuse	13
S[24]	– Fuse	17
to	– Fuse	18, 19, 20, 22
S[29]	– Fuse	25
T[2]	– Wire connector, two pole	
	a – behind accelerator pedal	3
	q – near left fog light	22
	r – near right fog light	26
T[4]	– Wire connector, four pole	
	g – near left parking light	21, 22
	h – near right parking light	24, 25

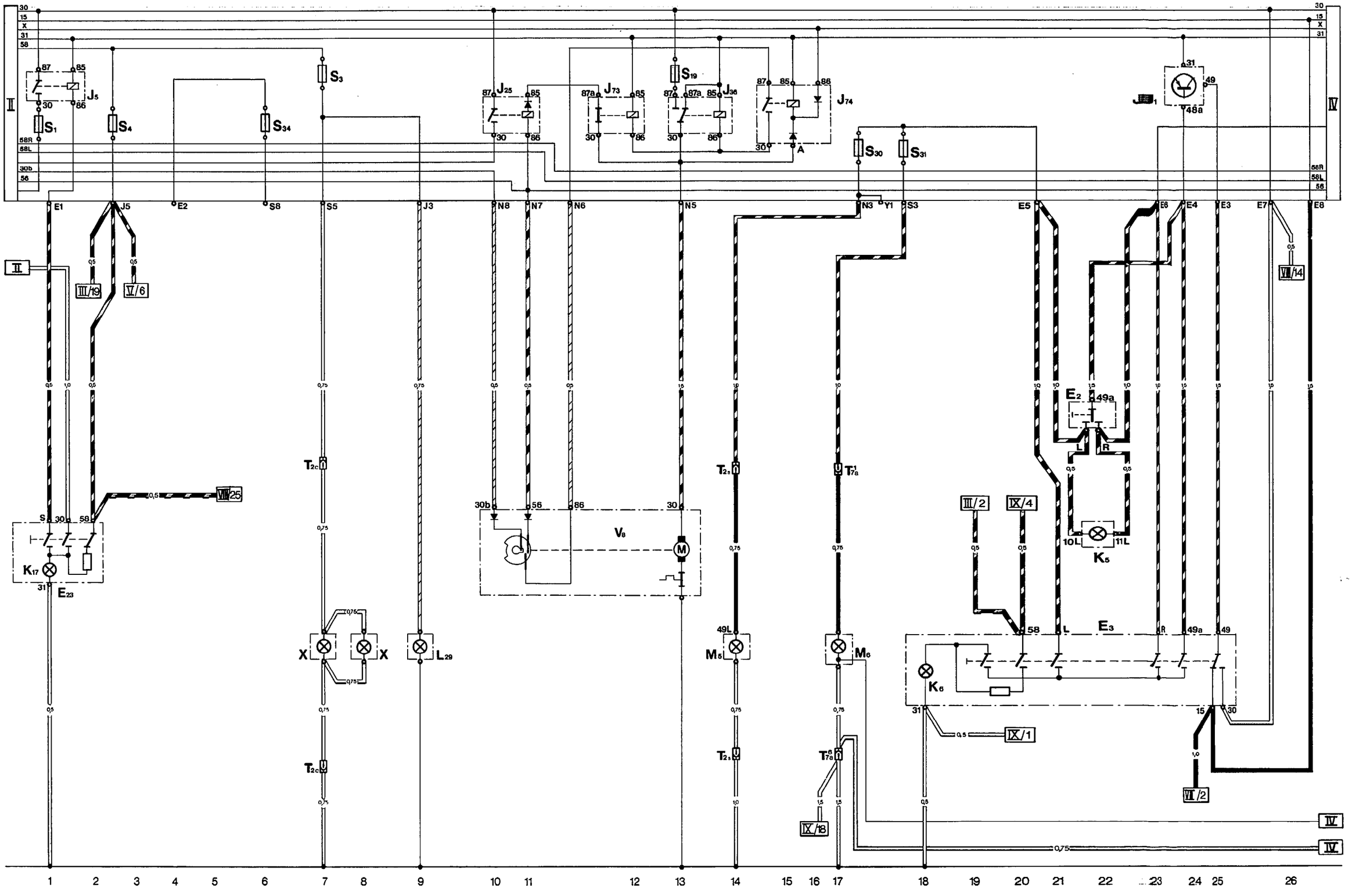
Current Flow Diagram, Type 928 USA, Part II


30
15
X
31
50
I
III
A6
A4
A5
B4
B3
A2
B6
B7
B5
A3
A1
B1
B2
M7
M8
M1
M3
M2
M4
M5
M6
N2
58R
58 L
30b
56
VIII/17
T2a
S2
S24
S26
S25
S27
S28
S29
VIII/24
J
E1
L9
E4
56a
56b
T4g
T2a
T4h
T2r
M11
M1
L22
L23
L1
L2
VI/8
IX/25
E19
PL
PR
P
D
R
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Ignition/starter switch, light switch
Headlight, parking light

Current Flow Diagram, Type 928 USA, Part III

Description		Current track
E^{2}	– Turn signal switch	22
E^{3}	– Emergency flasher switch	18 . . . 25
E^{23}	– Fog light switch	1
J^{1}	– Hazard/turn signal flasher	24
J^{5}	– Fog light relay	1
J^{25}	– Headlight relay	10, 11
J^{36}	– Concealing headlight relay	13
J^{73}	– Headlight control relay	12
J^{74}	– Headlight safety relay	15
K^{5}	– Turn signal indicator light	22
K^{6}	– Hazard flasher indicator light	18
K^{17}	– Fog light indicator light	1
L^{29}	– Engine compartment light	9
M^{5}	– Left front turn signal	14
M^{6}	– Left rear turn signal	17
S^{1}	– Fuse	1
S^{3}	– Fuse	7
S^{4}	– Fuse	3
S^{19}	– Fuse	13
S^{30}	– Fuse	17
S^{31}	– Fuse	18
S^{34}	– Fuse	6
T^{2}	– Wire connector, two-pole	
	c – behind rear bumper	7
	s – near left front turn signal	14
T^{7a}	– Wire connector, seven-pole behind luggage compartment covering, left	17
V^{8}	– Concealing headlight motor	10 . . . 13
X	– License plate light	7, 8

Current Flow Diagram, Type 928 USA, Part III

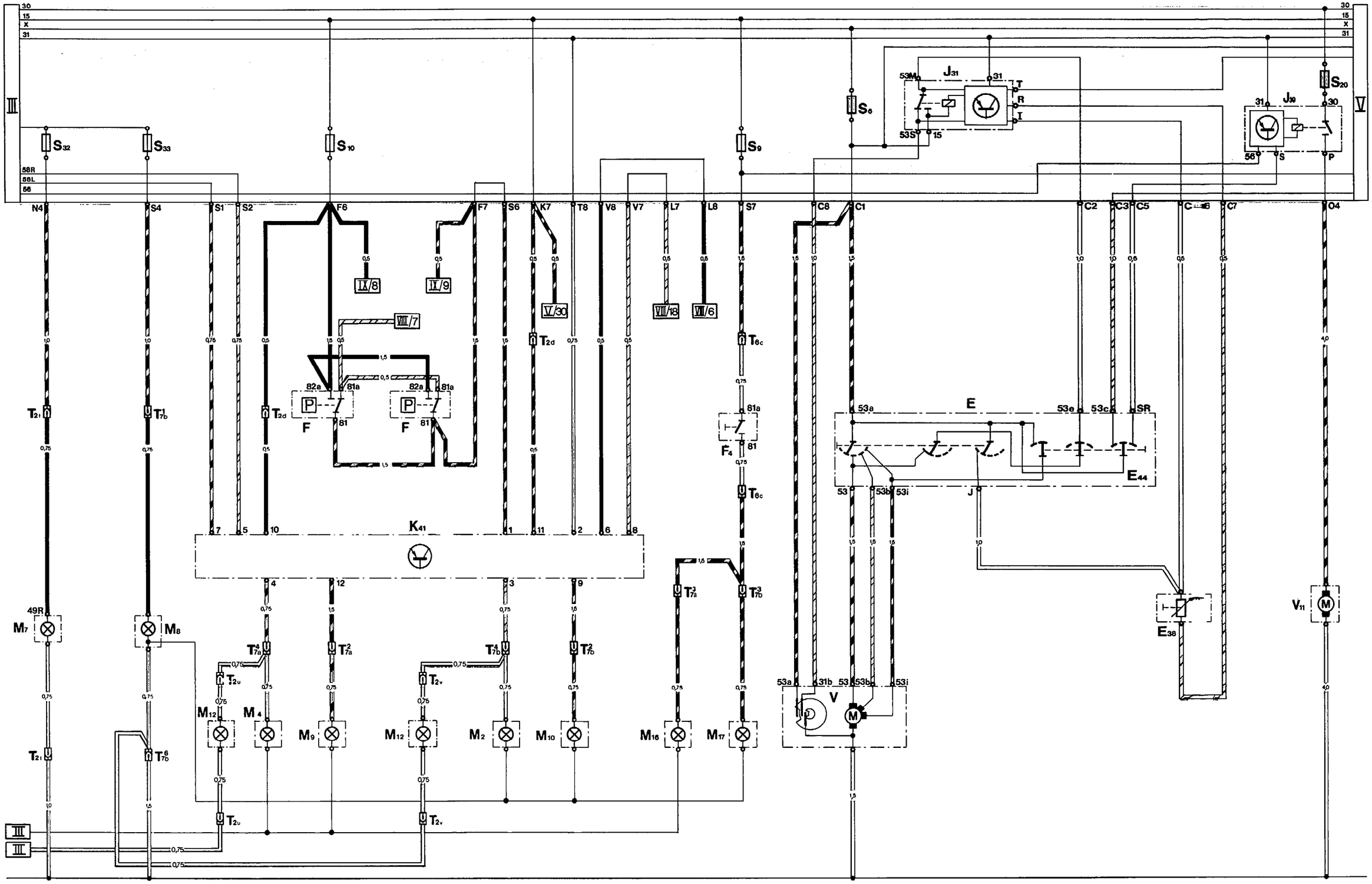


Fog light, license plate light — Concealed headlight — Front turn signal — Hazard flasher

Current Flow Diagram, Type 928 USA, Part IV

Description	Current track
E – Windshield wiper switch	17 . . . 23
E^{38} – Potentiometer for interval wiping	24
E^{44} – Windshield/headlight washer switch	23
F – Stop light switch	5, 8
F^{4} – Back-up light switch	15
J^{31} – Relay for interval wiping	19, 20
J^{39} – Headlight washer relay	25, 26
K^{41} – Lamp control unit	4 . . . 12
M^{2} – Right rear light	9
M^{4} – Left rear light	4
M^{7} – Right front turn signal	1
M^{8} – Right rear turn signal	3
M^{9} – Left brake light	5
M^{10} – Right brake light	12
M^{12} – Side marker light	4, 8
M^{16} – Left back-up light	13
M^{17} – Right back-up light	15
S^{6} – Fuse	17
S^{9} – Fuse	15
S^{10} – Fuse	5
S^{20} – Fuse	26
S^{32} – Fuse	1
S^{33} – Fuse	3
T^{2} – Wire connector, two pole	
d – near fuse/relay board	4, 10
t – near right front turn signal	1
u – near left side marker	4
v – near right side marker	8
T^{6c} – Wire connector, six pole, in spare wheel well	15
T^{7} – Wire connector, seven-pole	
a – behind luggage compartment covering left	4, 5, 13
b – behind luggage compartment covering right	3, 9, 12, 15
V – Windshield wiper motor	16 . . . 18
V^{11} – Headlight washer pump	26

Current Flow Diagram, Type 928 USA, Part IV

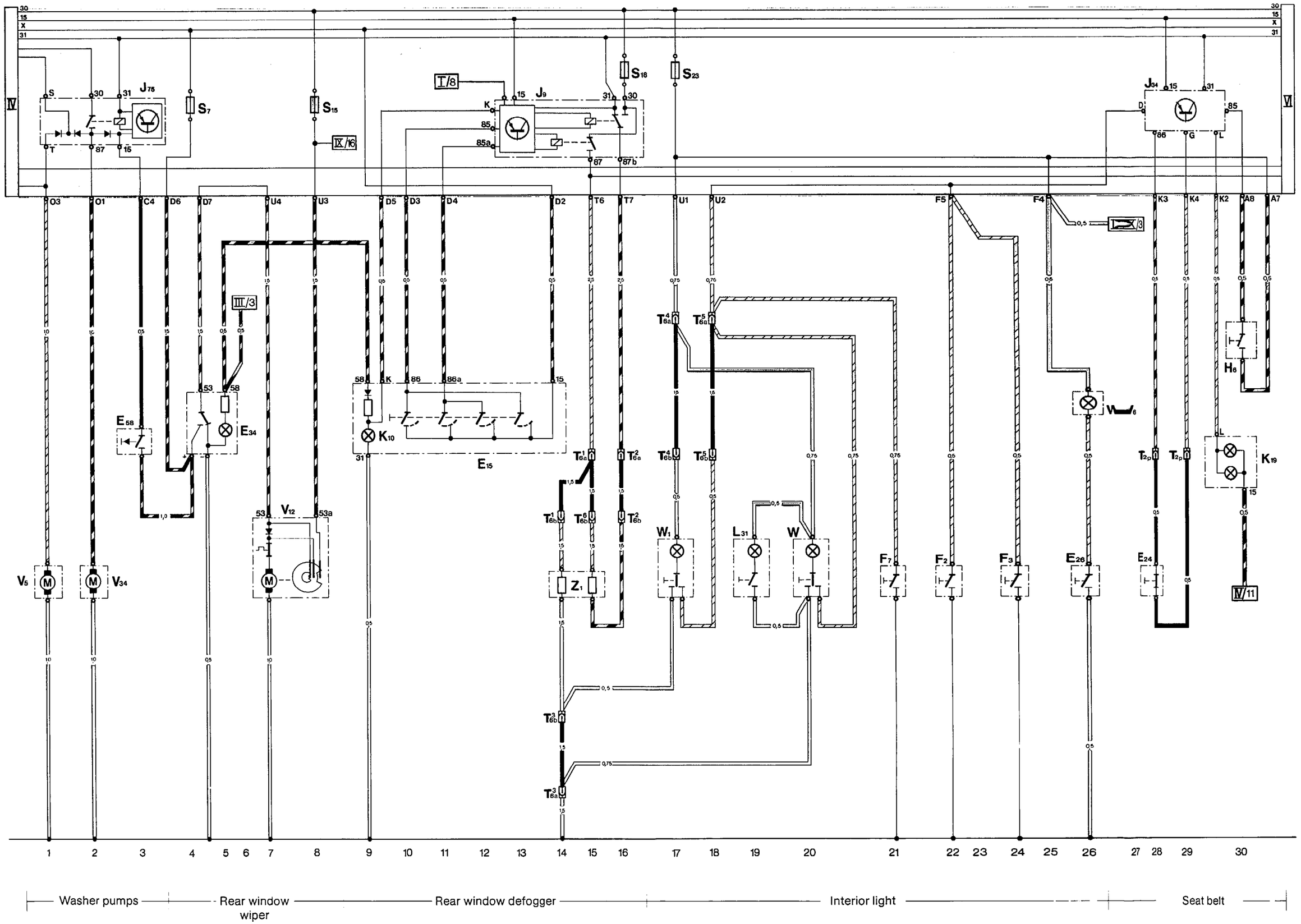

30
15
X
31
III
V
S32
S33
S10
S9
S6
S20
J31
J30
53M
53S
56R
56L
56
N4
S4
S1
S2
F6
F7
S6
K7
T8
V8
V7
L7
L8
S7
C8
C1
C2
C3
C5
C6
C7
O4
IX/8
IX/9
V/30
VIII/18
VIII/6
VIII/7
T2d
T6c
T2i
T7b
F
F4
E
E44
E38
SR
K41
49R
M7
M8
M12
M4
M9
M2
M10
M16
M17
V
V11
T7a
T2u
T2v
J
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Rear lights, lamp control unit
Windshield wiper

Current Flow Diagram, Type 928 USA, Part V

Description	Current track
E^{15} – Rear window defogger switch	9 . . . 13
E^{24} – Seat belt contact	28
E^{26} – Glove compartment light switch	26
E^{34} – Rear window wiper switch	4, 5
E^{58} – Intensive cleaner pump switch	3
F^{2} – Left door switch	22
F^{3} – Right door switch	24
F^{7} – Rear lid switch	21
H^{6} – Key warning buzzer contact	30
J^{9} – Rear window defogger relay	13 . . . 16
J^{34} – Seat belt warning system relay	29
J^{75} – Intensive cleaner pump relay	1 . . . 3
K^{10} – Rear window defogger indicator light	9
K^{19} – Seat belt warning light	30
L^{31} – Make-up mirror illumination	19
S^{7} – Fuse	4
S^{15} – Fuse	8
S^{18} – Fuse	16
S^{23} – Fuse	17
T^{2p} – Wire connector, two-pole near driver seat	28, 29
T^{6} – Wire connector, six-pole	
a – behind side covering, right	14, 15, 16, 17, 18
b – in rear lid, right	14, 15, 16, 17, 18
V^{5} – Windshield washer pump	1
V^{12} – Rear window wiper motor	7, 8
V^{34} – Intensive cleaner pump	2
W – Front interior light	20
W^{1} – Rear interior light	17
W^{6} – Glove compartment light	26
Z^{1} – Rear window defogger	14, 15

Current Flow Diagram, Type 928 USA, Part V

Current Flow Diagram, Type 928 USA, Part V

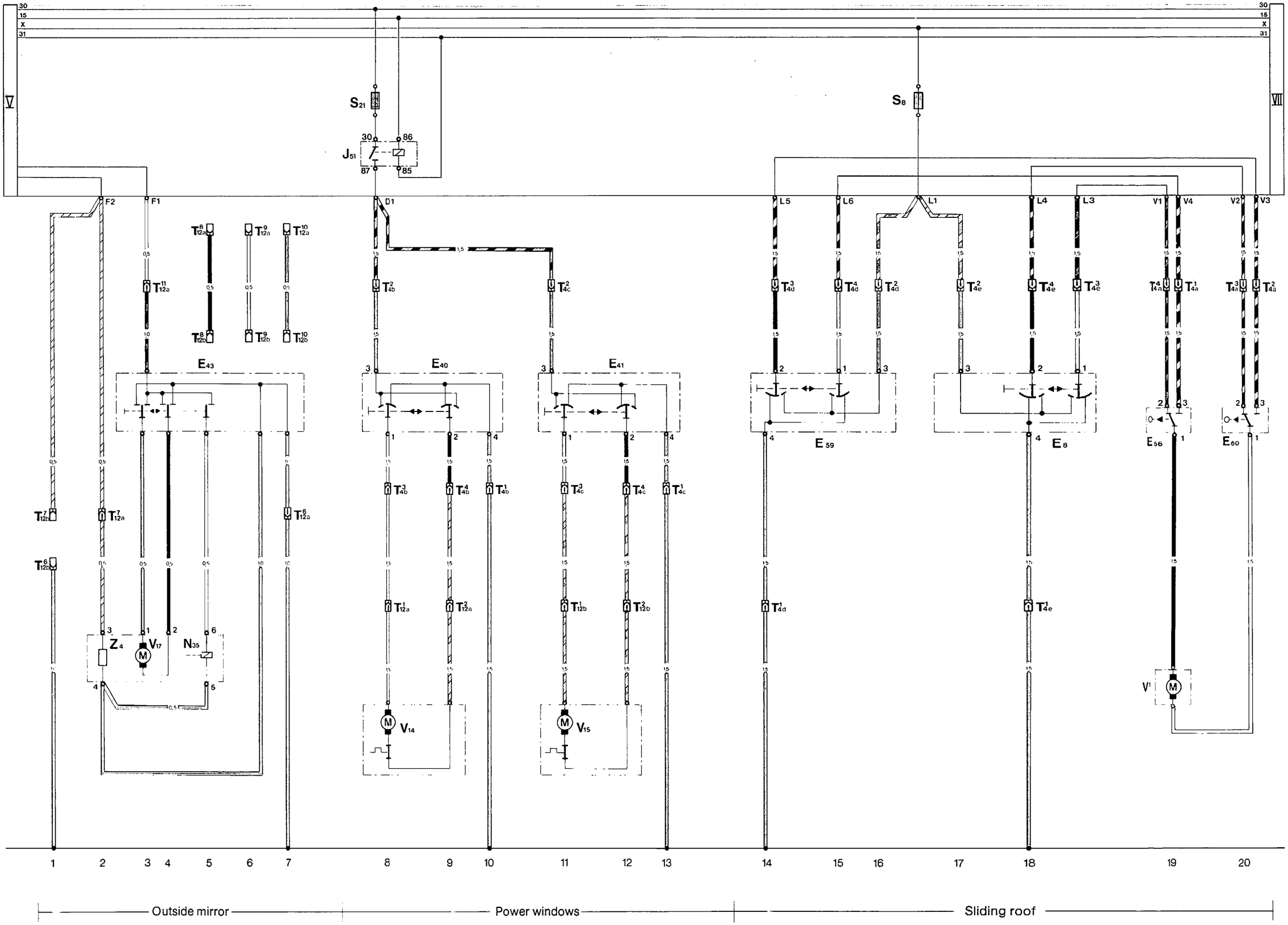


Current Flow Diagram, Type 928 USA, Part VI

Description	Current track
E^{8} – Sliding roof switch (open – close)	17, 18
E^{40} – Power window switch, left	8 . . . 10
E^{41} – Power window switch, right	11 . . . 13
E^{43} – Outside mirror control switch	3 . . . 7
E^{56} – Limit switch sliding roof (open – close)	19
E^{59} – Sliding roof switch (lift – lower)	14 . . . 16
E^{60} – Limit switch sliding roof (lift – lower)	20
J^{51} – Power window relay	8
N^{35} – Magnetic clutch for mirror control	5
S^{8} – Fuse	16
S^{21} – Fuse	8
T^{4} – Wire connector, four-pole	
a – behind side covering, right	19, 20
b – in console, right	8 . . . 10
c – in console, right	11 . . . 13
d – in console, right	14 . . . 16
e – in console, right	17, 18
T^{12} – Wire connector, twelve-pole	
a – in foot well, driver side	2, 3, 5 . . . 9
b – in foot well, passenger side	1, 5, 6, 7, 11, 12
V^{1} – Sliding roof motor	19
V^{14} – Power window motor, left	8
V^{15} – Power window motor, right	11
V^{17} – Outside mirror control motor	3
Z^{4} – Outside mirror defogger	2

Current Flow Diagram, Type 928 USA, Part VI

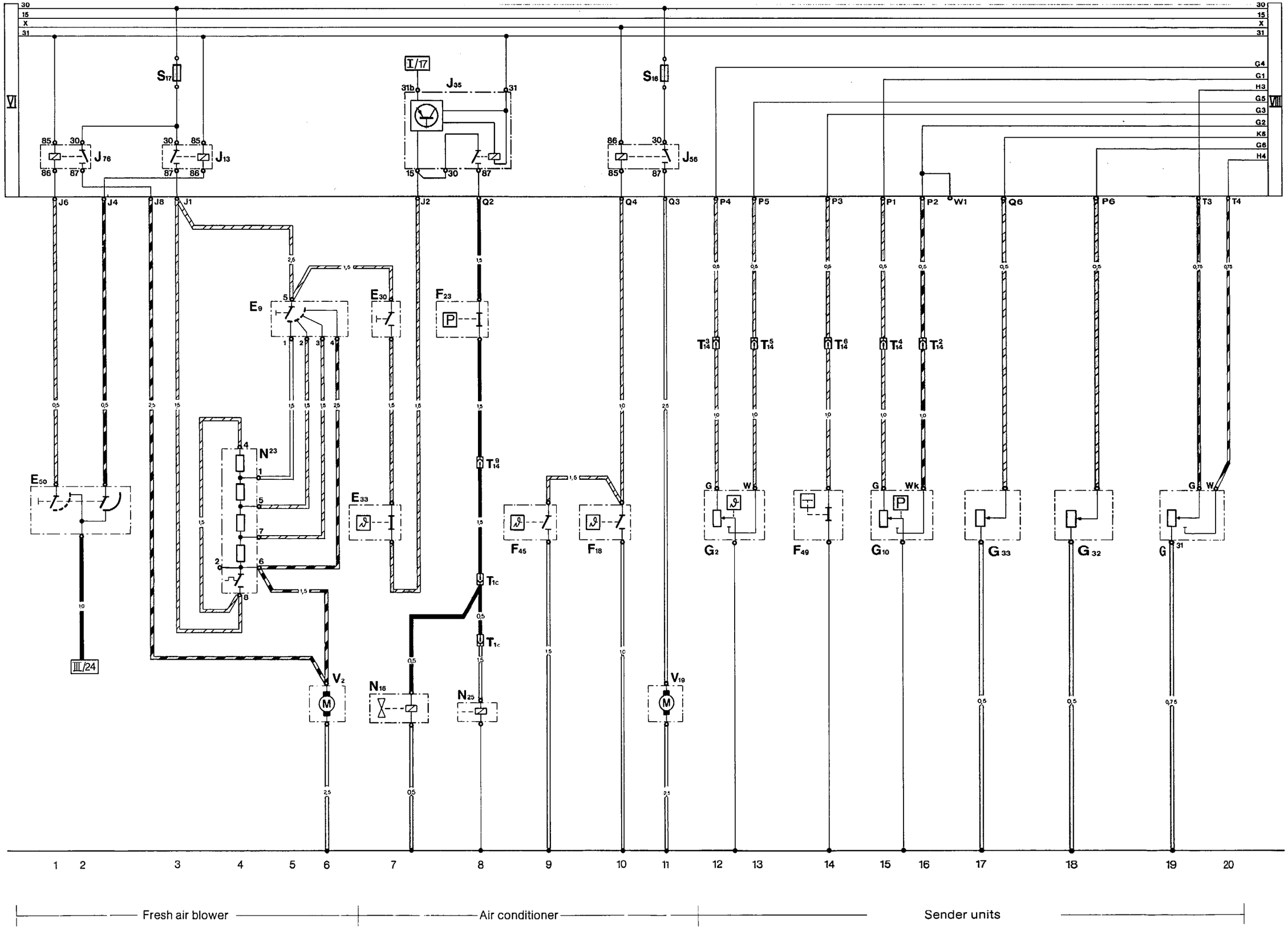
Current Flow Diagram, Type 928 USA, Part VI



Current Flow Diagram, Type 928 USA, Part VII

Description		Current track
E^{9}	– Fresh air blower switch	5, 6
E^{30}	– Air conditioner switch	7
E^{33}	– Temperature switch for AC	7
E^{50}	– Defroster switch	1, 2
F^{18}	– Thermo-switch for cooling fan	10
F^{23}	– Pressure switch for AC	8
F^{45}	– Thermo-switch for AC	9
F^{49}	– Engine oil level switch	14
G	– Fuel sender unit	19
G^{2}	– Coolant temperature sender unit	12, 13
G^{10}	– Oil pressure sender unit	15, 16
G^{32}	– Coolant level sender unit	18
G^{33}	– Cleaning water level sender unit	17
J^{13}	– Fresh air blower relay	3
J^{35}	– Speed relay for AC	8
J^{56}	– Cooling fan relay	10, 11
J^{76}	– Defroster relay	1, 2
N^{16}	– Supplementary air valve	7
N^{23}	– Resistor unit for fresh air blower	4
N^{25}	– Electromagnetic clutch for AC	8
S^{16}	– Fuse	11
S^{17}	– Fuse	3
T^{1c}	– Wire connector near AC-compressor	8
T^{14}	– Wire connector, fourteen-pole in engine compartment, near ignition unit	8, 12 . . . 16
V^{2}	– Fresh air blower	6
V^{19}	– Cooling fan	11

Current Flow Diagram, Type 928 USA, Part VII

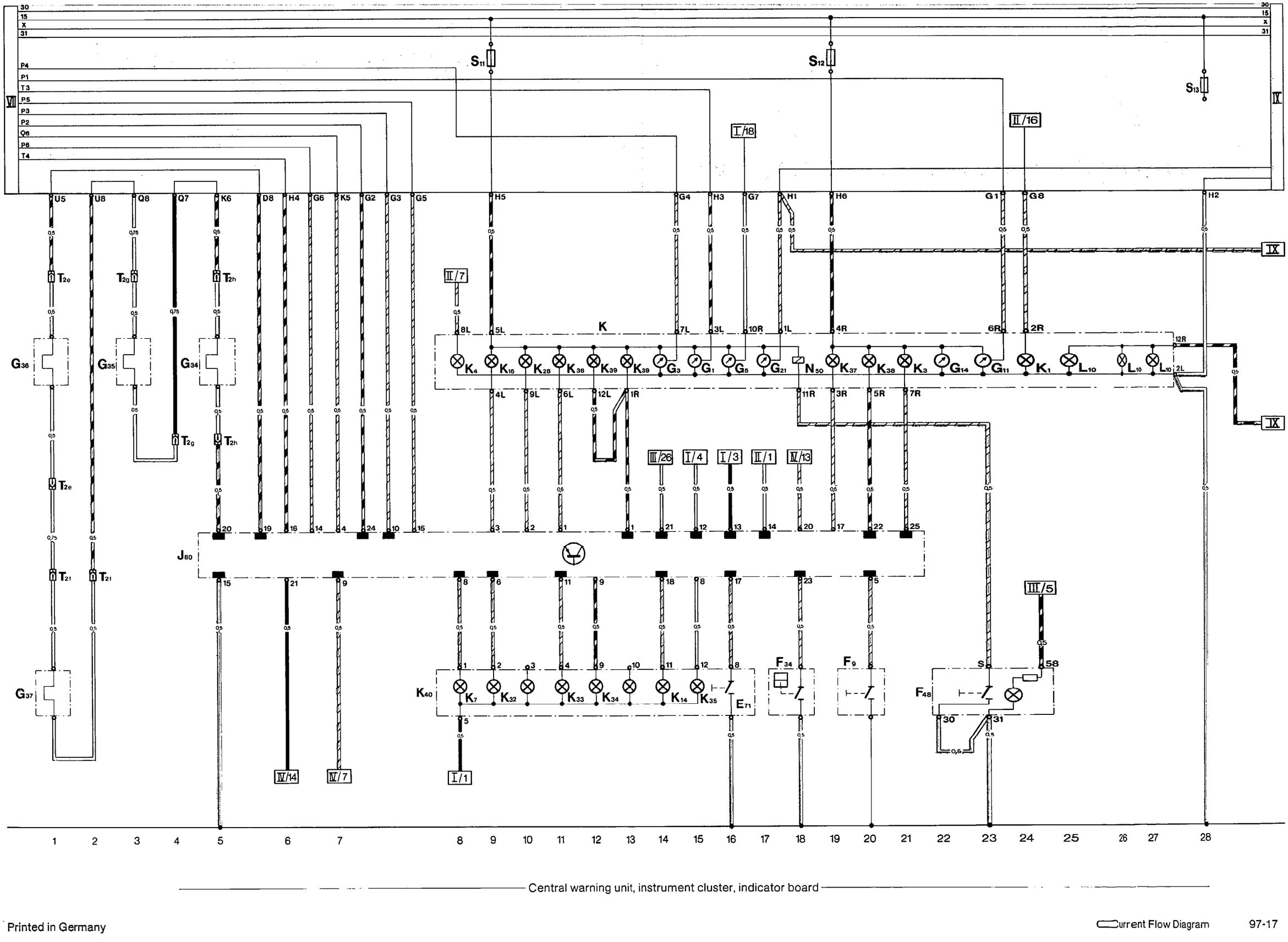

30
15
X
31
VI
VIII
S17
S16
I/17
J35
J76
J13
J56
E9
E30
F23
E50
E33
N23
N16
N25
V2
V19
T14a
T1c
T1c
F45
F18
G2
F49
G10
G33
G32
G31
J6
J4
J8
J1
J2
Q2
Q4
Q3
P4
P5
P3
P1
P2
W1
Q6
P6
T3
T4
G4
G1
H3
G5
G3
G2
K6
G6
H4
III/24
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Fresh air blower
Air conditioner
Sender units

Current Flow Diagram, Type 928 USA, Part VIII

Description	Current track
E^{71} – Reset button on indicator board	16
F^{9} – Parking brake contact	20
F^{34} – Brake fluid level switch	18
F^{48} – Reset button for mileage counter	23
G^{1} – Fuel gauge	15
G^{3} – Coolant temperature indicator	14
G^{5} – Tachometer	16
G^{11} – Oil pressure indicator	23
G^{14} – Voltmeter	22
G^{21} – Speedometer	17
G^{34} – Brake pad contact, front left	5
G^{35} – Brake pad contact, front right	3
G^{36} – Brake pad contact, rear left	1
G^{37} – Brake pad contact, rear right	1
J^{80} – Central warning unit	5 . . . 20
K – Instrument cluster	8 . . . 27
K^{1} – High beam indicator light	24
K^{3} – Oil pressure indicator light	21
K^{4} – Parking lights indicator light	8
K^{7} – Brake warning light	8
K^{14} – Parking brake indicator light	14
K^{16} – Low fuel warning light	9
K^{28} – Coolant temperature warning light	10
K^{32} – Brake pads warning light	9
K^{33} – Brake fluid level warning light	11
K^{34} – Stop lights warning light	12
K^{35} – Rear lights warning light	15
K^{36} – Coolant level warning light	11
K^{37} – Cleaning water level warning light	19
K^{38} – Engine oil level warning light	20
K^{39} – Central warning light	12, 13
K^{40} – Indicator board	8 . . . 16
L^{10} – Instrument cluster illumination light	25 . . . 27
N^{50} – Solenoid for mileage reset	18
S^{11} – Fuse	9
S^{12} – Fuse	19
S^{13} – Fuse	28
T^{2} Wire connector, two pole	
e – near left backwheel	1
f – near right backwheel	1, 2
g – near right frontwheel	3, 4
h – near left frontwheel	5

Current Flow Diagram, Type 928 USA, Part VIII

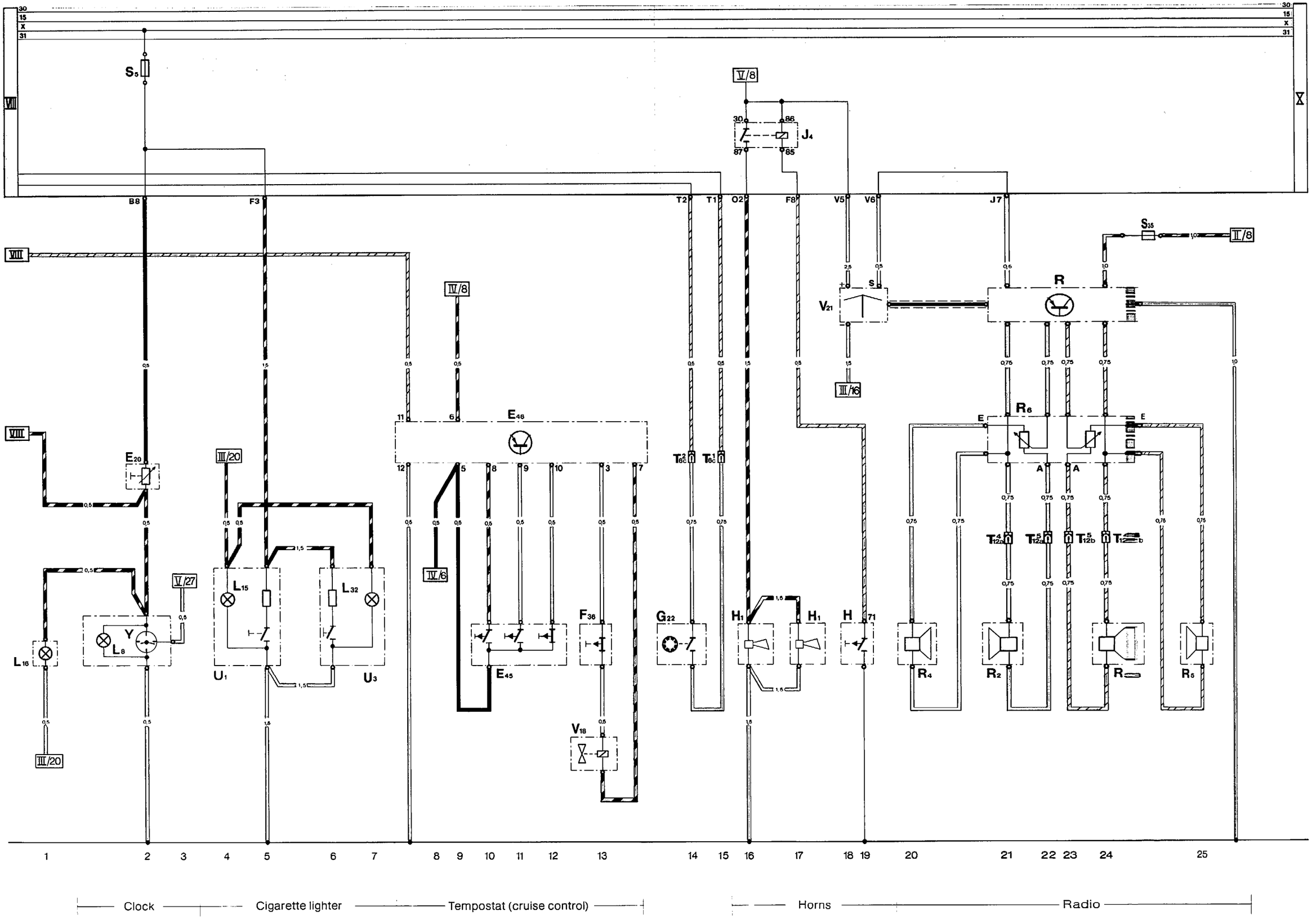
Current Flow Diagram, Type 928 USA, Part VIII



Current Flow Diagram, Type 928 USA, Part IX

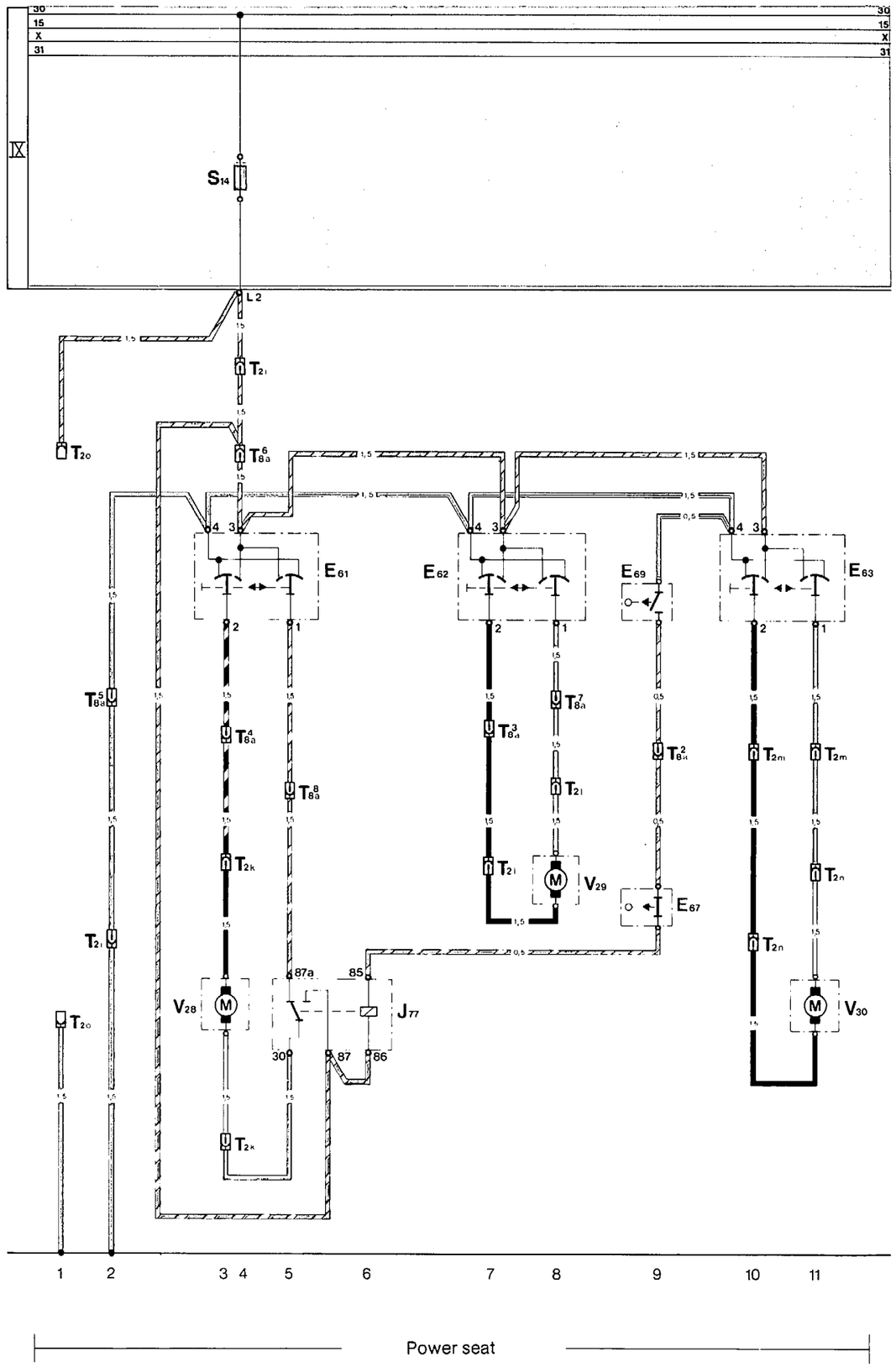
Description	Current track
E^{20} – Instruments illumination potentiometer	2
E^{45} – Tempostat (cruise control) switch	10 . . . 12
E^{46} – Tempostat control unit	8 . . . 13
F^{36} – Clutch pedal switch (Tempostat)	13
G^{22} – Speedometer sensor	14
H – Horn contact	19
H^{1} – Horn	16, 17
J^{4} – Horn relay	16, 17
L^{8} – Clock illumination light	2
L^{15} – Front ashtray illumination light	4
L^{16} – Heater control assembly illumination light	1
L^{32} – Rear ashtray illumination light	7
R – Radio	21 . . . 24
R^{2} – Loudspeaker, front left	21
R^{3} – Loudspeaker, front right	24
R^{4} – Loudspeaker, rear left	20
R^{5} – Loudspeaker, rear right	25
R^{6} – Speaker balance	21 . . . 24
S^{5} – Fuse	2
S^{35} – Fuse	24
T^{6c} – Wire connector, six-pole, in spare wheel well	14, 15
T^{12} – Wire connector, twelve-pole	
a – in foot well, driver side	21, 22
b – in foot well, passenger side	23, 24
U^{1} – Front cigarette lighter	5
U^{3} – Rear cigarette lighter	6
V^{18} – Tempostat motor	13
V^{21} – Antenna	19
Y – Clock	2

Current Flow Diagram, Type 928 USA, Part IX


30
15
X
31
S5
VIII
V/8
J4
B8
F3
T2
T1
O2
F8
V5
V6
J7
S35
II/8
R
V21
III/16
IV/8
E46
R6
E20
III/20
V/27
L15
L32
L16
Y
L8
U1
U3
IV/6
E45
F36
V18
G22
H1
H
T6c2
T6c1
T12a4
T12a5
T12b5
T12b
R4
R2
R5
R3
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Clock
Cigarette lighter
Tempostat (cruise control)
Horns
Radio

Current Flow Diagram, Type 928 USA, Part X

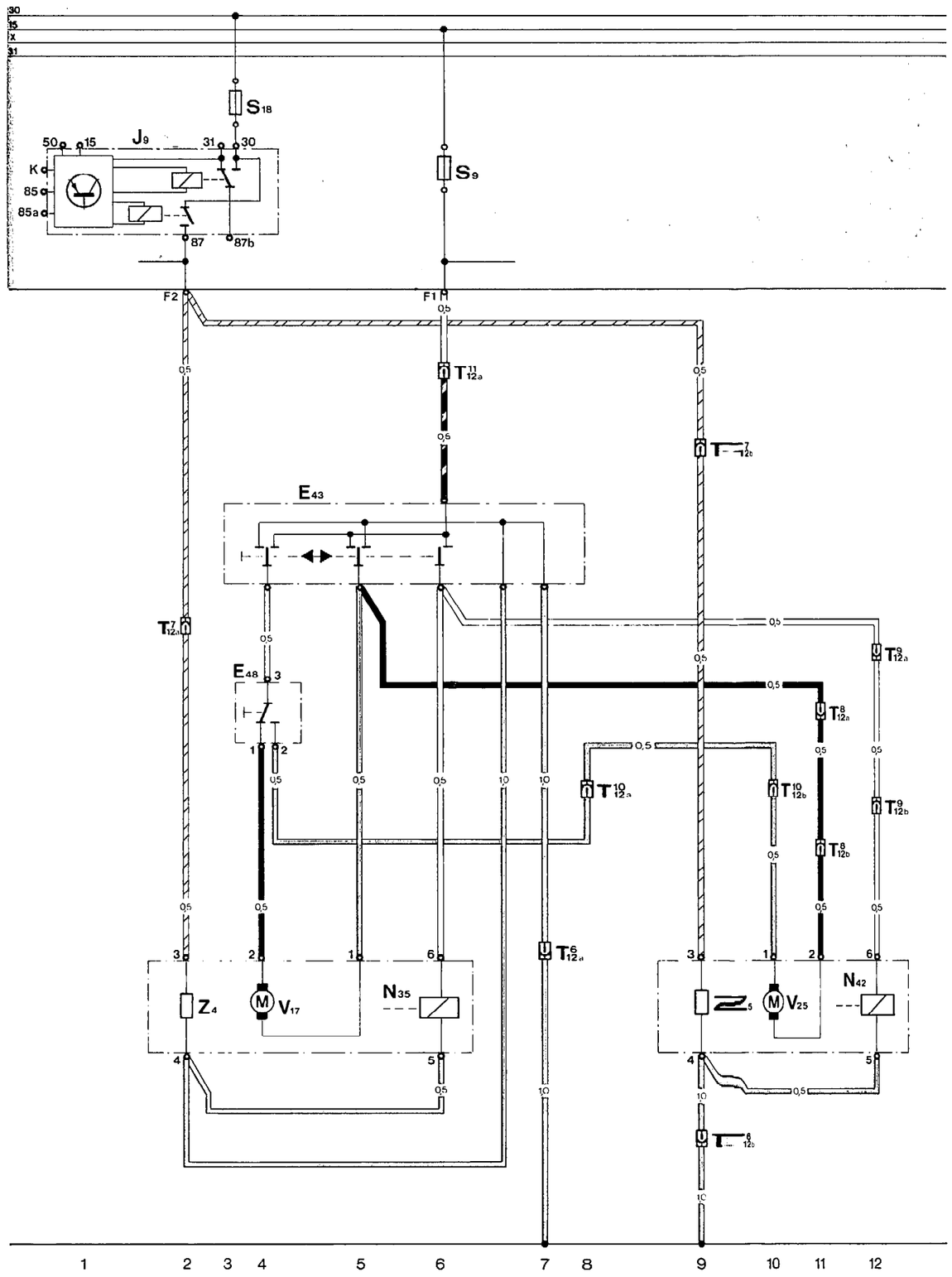
Description	Current track
E^{61} – Switch for longitudinal seat adjustment, driver side	4, 5
E^{62} – Switch for vertical seat adjustment, driver side	7, 8
E^{63} – Switch for backrest adjustment, driver side	10, 11
E^{67} – Seat rail limit switch, driver side	9
E^{69} – Backrest limit switch, driver side	9
J^{77} – Seat relay, driver side	5, 6
S^{14} – Fuse	3
T^{2} – Wire connector, two-pole	
i – near driver seat	2, 4
k – in driver seat	3
l – in driver seat	7, 8
m – in driver seat	10, 11
n – in driver seat	10, 11
o – near passenger seat	1
T^{8a} – Wire connector, eight-pole in driver seat	2 . . . 5, 7 . . . 9
V^{28} – Motor for longitudinal seat adjustment, driver side	3
V^{29} – Motor for vertical seat adjustment, driver side	8
V^{30} – Motor for backrest adjustment, driver side	11


30
15
X
31
IX
S14
L2
T2l
T2o
T8a6
T8a5
T8a4
T8a8
T2k
T2i
T2o
T2k
E61
E62
E69
E63
T8a7
T8a3
T8a2
T2l
T2l
V29
E67
T2m
T2m
T2n
T2n
V30
V28
J77
87a
85
30
87
86
4 3
2
1
1,5
0,5
1 2 3 4 5 6 7 8 9 10 11
Power seat

Additional Current Flow Diagram, Type 928 Remotely Controlled Outside Mirrors

Additional Current Flow Diagram, Type 928 Remotely Controlled Outside Mirrors

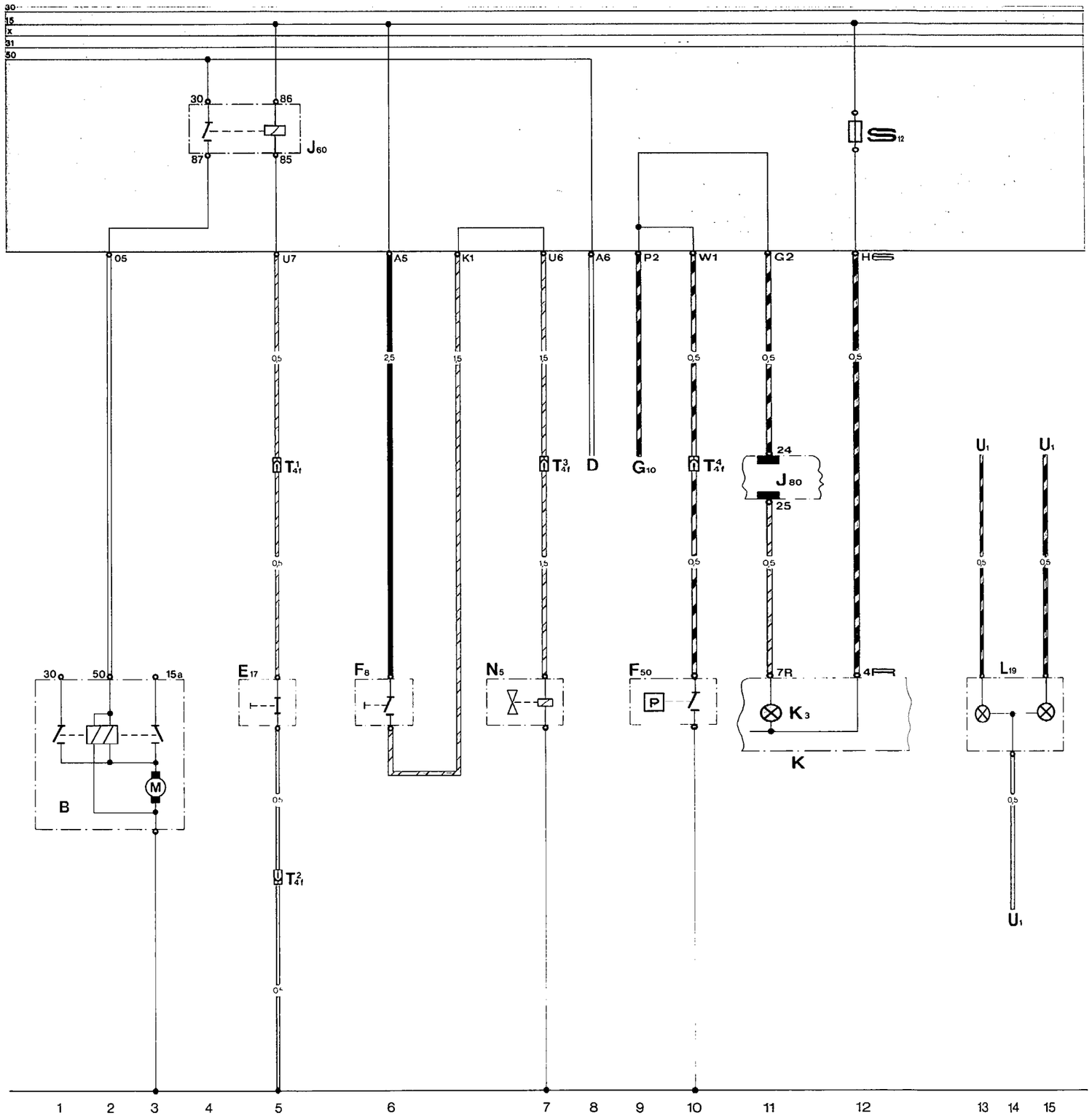
Description		Current track
E^{43}	– Mirror control switch	4 . . . 7
E^{48}	– Change-over switch for mirror control	4
J^{9}	– Rear window defogger relay	1, 2, 3
N^{35}	– Magnetic clutch for mirror control, driver side	6
N^{42}	– Magnetic clutch for mirror control, passenger side	12
S^{9}	– Fuse	6
S^{18}	– Fuse	4
T^{12}	– Wire connector, twelve pole	
	a - in foot well, driver side	2, 6, 7, 8, 11, 12
	b - in foot well, passenger side	9 . . . 12
V^{17}	– Mirror control motor, driver side	4
V^{25}	– Mirror control motor, passenger side	10
Z^{4}	– Outside mirror defogger, driver side	2
Z^{5}	– Outside mirror defogger, passenger side	9



Additional Current Flow Diagram, Type 928 Automatic Transmission

Additional Current Flow Diagram, Type 928 Automatic Transmission

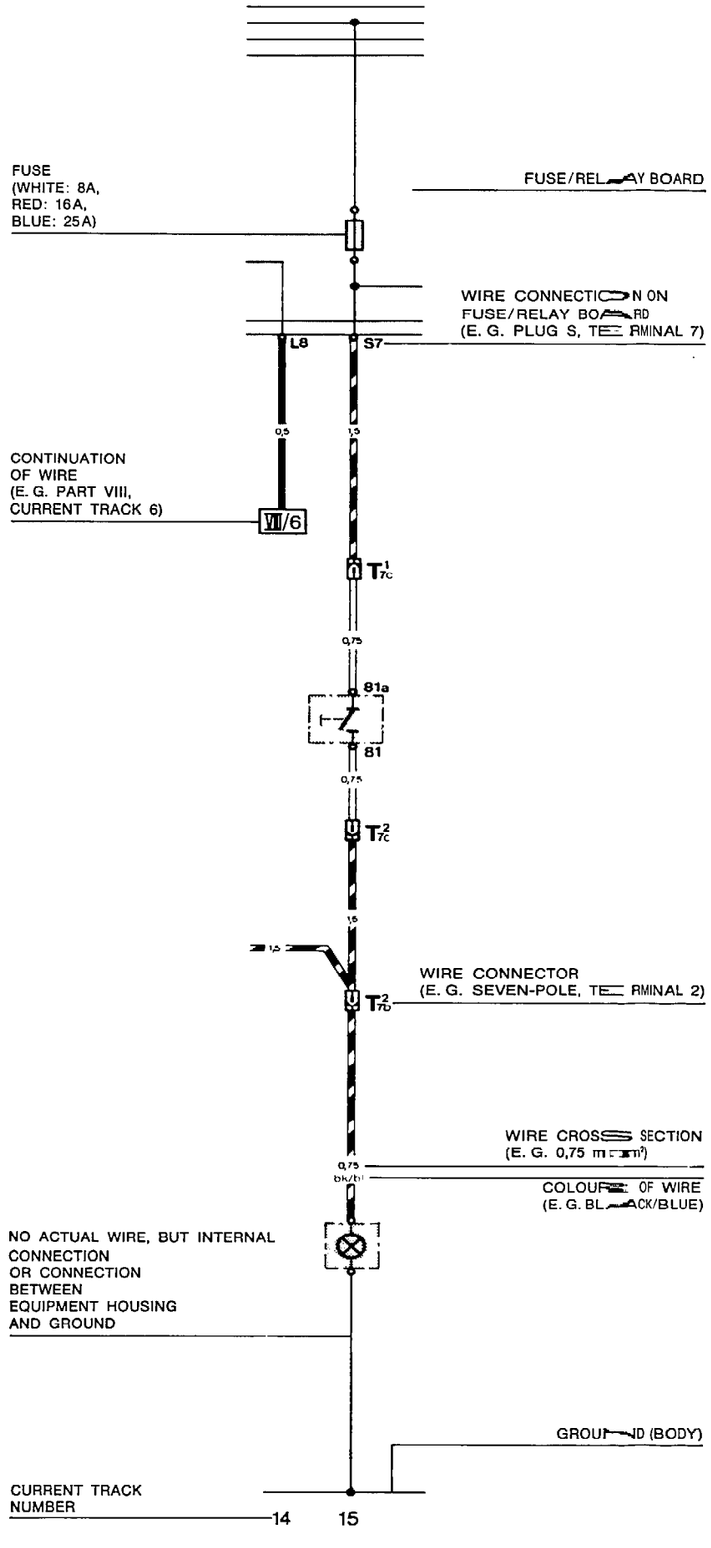
Description		Current track
B	– Starter	1, 2, 3
D	– to ignition / starter switch	8
E^{17}	– Starter interlock switch (back-up light switch see part IV)	5
F^{8}	– Kick-down switch	6
F^{50}	– Oil pressure switch (ATF)	10
G^{10}	– to oil pressure switch (engine)	9
J^{60}	– Starter interlock relay	4, 5
J^{80}	– Central warning unit	11
K	– Instrument cluster	11, 12
K^{3}	– Oil pressure indicator light	11
L^{19}	– Selector lever illumination	13, 15
N^{5}	– Solenoid valve	7
S^{12}	– Fuse	12
T^{4f}	– Wire connector, four pole in spare wheel well	5, 7, 10
U^{1}	– to cigarette lighter (terminal +)	13, 15
U^{1}	– to cigarette lighter (ground)	14



Current Flow Diagram Type 928 USA
Model 79
Symbols and Explanation

Current Flow Diagram Type 928 USA
Model 79
Symbols and Explanation

- SWITCH, OPEN
- SWITCH, CLOSED
- SEQUENCE SWITCH
- TIP SWITCH
- SWITCH (TIP SWITCH), MANUALLY OPERATED
- SWITCH (TIP SWITCH), MECHANICALLY OPERATED, E.G. LIMIT SWITCH
- TEMPERATURE SWITCH
- PRESSURE SWITCH
- TEMPERATURE SWITCH (THERMAL OVERLOAD PROTECTION)
- FLOAT SWITCH
- MOTOR
- GENERATOR
- METER, INDICATOR
- SOLENOID
- RELAY
- SOLENOID VALVE
- RESISTOR, HEATING ELEMENT
- FUSE
- BULB
- POTENTIOMETER
- RESISTOR SENDER UNIT
- INDUCTANCE, COIL
- HORN
- LOUDSPEAKER
- ANTENNA
- EQUIPMENT BORDER LINE
- SOLID-STATE CIRCUIT
- SPARK GAP
- DIODE
- BATTERY CELL
- WIRE CONNECTION, PERMANENT
- WIRE CONNECTION, DETACHABLE
- SHIELDED WIRE



Current Flow Diagram Type 928 USA

Model 79

Index

Current Flow Diagram Type 928 USA Model 79

Index

Part	Current-track	
VII	7	AIR CONDITIONER SWITCH
IX	19	ANTENNA
X	11	BACKREST ADJUSTMENT, MOTOR
X	11	BACKREST ADJUSTMENT, SWITCH
X	9	BACKREST LIMIT SWITCH
IV	13	BACK-UP LIGHT, LEFT
IV	15	BACK-UP LIGHT, RIGHT
IV	6	BACK-UP LIGHT, SWITCH
I	7	BATTERY
VIII	14	BRAKE FLUID LEVEL SWITCH
VIII	28	BRAKE FLUID LEVEL WARNING LIGHT
IV	5	BRAKE LIGHT, LEFT
IV	12	BRAKE LIGHT, RIGHT
VI	6	BRAKE LIGHT SWITCH
VI	24	BRAKE PAD CONTACT, FRONT, LEFT
VI	22	BRAKE PAD CONTACT, FRONT, RIGHT
VI	20	BRAKE PAD CONTACT, REAR, LEFT
VI	20	BRAKE PAD CONTACT, REAR, RIGHT
VIII	31	BRAKE PADS WARNING LIGHT
VIII	32	BRAKE WARNING LIGHT
VIII	25	CENTRAL WARNING LIGHT
VIII	23	CENTRAL WARNING LIGHT - RESET BUTTON
VIII	10	CENTRAL WARNING UNIT
IX	5	CIGARETTE LIGHTER, FRONT
IX	6	CIGARETTE LIGHTER, REAR
VII	17	CLEANING WATER LEVEL SENDER UNIT
VIII	16	CLEANING WATER LEVEL WARNING LIGHT
IX	2	CLOCK
IX	13	CLUTCH PEDAL SWITCH (TEMPOSTAT)
III	10	CONCEALING HEADLIGHT MOTOR
III	13	CONCEALING HEADLIGHT RELAY
VII	18	COOLANT LEVEL SENDER UNIT
VIII	12	COOLANT LEVEL WARNING LIGHT
VIII	13	COOLANT TEMPERATURE INDICATOR
VII	12	COOLANT TEMPERATURE SENDER UNIT
VIII	24	COOLANT TEMPERATURE WARNING LIGHT
VII	11	COOLING FAN MOTOR, AC
VII	11	COOLING FAN RELAY, AC
VII	2	DEFROSTER RELAY
II	13	DIMMER/HEAD LIGHT FLASHER SWITCH
I	15	DISTRIBUTOR
V	22	DOOR SWITCH, LEFT
V	24	DOOR SWITCH, RIGHT
VII	8	ELECTROMAGNETIC CLUTCH FOR AC
III	20	EMERGENCY FLASHER SWITCH
III	9	ENGINE COMPARTMENT LIGHT
II	21	FOG LIGHT, LEFT
III	1	FOG LIGHT RELAY
II	24	FOG LIGHT, RIGHT
III	1	FOG LIGHT SWITCH
VII	6	FRESH AIR BLOWER MOTOR
VII	3	FRESH AIR BLOWER RELAY
VII	4	FRESH AIR BLOWER, RESISTOR UNIT
VII	5	FRESH AIR BLOWER SWITCH
VIII	15	FUEL GAUGE
I	20	FUEL PUMP
I	20	FUEL PUMP RELAY
VII	19	FUEL SENDER UNIT

Part	Current-track	
		FUSES
III	1	1
II	13	2
III	7	3
III	2	4
IX	5	5
IV	17	6
V	4	7
XI	15	8
IV	15	9
IV	5	10
IX	2	11
VIII	26	12
	13	(free)
X	4	14
V	8	15
VII	11	16
VII	3	17
V	16	18
III	13	19
IV	26	20
VI	9	21
I	20	22
V	17	23
II	15	24
II	17	25
II	16	26
II	18	27
II	20	28
II	23	29
III	18	30
III	19	31
IV	1	32
IV	3	33
III	6	34
IX	25	FUSE (RADIO)
I	6	GENERATOR
VIII	37	GENERATOR CHARGE INDICATOR LIGHT
V	26	GLOVE COMPARTMENT LIGHT
V	26	GLOVE COMPARTMENT LIGHT SWITCH
III	24	HAZARD/TURN SIGNAL FLASHER
III	12	HEADLIGHT CONTROL RELAY
II	14	HEADLIGHT DIMMER RELAY
II	15	HEADLIGHT, LEFT
III	10	HEADLIGHT RELAY
II	17	HEADLIGHT, RIGHT
III	18	HEADLIGHT SAFETY RELAY
IV	26	HEADLIGHT WASHER PUMP
IV	25	HEADLIGHT WASHER RELAY
VII	1	HEATER CONTROL ASSEMBLY
IX	1	HEATER CONTROL ASSEMBLY LIGHT
VIII	39	HIGH BEAM INDICATOR LIGHT
IX	16	HORN
IX	18	HORN CONTACT
IX	16	HORN RELAY
I	15	IGNITION COIL
II	7	IGNITION/STARTER SWITCH
VIII	8	INSTRUMENT CLUSTER ILLUMINATION
IX	2	INSTRUMENT CLUSTER ILLUMINATION, POTENTIOMETER
V	2	INTENSIVE CLEANER PUMP
V	2	INTENSIVE CLEANER PUMP RELAY
V	3	INTENSIVE CLEANER PUMP SWITCH
V	20	INTERIOR LIGHT, FRONT
V	17	INTERIOR LIGHT, REAR
IV	24	INTERVAL WIPING, POTENTIOMETER
IV	20	INTERVAL WIPING, RELAY
V	30	KEY WARNING BUZZER CONTACT
IV	8	LAMP CONTROL UNIT
III	7	LICENCE PLATE LIGHT
II	8	LIGHT SWITCH
X	3	LONGITUDINAL SEAT ADJUSTMENT, MOTOR
X	5	LONGITUDINAL SEAT ADJUSTMENT, SWITCH
IX	21	LOUDSPEAKER, FRONT, LEFT
IX	24	LOUDSPEAKER, FRONT, RIGHT
IX	20	LOUDSPEAKER, REAR, LEFT
IX	26	LOUDSPEAKER, REAR, RIGHT
VIII	14	LOW FUEL WARNING LIGHT
VII	8	LOW PRESSURE SWITCH, AC
V	19	MAKE-UP MIRROR ILLUMINATION
VIII	20	MILEAGE RESET, SOLENOID
VIII	20	MILEAGE RESET SWITCH
VIII	36	OIL LEVEL INDICATOR LIGHT
VII	14	OIL LEVEL SWITCH
VIII	27	OIL PRESSURE INDICATOR
VIII	33	OIL PRESSURE INDICATOR LIGHT
VII	15	OIL PRESSURE SENDER UNIT
VI	3	OUTSIDE MIRROR, LEFT
VI	5	OUTSIDE MIRROR, LEFT, SWITCH

Part	Current-track	
VIII	10	PARKING BRAKE CONTACT
VIII	34	PARKING BRAKE INDICATOR LIGHT
II	5	PARKING LIGHT CONTACT
VIII	11	PARKING LIGHT INDICATOR
II	20	PARKING LIGHT, LEFT
II	23	PARKING LIGHT, RIGHT
VI	9	POWER WINDOW MOTOR, LEFT
VI	12	POWER WINDOW MOTOR, RIGHT
VI	9	POWER WINDOW RELAY
VI	10	POWER WINDOW SWITCH, LEFT
VI	13	POWER WINDOW SWITCH, RIGHT
IX	23	RADIO
V	21	REAR LID SWITCH
IV	4	REAR LIGHT, LEFT
IV	9	REAR LIGHT, RIGHT
VIII	18	REAR LIGHTS WARNING LIGHT
V	14	REAR WINDOW DEFOGGER
V	14	REAR WINDOW DEFOGGER RELAY
V	11	REAR WINDOW DEFOGGER SWITCH
V	7	REAR WINDOW WIPER MOTOR
V	5	REAR WINDOW WIPER SWITCH
I	6	REGULATOR
I	13	RESISTOR
V	28	SEAT BELT CONTACT
V	30	SEAT BELT WARNING LIGHT
V	28	SEAT BELT WARNING SYSTEM RELAY
X	9	SEAT RAIL LIMIT SWITCH
X	6	SEAT RELAY
II	19	SIDE MARKER, FRONT LEFT
II	22	SIDE MARKER, FRONT RIGHT
IV	7	SIDE MARKER, REAR LEFT
IV	4	SIDE MARKER, REAR RIGHT
VI	18	SLIDING ROOF MOTOR
VI	16	SLIDING ROOF SWITCH
I	17	SPARK PLUG
IX	24	SPEAKER BALANCE
VIII	21	SPEEDOMETER
IX	14	SPEEDOMETER SENSOR
VII	8	SPEED RELAY, AC
I	8	STARTER
I	9	STARTER BLOCKING RELAY (CARS WITH AUTOMATIC TRANSMISSION ONLY)
I	11	START VALVE
VIII	17	STOP LIGHTS WARNING LIGHT
I	23	SUPPLEMENTARY AIR VALVE
VII	7	SUPPLEMENTARY AIR VALVE, AC
IX	27	SUPPRESSOR (RADIO)
VIII	26	TACHOMETER
VII	10	TEMPERATURE SWITCH, COOLANT
VII	7	TEMPERATURE SWITCH, EVAPORATOR
VII	9	TEMPERATURE SWITCH, REFRIGERANT
IX	11	TEMPOSTAT CONTROL UNIT
IX	11	TEMPOSTAT (CRUISE CONTROL), SWITCH
IX	13	TEMPOSTAT MOTOR
I	11	THERMO SWITCH FOR COLD START VALVE
I	19	TRANSISTOR IGNITION UNIT
III	14	TURN SIGNAL, FRONT, LEFT
IV	1	TURN SIGNAL, FRONT, RIGHT
VIII	23	TURN SIGNAL INDICATOR LIGHT
VIII	22	TURN SIGNAL INDICATOR LIGHT, (TRAILER)
III	17	TURN SIGNAL, REAR, LEFT
IV	3	TURN SIGNAL, REAR, RIGHT
III	22	TURN SIGNAL SWITCH
X	8	VERTICAL SEAT ADJUSTMENT, MOTOR
X	7	VERTICAL SEAT ADJUSTMENT, SWITCH
VIII	30	VOLTMETER
I	22	WARM UP REGULATOR
V	1	WIND SHIELD WASHER PUMP
IV	17	WIND SHIELD WIPER MOTOR
IV	20	WIND SHIELD WIPER SWITCH

WIRE CONNECTORS

T1 - ONE-POLE
- A - NEAR TURN SIGNAL LEFT
- B - NEAR TURN SIGNAL RIGHT
- C - NEAR AC-COMPRESSOR
- D -
- E -
- F - NEAR FRESH AIR BLOWER
- G - NEAR GLOVE COMPARTMENT
- H - NEAR FUSE RELAY BOARD
- I - IN LEFT DOOR

T2 - TWO-POLE
- A - BEHIND ACCELERATOR PEDAL
- C - BEHIND REAR BUMPER
- D - BEHIND SIDE COVERING, RIGHT
- E - NEAR LEFT BACKWHEEL
- F - NEAR RIGHT BACKWHEEL
- G - NEAR RIGHT FRONT WHEEL
- H - NEAR LEFT FRONT WHEEL
- I - NEAR DRIVER SEAT
- K - IN DRIVER SEAT
- L - IN DRIVER SEAT
- M - IN DRIVER SEAT
- N - IN DRIVER SEAT
- O - NEAR PASSENGER SEAT
- P - NEAR DRIVER SEAT
- Q - NEAR LEFT FOG LIGHT
- R - NEAR RIGHT FOG LIGHT
- U - NEAR LEFT SIDE MARKER
- V - NEAR RIGHT SIDE MARKER

T4 - FOUR-POLE
- A - IN SPARE WHEEL WELL
- B - IN CONSOLE, RIGHT
- C - IN CONSOLE RIGHT
- D - IN CONSOLE RIGHT
- G - NEAR LEFT REAR LIGHTS
- H - NEAR RIGHT REAR LIGHTS

T6 - SIX-POLE
- A - BEHIND SIDE COVERING, RIGHT
- B - IN REAR LID, RIGHT

T7 - SEVEN-POLE
- A - BEHIND LUGGAGE COMPARTMENT COVERING LEFT
- B - BEHIND LUGGAGE COMPARTMENT COVERING RIGHT
- C - IN SPARE WHEEL WELL

T8 - EIGHT-POLE
- A - IN DRIVER SEAT

T12 - TWELVE-POLE
- A - IN DRIVER SEAT, LEFT
- B - IN FOOT WELL, PASSENGER SIDE

T14 - FOURTEEN-POLE
- IN ENGINE COMPARTMENT, RIGHT

GROUND TERMINALS

① ON FRONT LOCK MEMBER, RIGHT

② AT REAR OF WHEEL ARCH UNDERNEATH RIGHT REAR TRIM PANEL

③ ON STEERING CONSOLE

④ ON FRONT LOCK MEMBER, LEFT

⑤ ON UPPER MOUNTING FOR FUSE/RELAY BOARD

WIRE COLOURS

BK - BLACK	GN - GREEN	BR - BROWN
WT - WHITE	YE - YELLOW	BL - BLUE
RE - RED	GR - GREY	VI - VIOLET

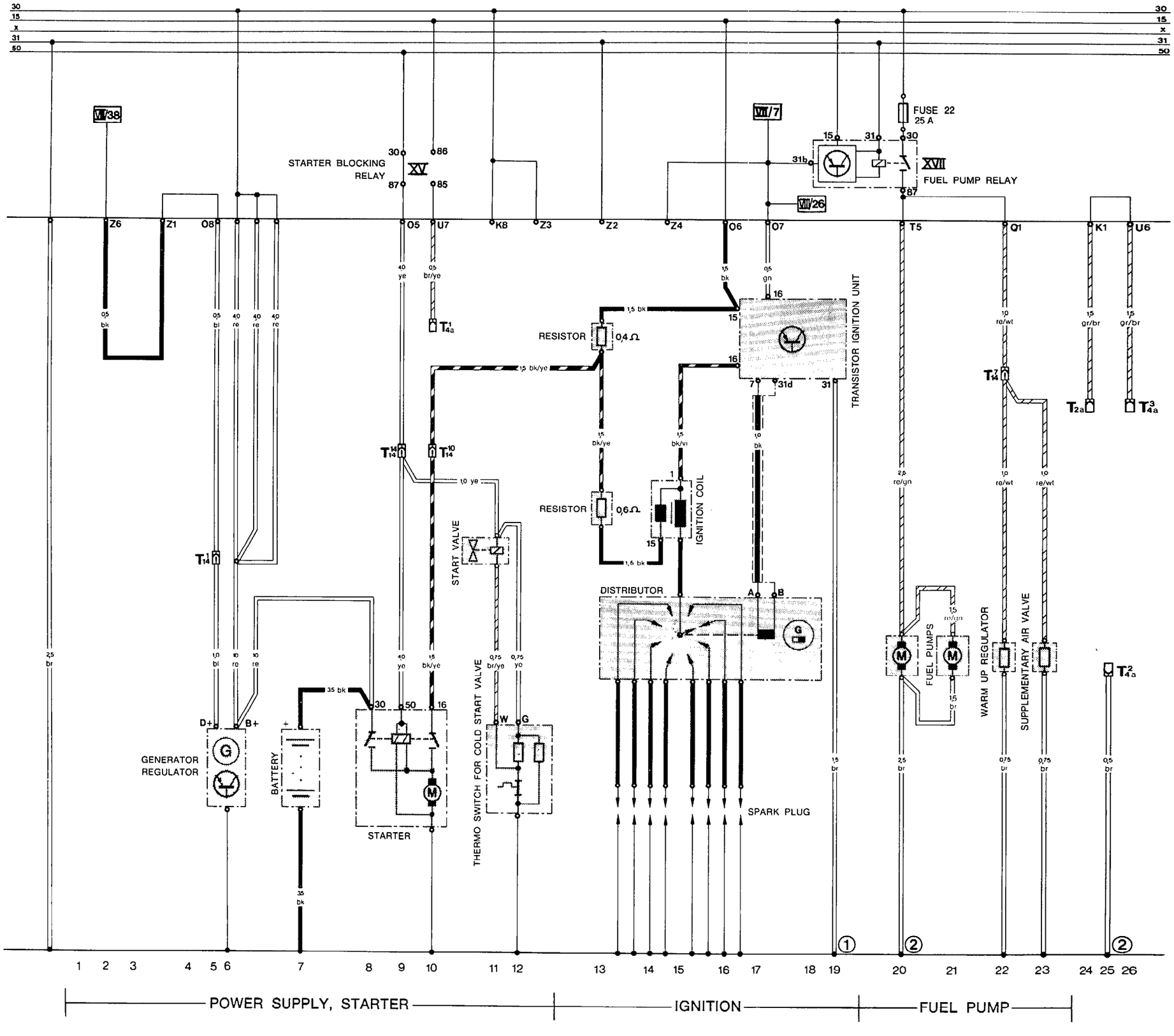
Current Flow Diagram Type 928 USA
Model 79, Part I

POWER SUPPLY, STARTER

IGNITION

FUEL PUMP

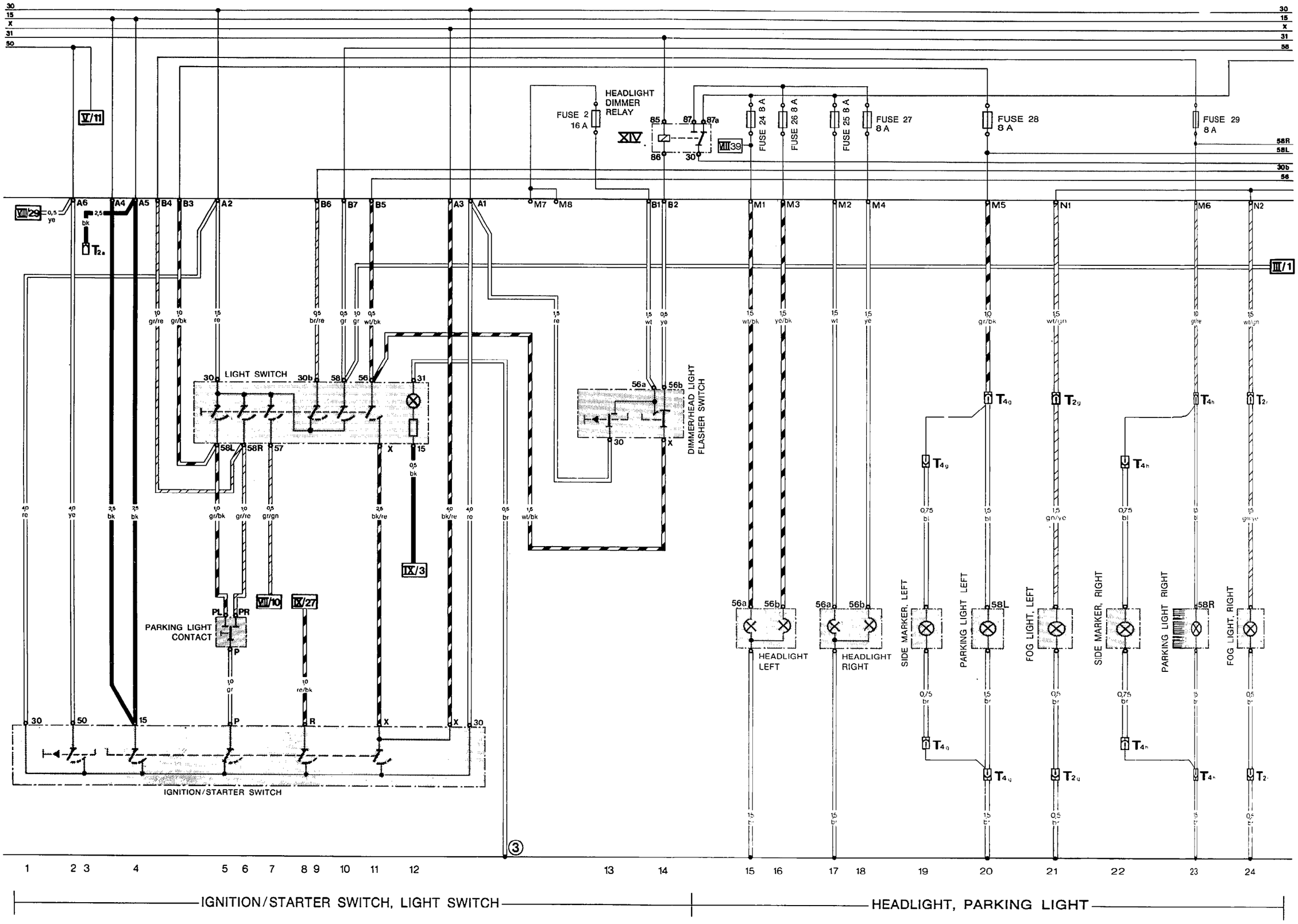
Current Flow Diagram Type 928 USA Model 79, Part I



Current Flow Diagram Type 928 USA
Model 79, Part II

IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT, PARKING LIGHT

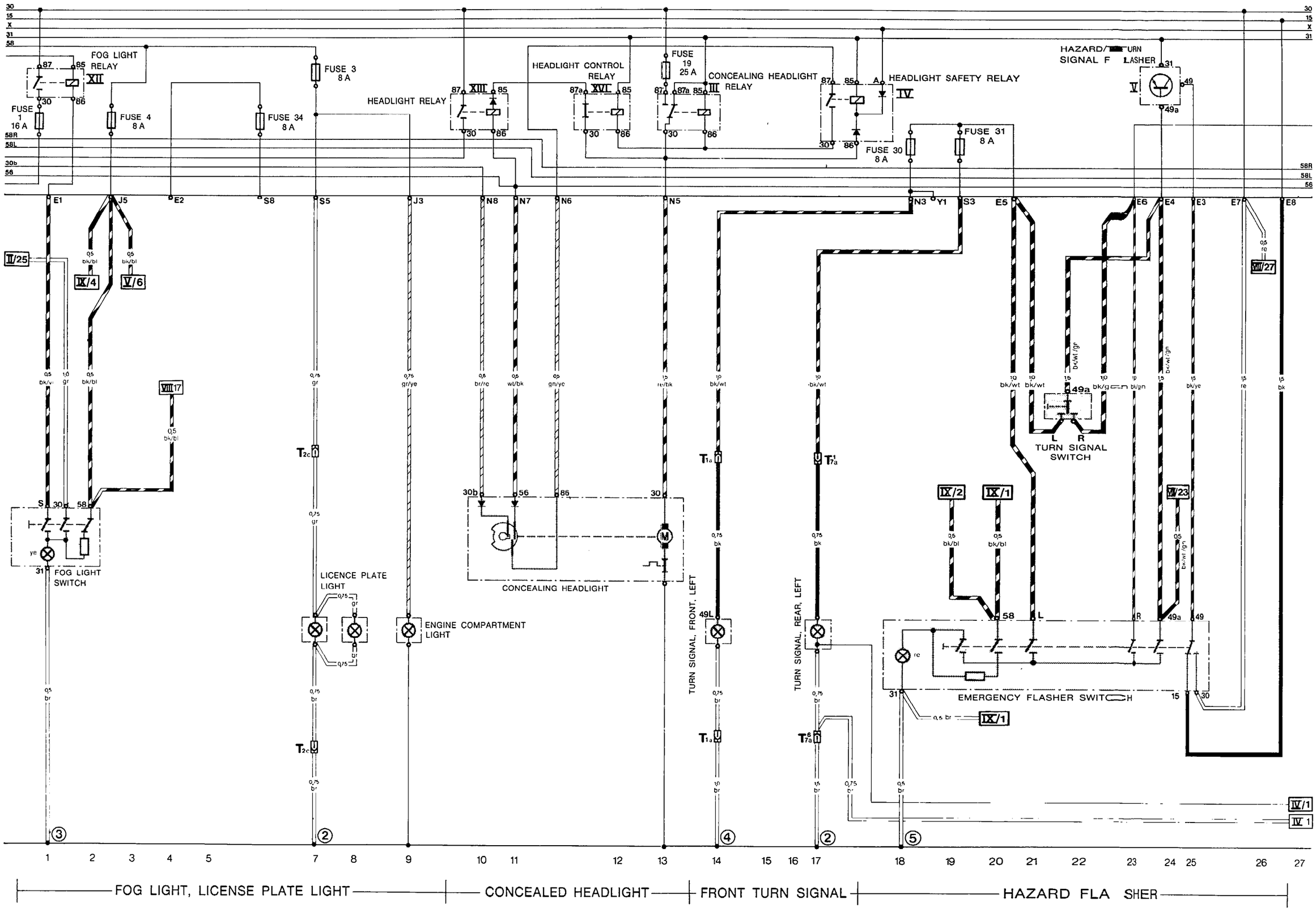
Current Flow Diagram Type 928 USA Model 79, Part II



Current Flow Diagram Type 928 USA
Model 79, Part III

FOG LIGHT, LICENSE PLATE LIGHT
CONCEALED HEADLIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

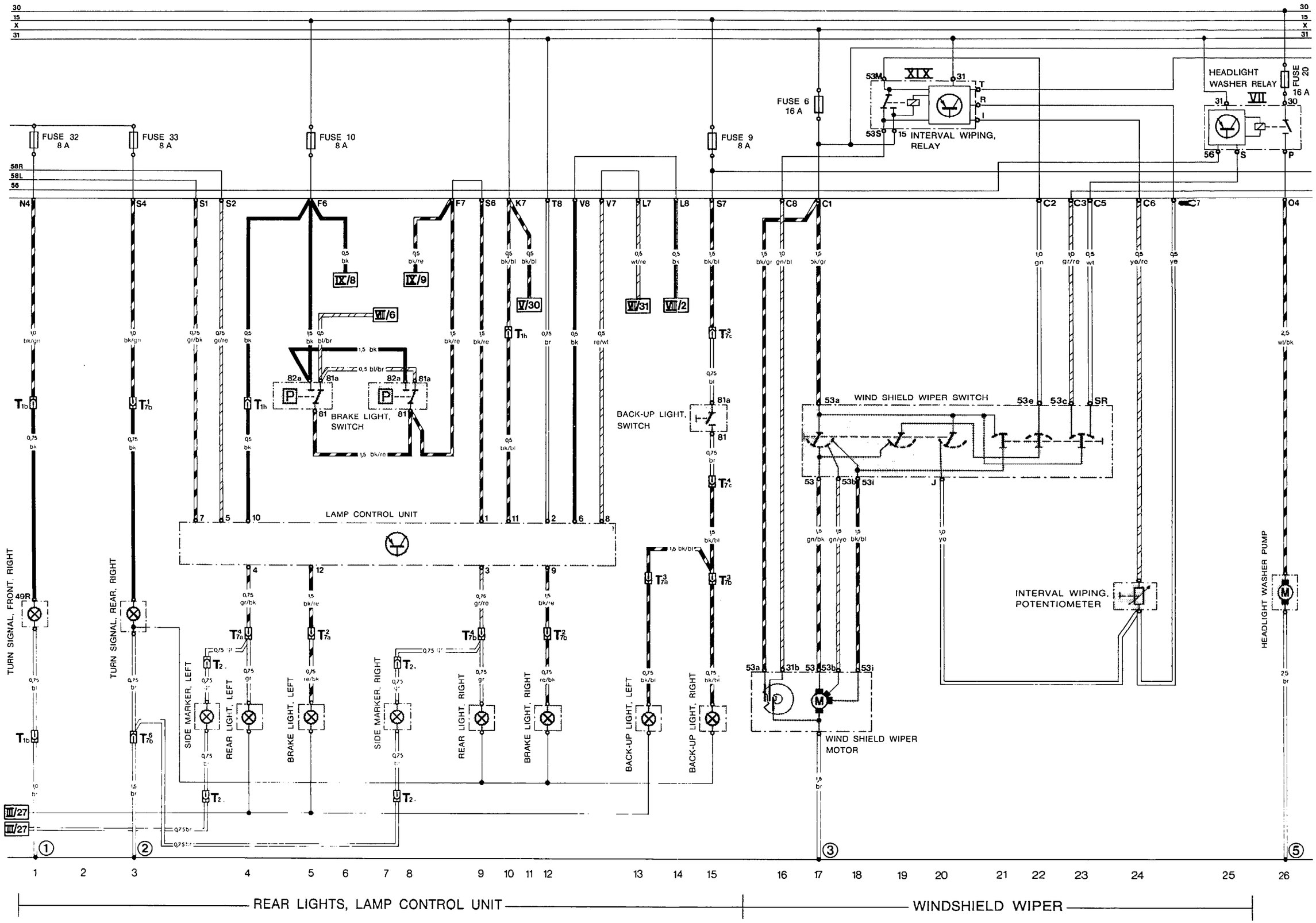
Current Flow Diagram Type 928 USA Model 79, Part III



Current Flow Diagram Type 928 USA
Model 79, Part IV

REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

Current Flow Diagram Type 928 USA Model 79, Part IV



Current Flow Diagram Type 928 USA
Model 79, Part V

WASHER PUMPS

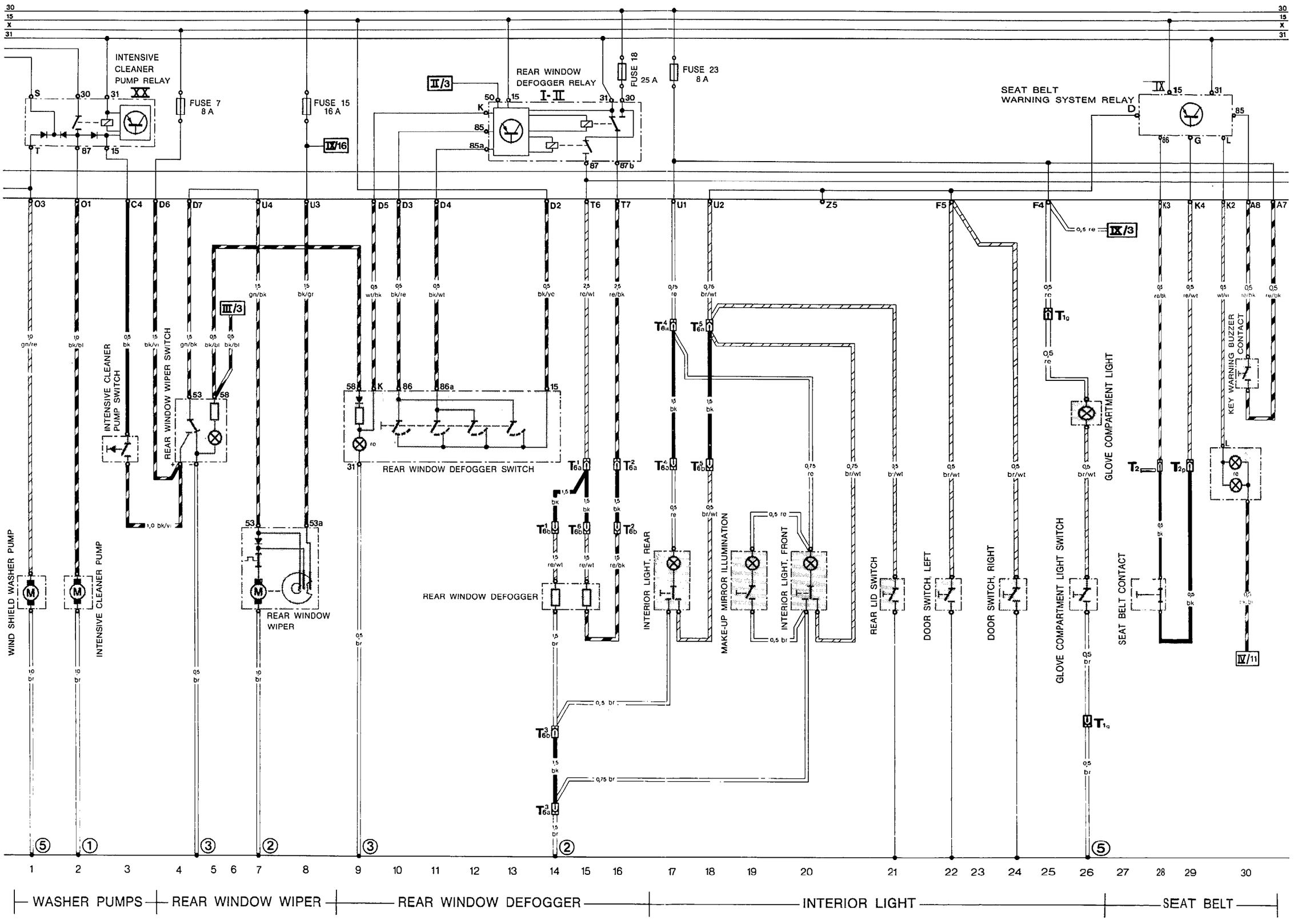
REAR WINDOW WIPER

REAR WINDOW DEFOGGER

INTERIOR LIGHT

SEAT BELT

Current Flow Diagram Type 928 USA Model 79, Part V



Current Flow Diagram Type 928 USA
Model 79, Part VI

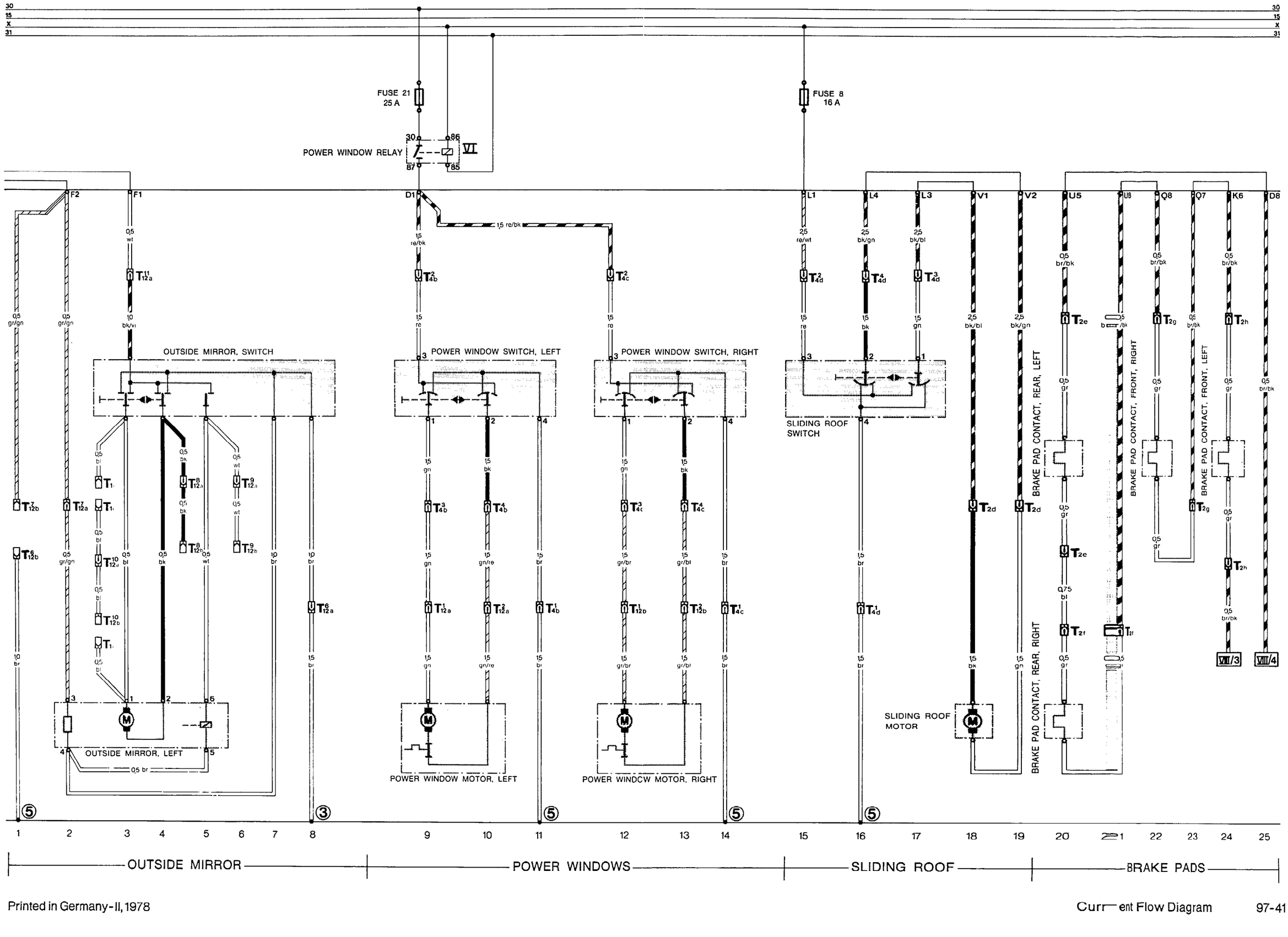
OUTSIDE MIRROR

POWER WINDOWS

SLIDING ROOF

BRAKE PADS

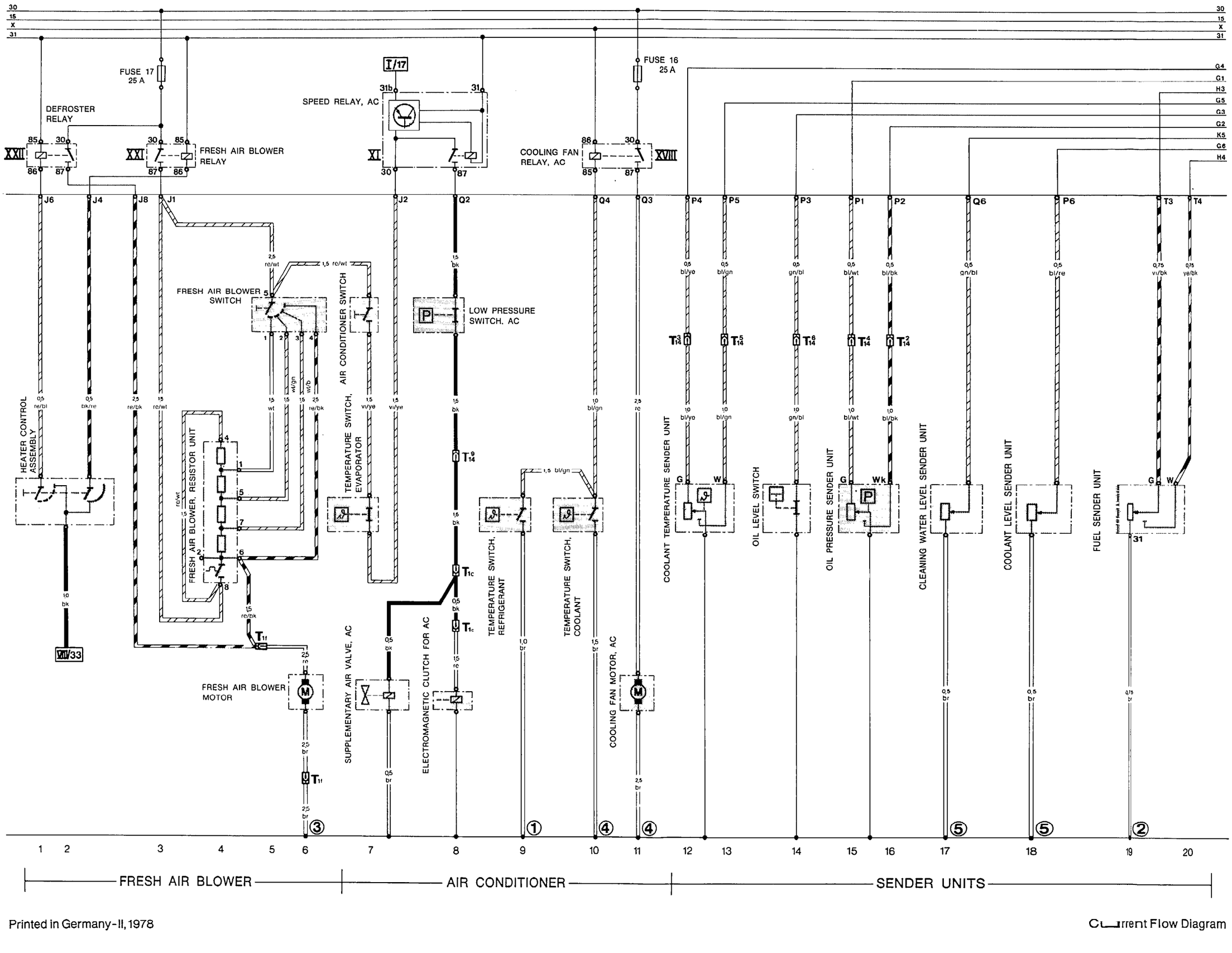
Current Flow Diagram Type 928 USA Model 79, Part VI



Current Flow Diagram Type 928 USA
Model 79, Part VII

FRESH AIR BLOWER
AIR CONDITIONER
SENDER UNITS

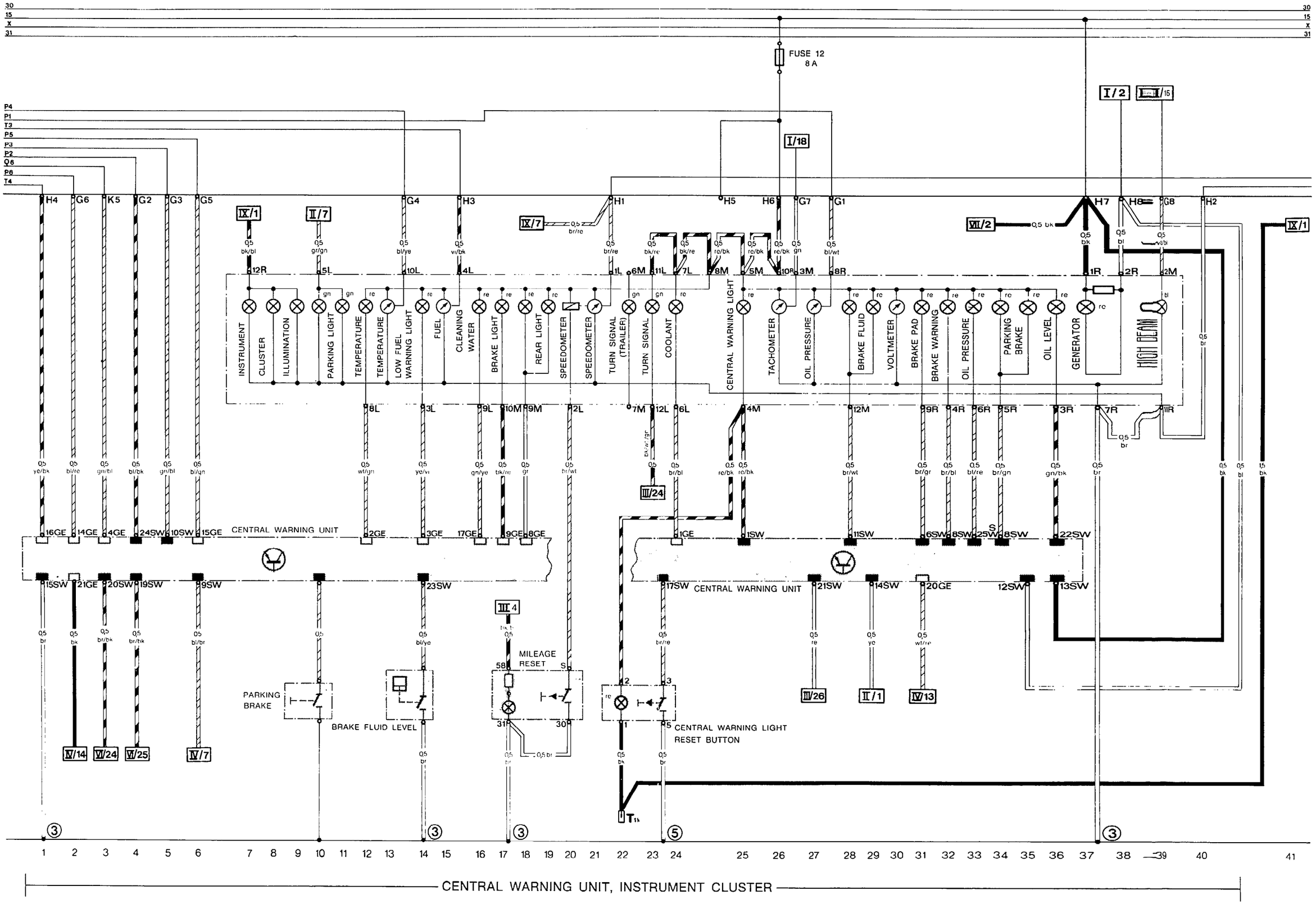
Current Flow Diagram Type 928 USA Model 79, Part VII



Current Flow Diagram Type 928 USA
Model 79, Part VIII

CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

Current Flow Diagram Type USA Model 79, Part VIII



Current Flow Diagram Type 928 USA
Model 79, Part IX

CLOCK

CIGARETTE LIGHTER

TEMPOSTAT (CRUISE CONTROL)

HORNS

RADIO

Current Flow Diagram Type 928 USA Model 79, Part IX

30
15
x
31

FUSE 11 8 A
FUSE 5 8 A

HORN RELAY
30 86 87 85

B8 F3 T2 T1 O2 F8 V5 V6 J7

VII/41 1,5 bk

II/12

VII/18 IV/8

TEMPOSTAT CONTROL UNIT
11 6 12 5 8 9 10 3 7

T6c2 T6c1

ANTENNA

FUSE (RADIO) 10 re/bk

RADIO

SPEAKER BALANCE

T12a4 T12a3 T12b5 T12b4

LOUDSPEAKER, REAR, LEFT
LOUDSPEAKER, FRONT, LEFT
LOUDSPEAKER, FRONT, RIGHT
LOUDSPEAKER, REAR, RIGHT

SUPPRESSOR (RADIO)

VII/7 INSTRUMENT CLUSTER ILLUMINATION, POTENTIOMETER

III/20 III/19

HEATER CONTROL ASSEMBLY LIGHT

V/27 CLOCK

III/2 CIGARETTE LIGHTER, FRONT

CIGARETTE LIGHTER, REAR

IV/6

TEMPOSTAT (CRUISE CONTROL), SWITCH

CLUTCH PEDAL SWITCH (TEMPOSTAT)

TEMPOSTAT MOTOR

SPEEDOMETER SENSOR

HORN

HORN CONTACT 71

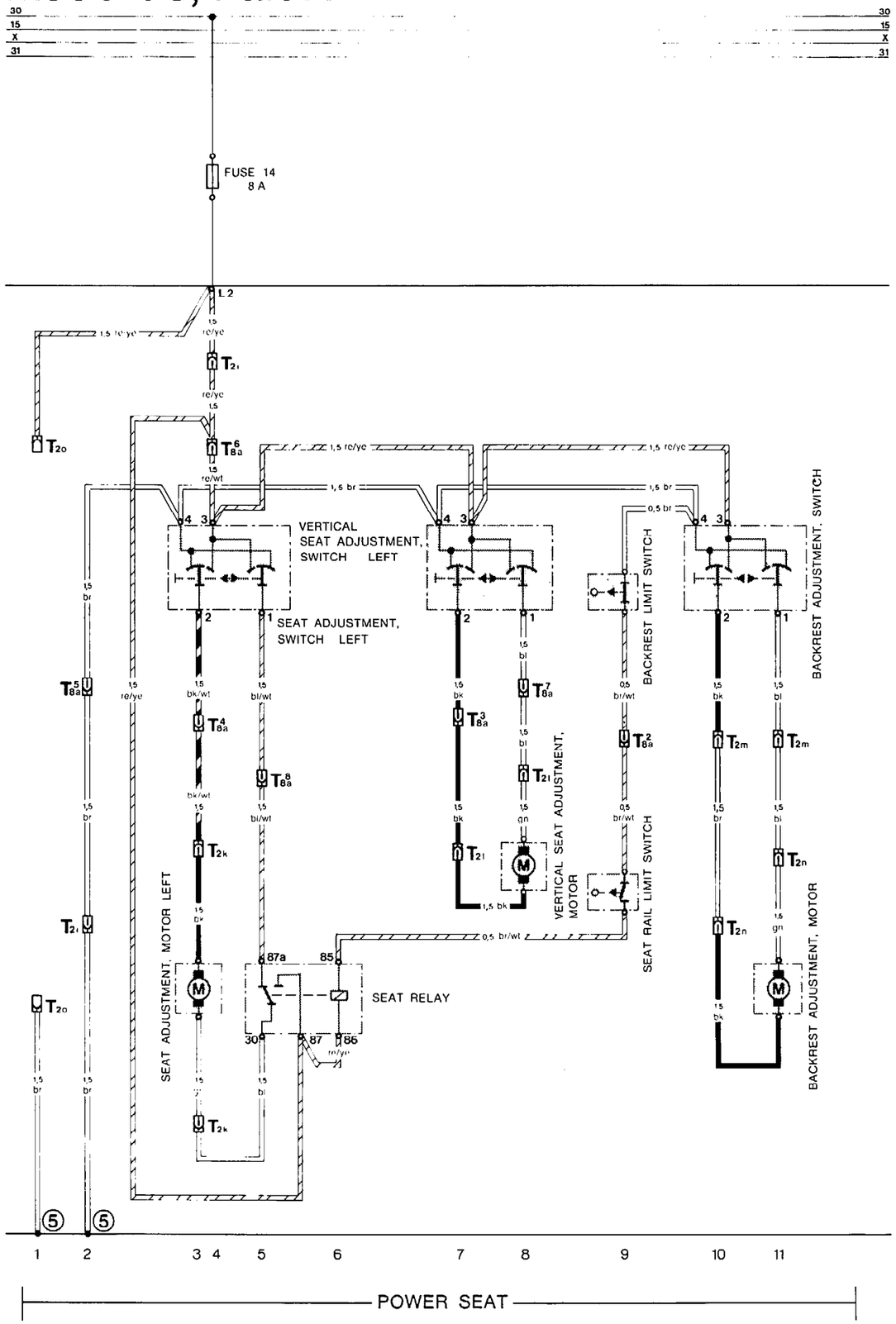
II/8

⑤ ⑤ ⑤ ①

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

CLOCK | CIGARETTE LIGHTER | TEMPOSTAT (CRUISE CONTROL) | HORNS | RADIO

Current Flow Diagram Type 928 USA Model 79, Part X


30
15
X
31
FUSE 14
8 A
L 2
T2i
T2o
T8a6
VERTICAL SEAT ADJUSTMENT, SWITCH LEFT
SEAT ADJUSTMENT, SWITCH LEFT
BACKREST LIMIT SWITCH
BACKREST ADJUSTMENT, SWITCH
T8a5
T8a4
T8a8
T8a3
T8a7
T8a2
T2k
T2l
T2m
T2n
SEAT ADJUSTMENT, MOTOR LEFT
VERTICAL SEAT ADJUSTMENT, MOTOR
SEAT RAIL LIMIT SWITCH
BACKREST ADJUSTMENT, MOTOR
SEAT RELAY
87a
85
30
87
86
1,5 re/ye
1,5 br
1,5 bk/wt
1,5 bl/wt
1,5 bk
1,5 bl
1,5 gn
0,5 br/wt
1,5 bk
1,5 re/wt
1,5 bl
1,5 br
0,5 br
1,5 bk
1,5 bl
1,5 bk
1,5 br
1,5 bl
1,5 gn
1,5 bk
1,5 br
1,5 bl
1,5 bk
1,5 gn
1,5 bk
0,5 br/wt
1,5 bk
1,5 bl
1,5 bk
1,5 br
1,5 bl
1,5 bk
1,5 gn

Current Flow Diagram Type 928 USA Model 80

PART I POWER SUPPLY, STARTER
IGNITION
FUEL PUMP

PART II FUEL INJECTION SYSTEM

PART III IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT

PART IV HEADLIGHT, PARKING LIGHT
FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

PART V REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

PART VI WASHER PUMPS
REAR WINDOW WIPER
REAR WINDOW DEFOGGER
INTERIOR LIGHT
CENTRAL LOCKING SYSTEM

PART VII DOOR LIGHT
SEAT BELT
OUTSIDE MIRROR
POWER WINDOWS
BRAKE PADS

PART VIII AUTOMATIC AIR CONDITIONER

PART IX AUTOMATIC AIR CONDITIONER
SENDER UNITS

PART X CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

PART XI CLOCK
CIGARETTE LIGHTER
TEMPOSTAT (CRUISE CONTROL)
HORNS
RADIO

Current Flow Diagram
Type 928 USA Model 80

WIRE CONNECTORS

T1 - ONE-POLE

A - NEAR TURN SIGNAL LEFT
B - NEAR TURN SIGNAL RIGHT
C - NEAR AC-COMPRESSOR
F - NEAR FRESH AIR BLOWER
G - NEAR GLOVE COMPARTMENT
H - NEAR FUSE/RELAY BOARD
I - IN TUNNEL
K - NEAR FUEL PUMP

T2 - TWO-POLE

A - BEHIND ACCELERATOR PEDAL
C - BEHIND REAR BUMPER
D - NEAR LEFT BACKWHEEL
E - NEAR RIGHT BACKWHEEL
F - NEAR RIGHT FRONT WHEEL
G - NEAR LEFT FRONT WHEEL
H - NEAR DRIVER SEAT
I - NEAR PASSENGER SEAT
K - NEAR DRIVER SEAT
Q - NEAR LEFT FOG LIGHT
R - NEAR RIGHT FOG LIGHT
U - NEAR LEFT SIDE MARKER
V - NEAR RIGHT SIDE MARKER

T4 - FOUR-POLE

A - IN SPARE WHEEL WELL
B - IN CONSOLE, RIGHT
C - IN CONSOLE RIGHT
D - IN CONSOLE
E - IN CONSOLE
F - IN CONSOLE
G - NEAR RIGHT FRONT WHEEL
H - NEAR LEFT FRONT WHEEL

T6 - SIX-POLE

A - BEHIND SIDE COVERING, RIGHT
B - IN REAR LID, RIGHT
C - IN SPARE WHEEL WELL
D - IN CONSOLE

T7 - SEVEN-POLE

A - BEHIND LUGGAGE COMPARTMENT COVERING LEFT
B - BEHIND LUGGAGE COMPARTMENT COVERING RIGHT

T14 - FOURTEEN-POLE

IN ENGINE COMPARTMENT, RIGHT

T18 - EIGHTEEN-POLE

A - IN FOOT WEEL, DRIVER SIDE
B - IN FOOT WELL, PASSENGER SIDE

GROUND TERMINALS

① ON FRONT LOCK MEMBER, RIGHT

② AT REAR OF WHEEL ARCH UNDERNEATH RIGHT REAR TRIM PANEL

③ ON STEERING CONSOLE

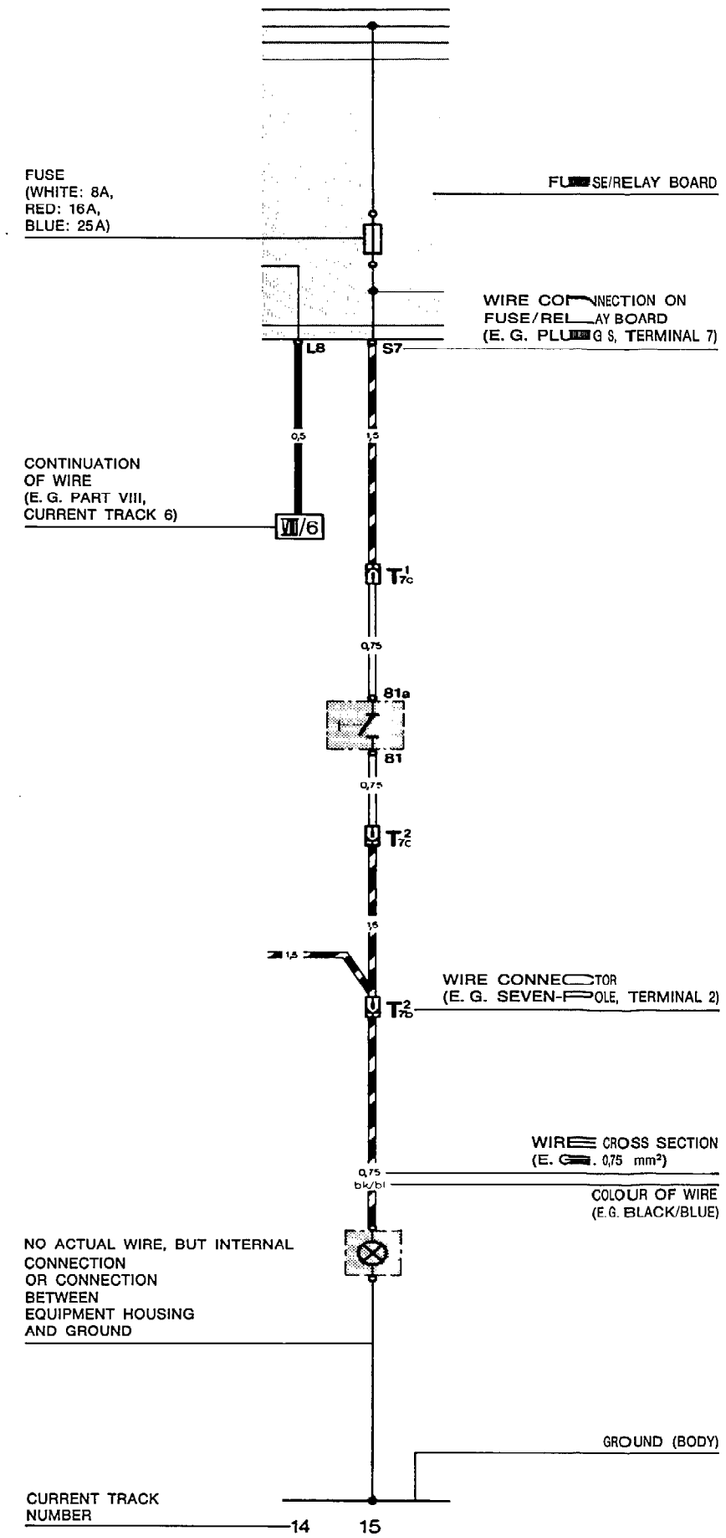
④ ON FRONT LOCK MEMBER, LEFT

⑤ ON UPPER MOUNTING FOR FUSE/RELAY BOARD

⑥ ON FRONT WALL

WIRE COLOURS

BK - BLACK	GN - GREEN	BR - BROWN
WT - WHITE	YE - YELLOW	BL - BLUE
RE - RED	GR - GREY	VI - VIOLET



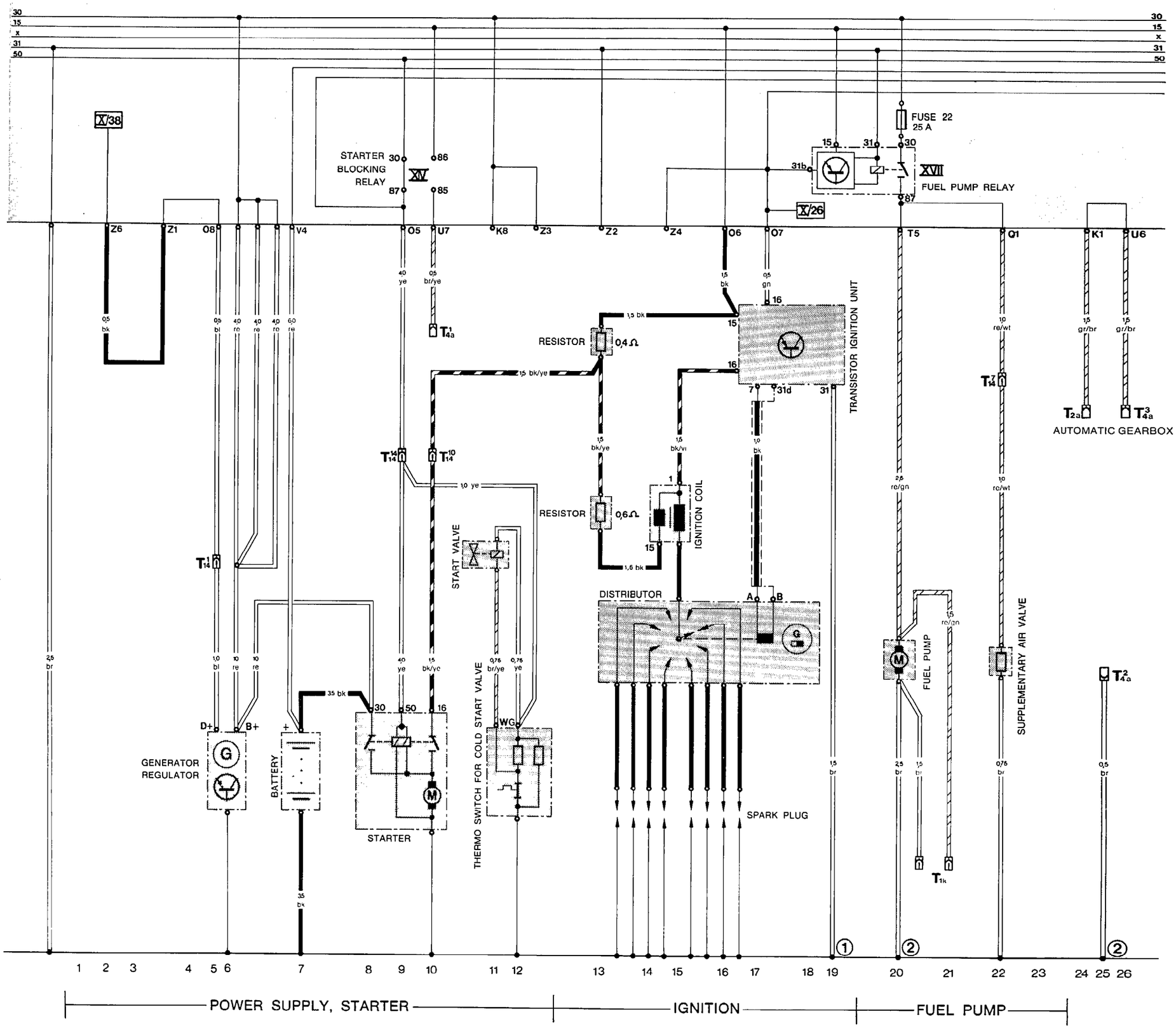
Current Flow Diagram Type 928 USA
Model 80 Part I

POWER SUPPLY, STARTER

IGNITION

FUEL PUMP

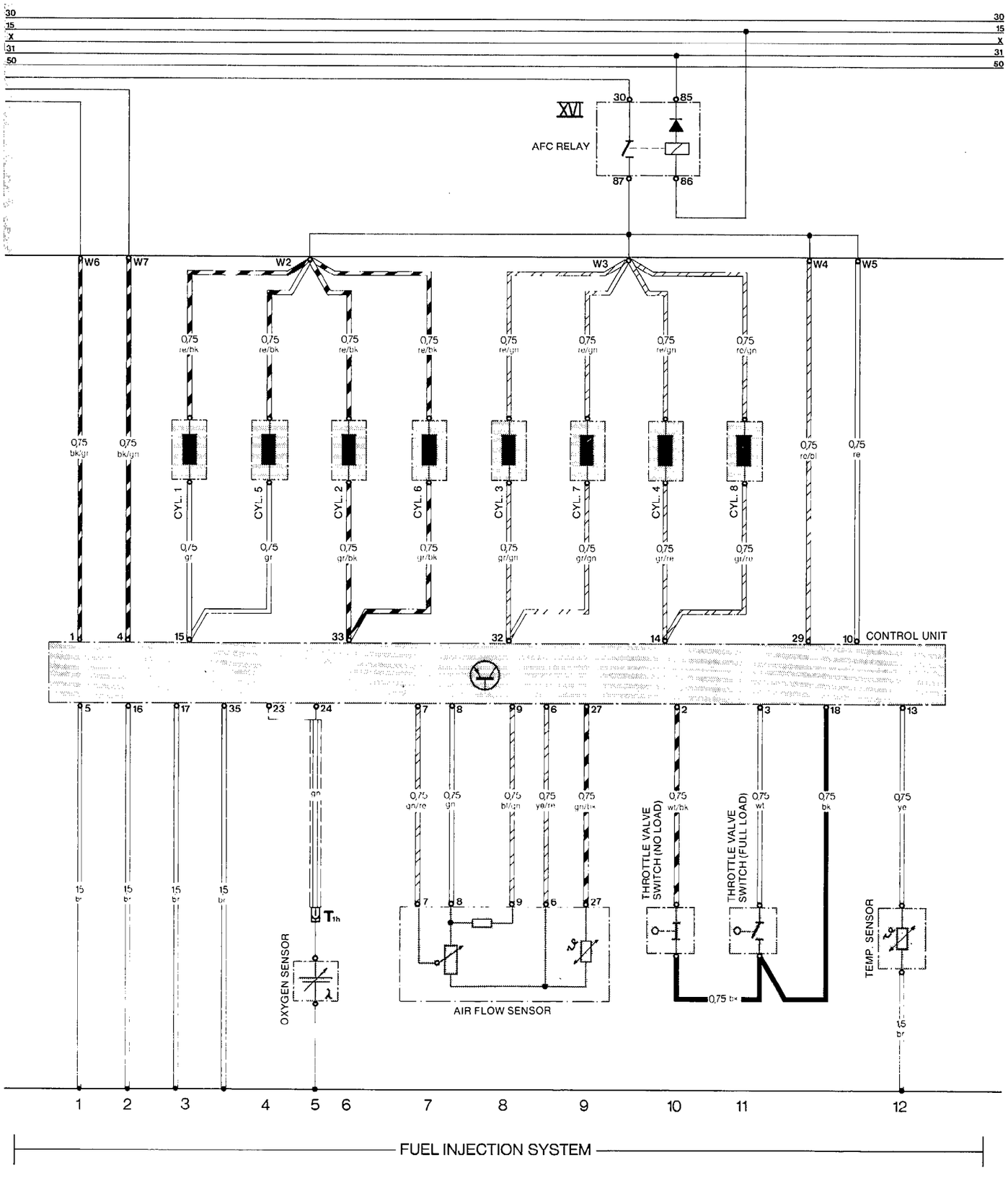
Current Flow Diagram Type 928 USA Model 80 Part I



Current Flow Diagram Type 928 USA
Model 80 Part II

FUEL INJECTION SYSTEM

Current Flow Diagram Type 928 USA Model 80 Part II

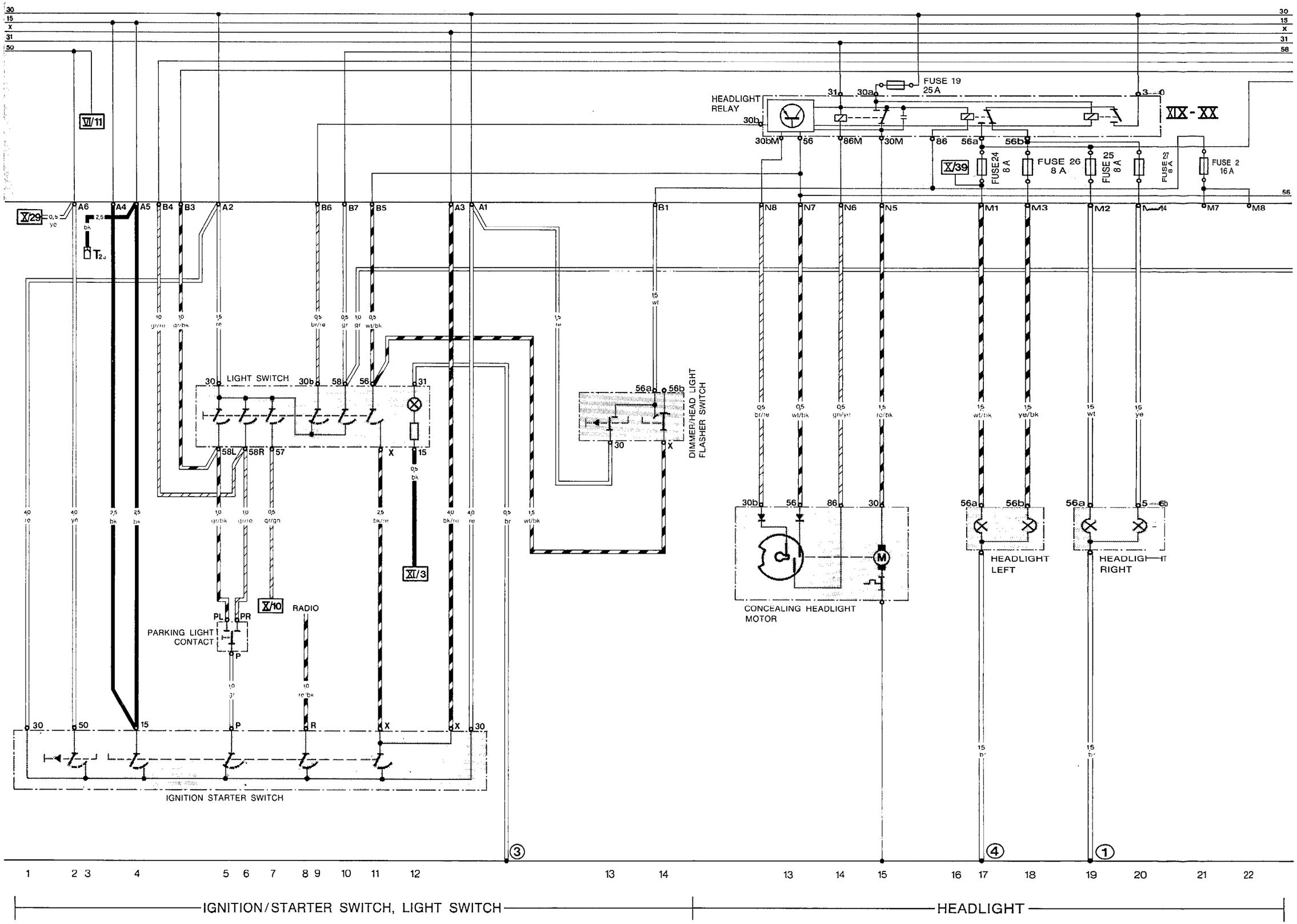


Printed in Germany - IV, 1980

Current Flow Diagram Type 928 USA
Model 80 Part III

IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT, PARKING LIGHT

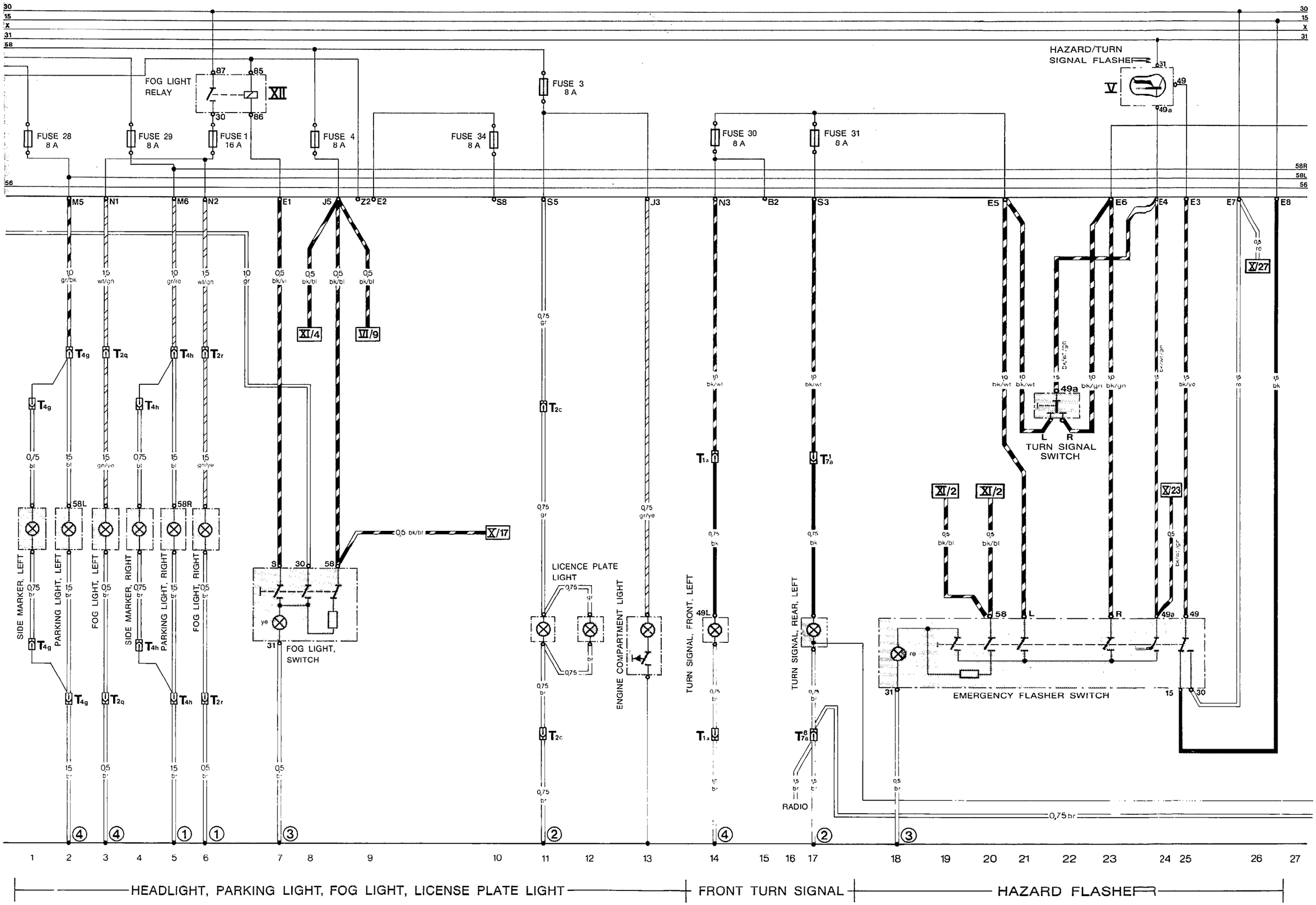
Current Flow Diagram Type 928 USA Model 80 Part III



Current Flow Diagram Type 928 USA
Model 80 Part IV

FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

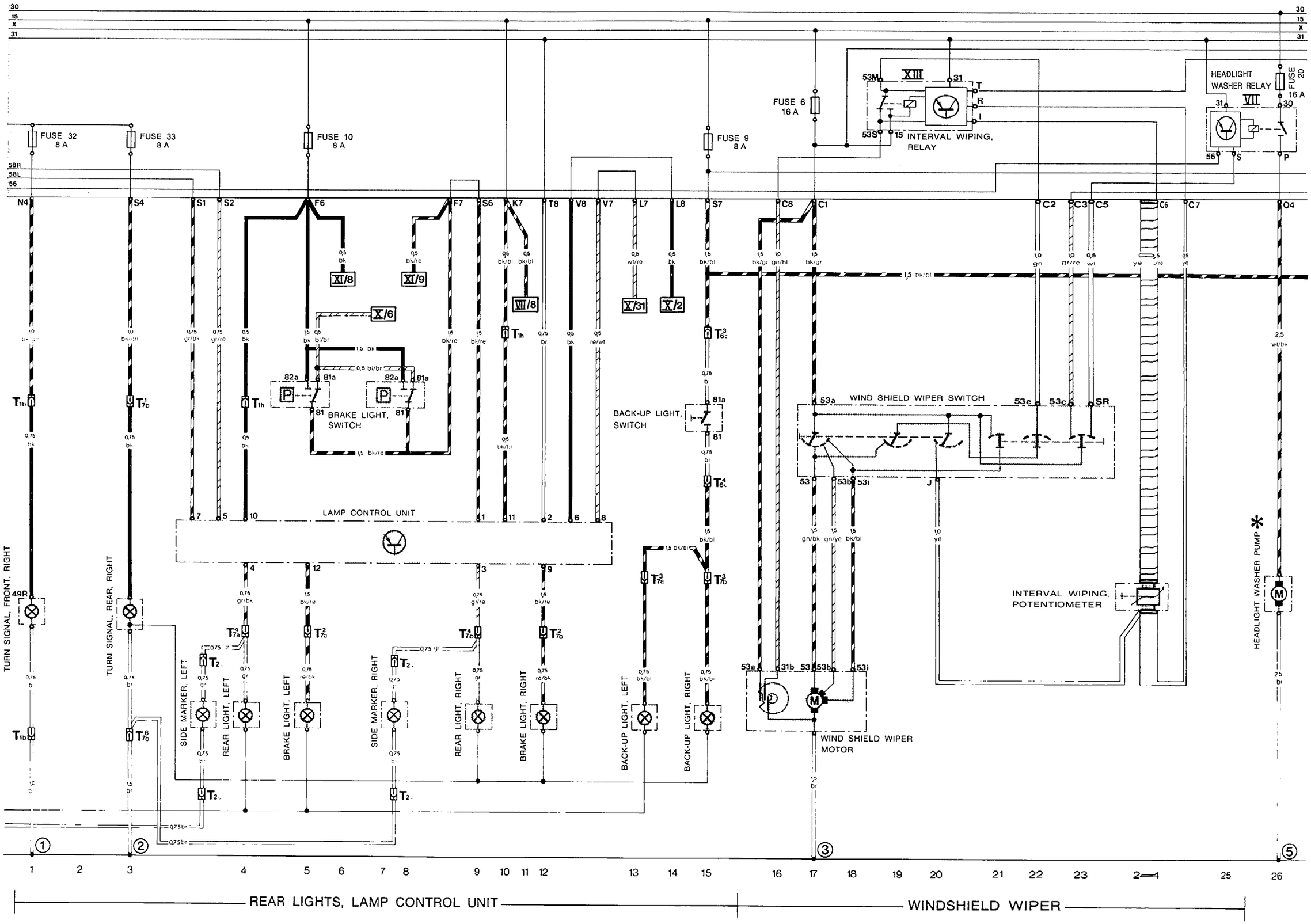
Current Flow Diagram Type 928 USA Model 80 Part IV



Current Flow Diagram Type 928 USA
Model 80 Part V

REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

Current Flow Diagram Type 928 USA Model 80 Part V



✻ OPTIONAL

Current Flow Diagram Type 928 USA
Model 80 Part VI

WASHER PUMPS

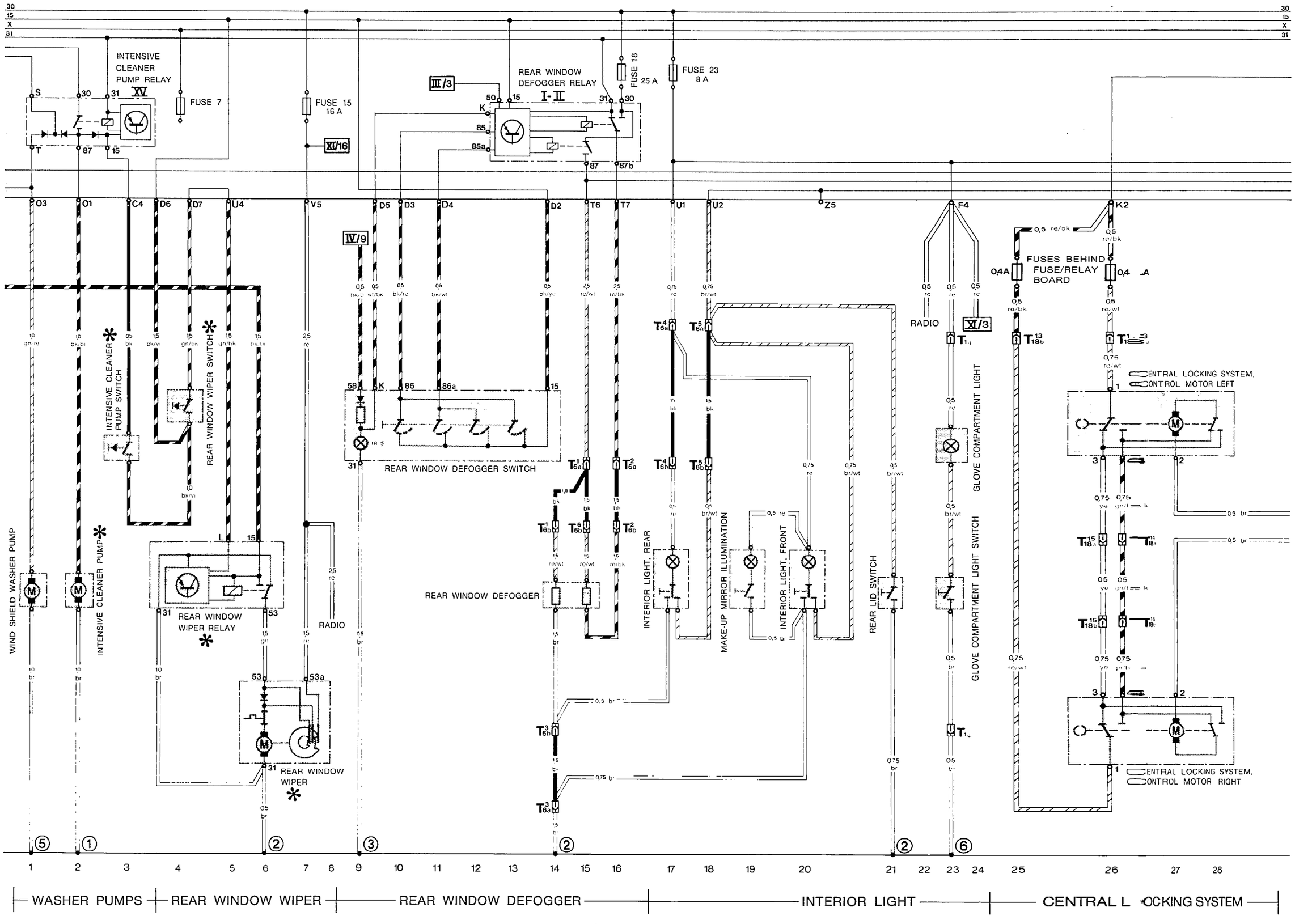
REAR WINDOW WIPER

REAR WINDOW DEFOGGER

INTERIOR LIGHT

SEAT BELT

Current Flow Diagram Type 928 USA Model 80 Part VI



* OPTIONAL

Current Flow Diagram Type 928 USA
Model 80 Part VII

DOOR LIGHT

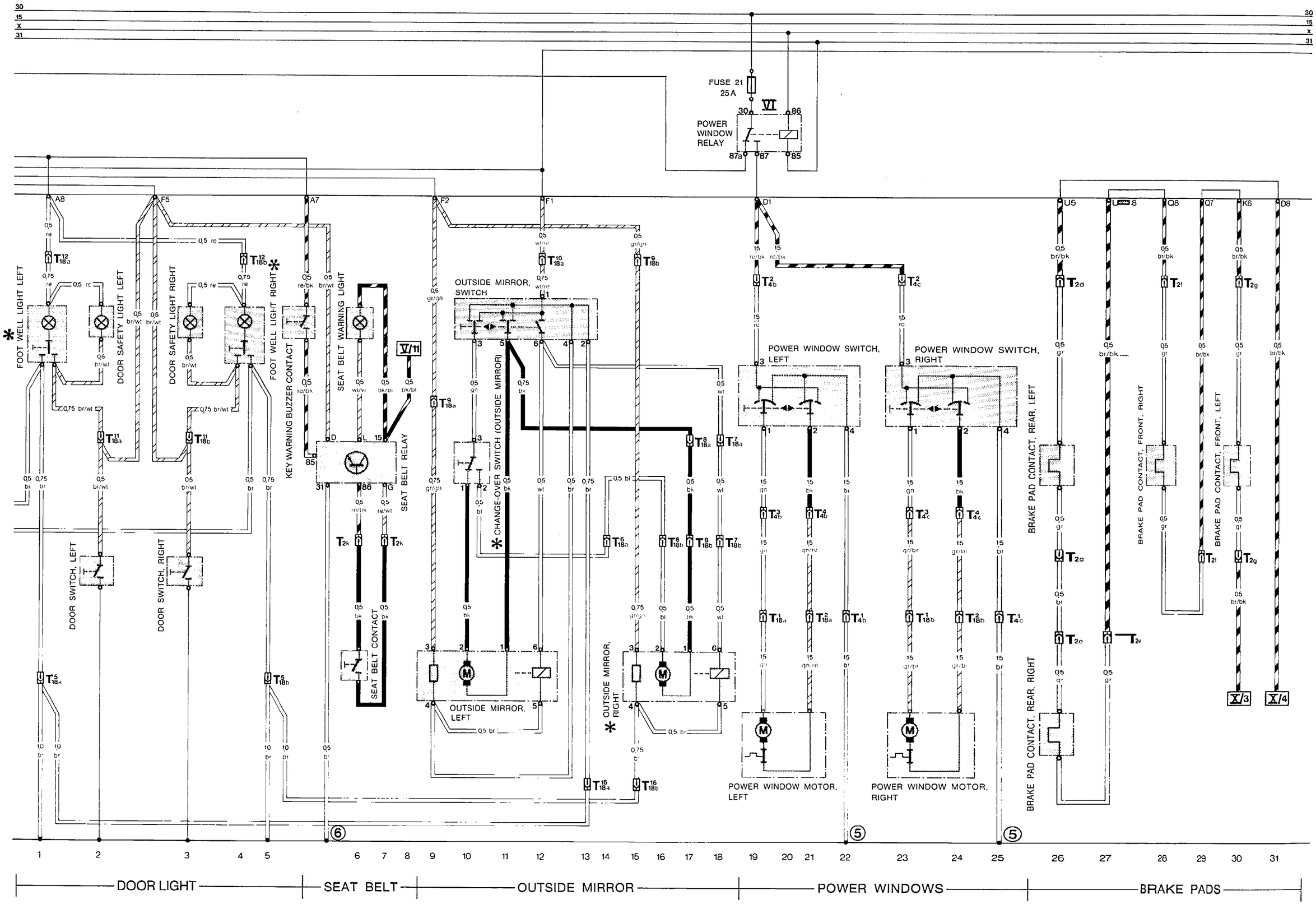
SEAT BELT

OUTSIDE MIRROR

POWER WINDOWS

BRAKE PADS

Current Flow Diagram Type 928 USA Model 80 Part VII

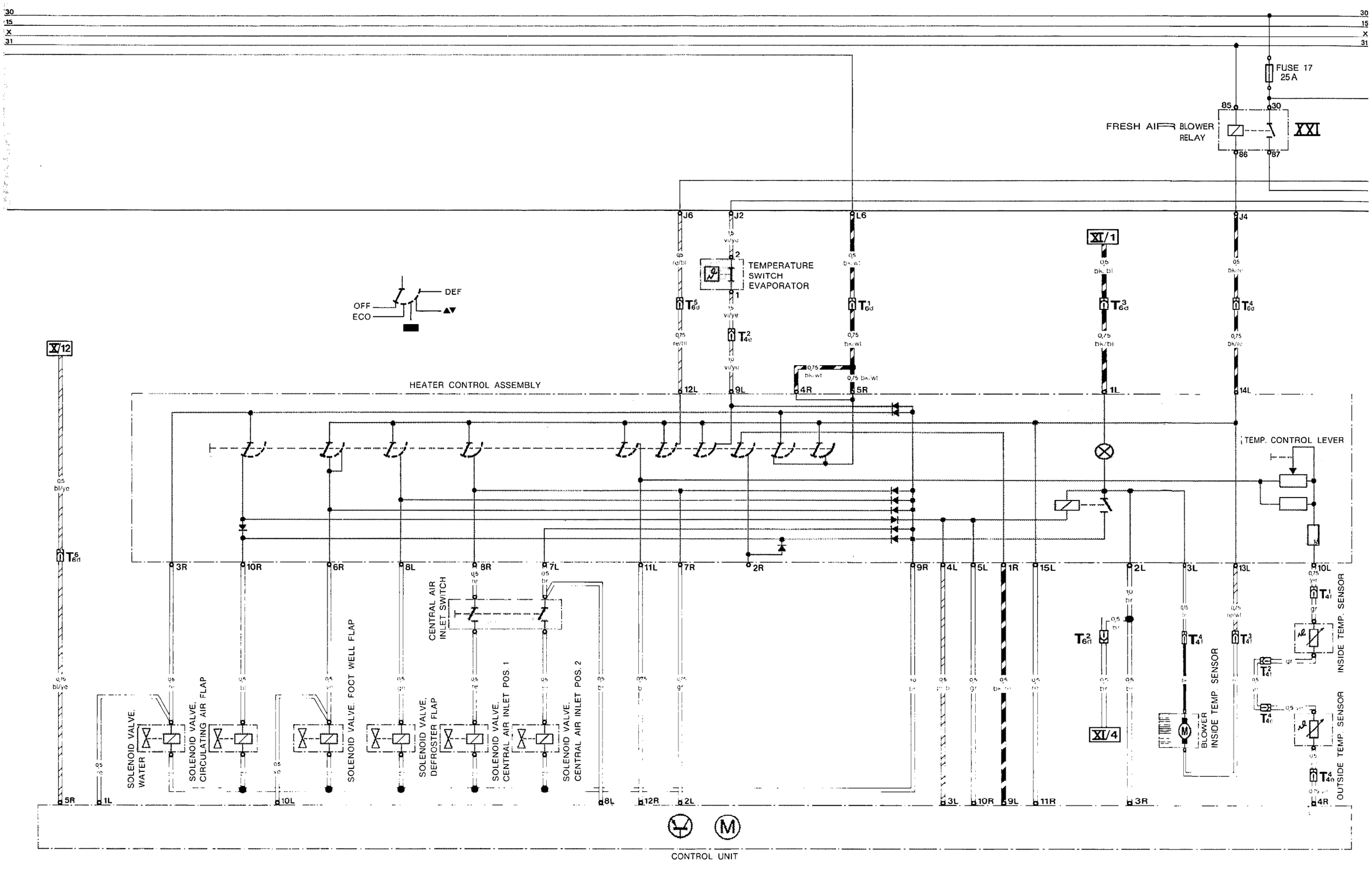


* OPTIONAL

Current Flow Diagram Type 928 USA
Model 80 Part VIII

AUTOMATIC AIR CONDITIONER

Current Flow Diagram Type 928 USA Model 80 Part VIII



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

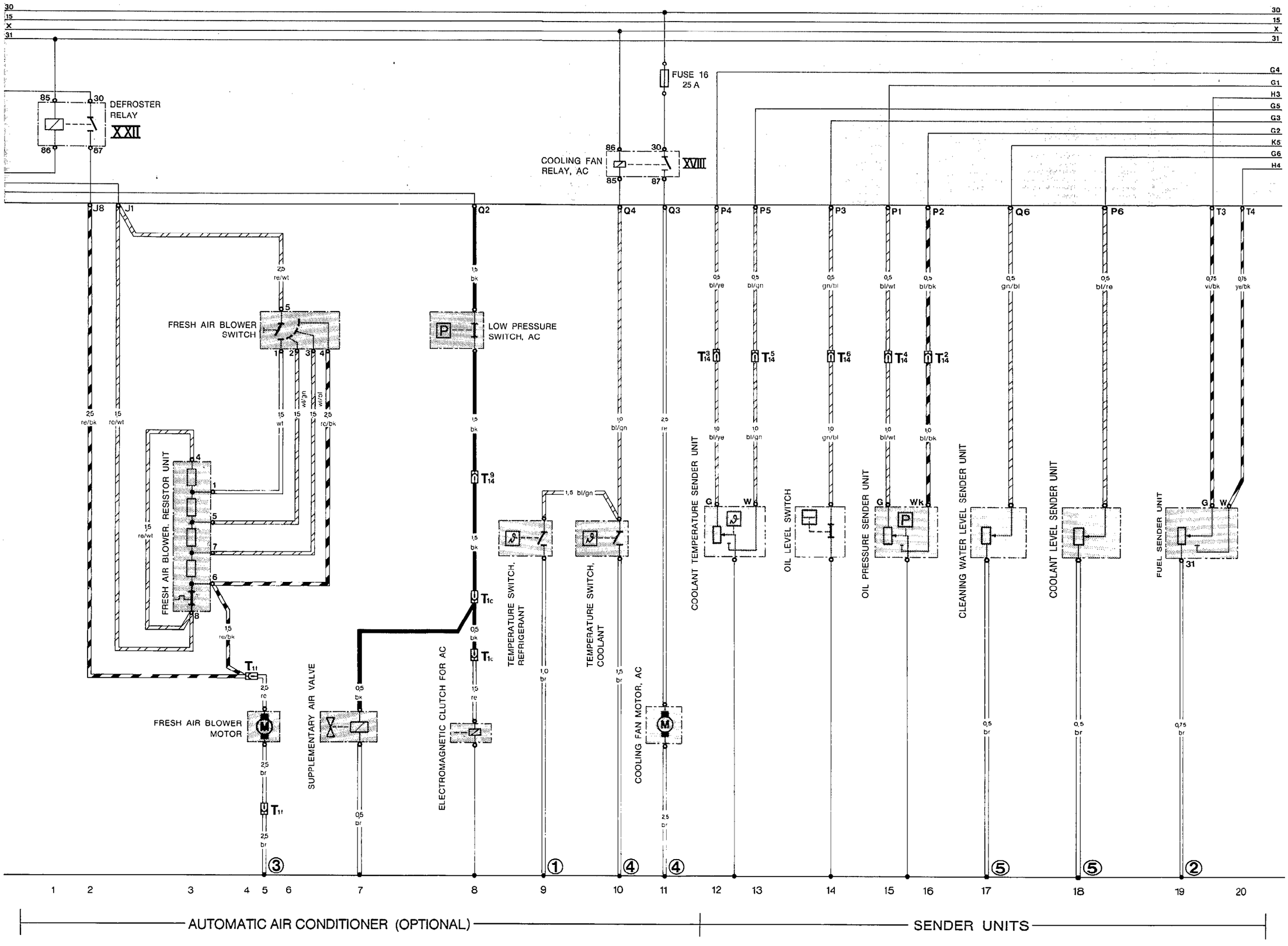
AUTOMATIC AIR CONDITIONER (OPTIONAL)

Current Flow Diagram Type 928 USA
Model 80 Part IX

AUTOMATIC AIR CONDITIONER

SENDER UNITS

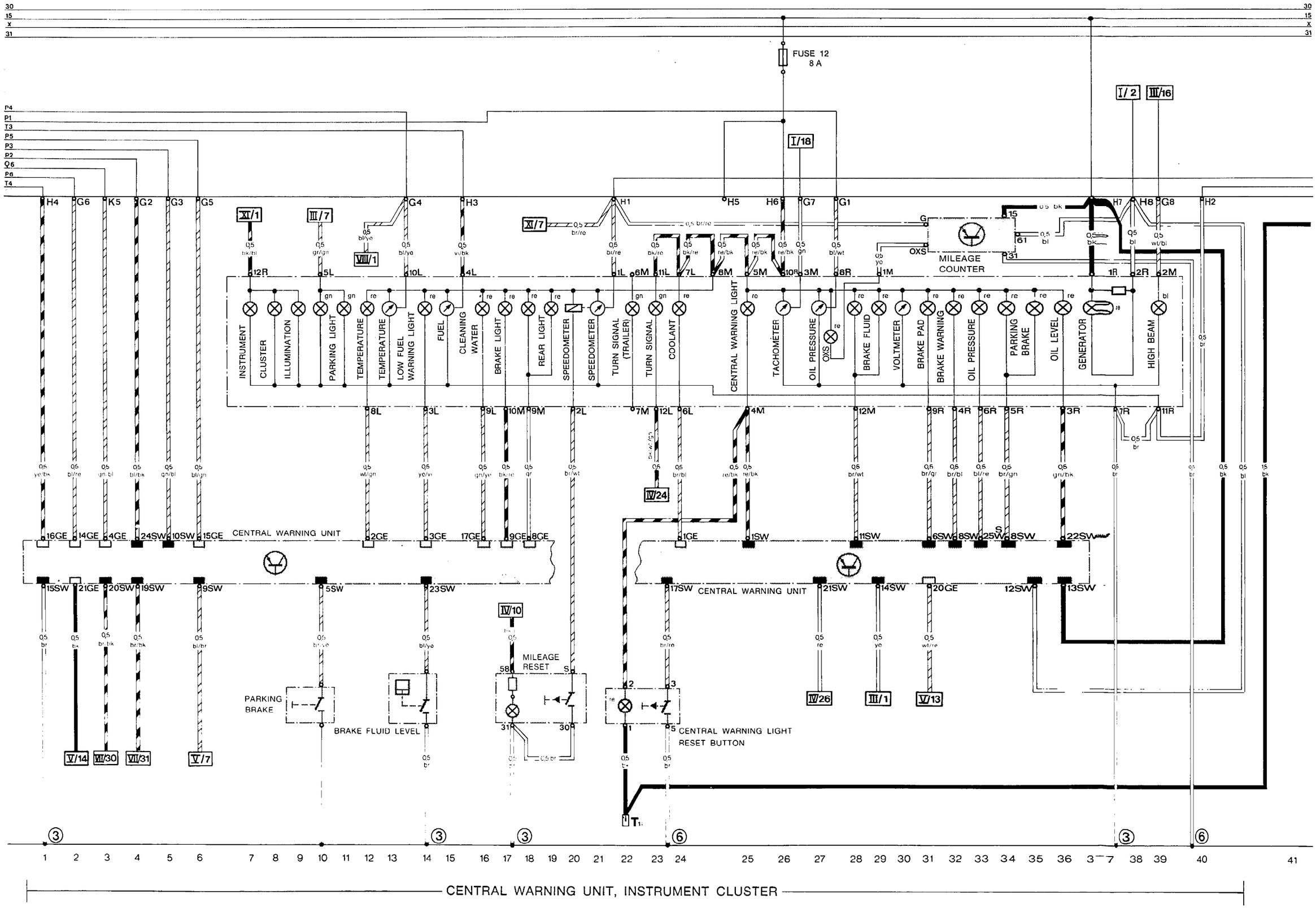
Current Flow Diagram Type 928 USA Model 80 Part IX



Current Flow Diagram Type 928 USA
Model 80 Part X

CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

Current Flow Diagram Type 928 USA Model 80 Part X



Current Flow Diagram Type 928 USA
Model 80 Part XI

CLOCK

CIGARETTE LIGHTER

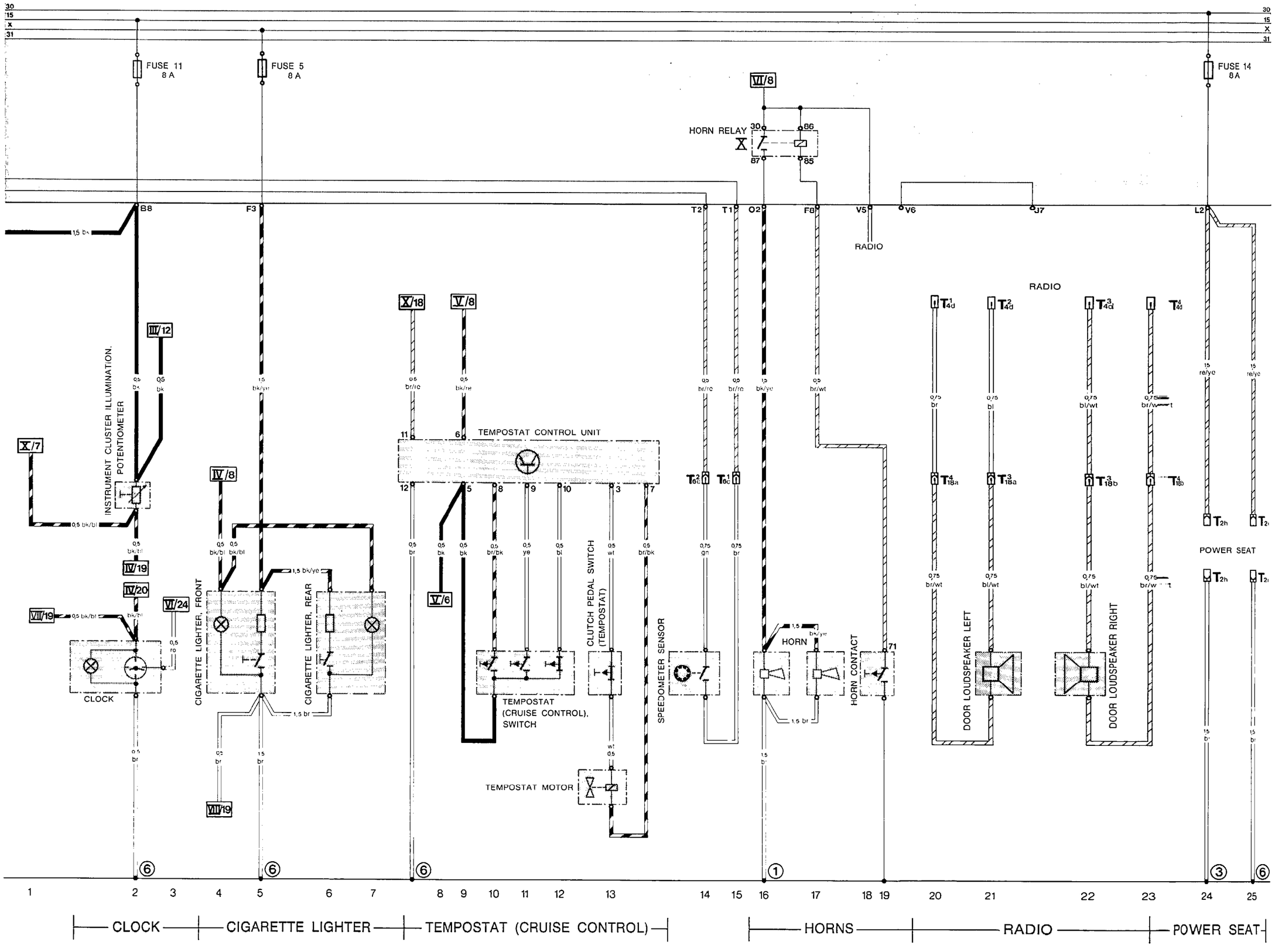
TEMPOSTAT (CRUISE CONTROL)

HORNS

RADIO

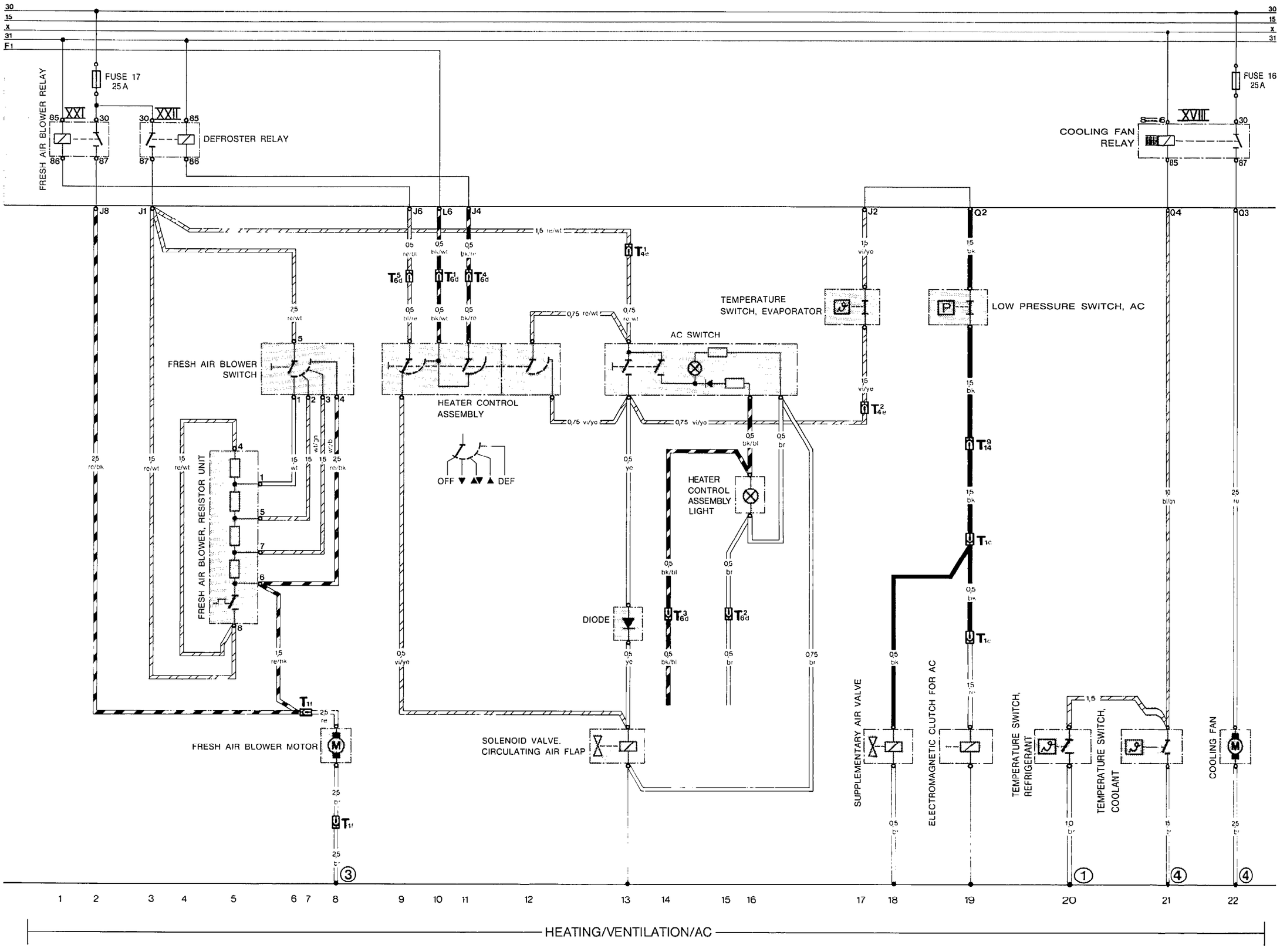
POWER SEAT

Current Flow Diagram Type 928 USA Model 80 Part XI

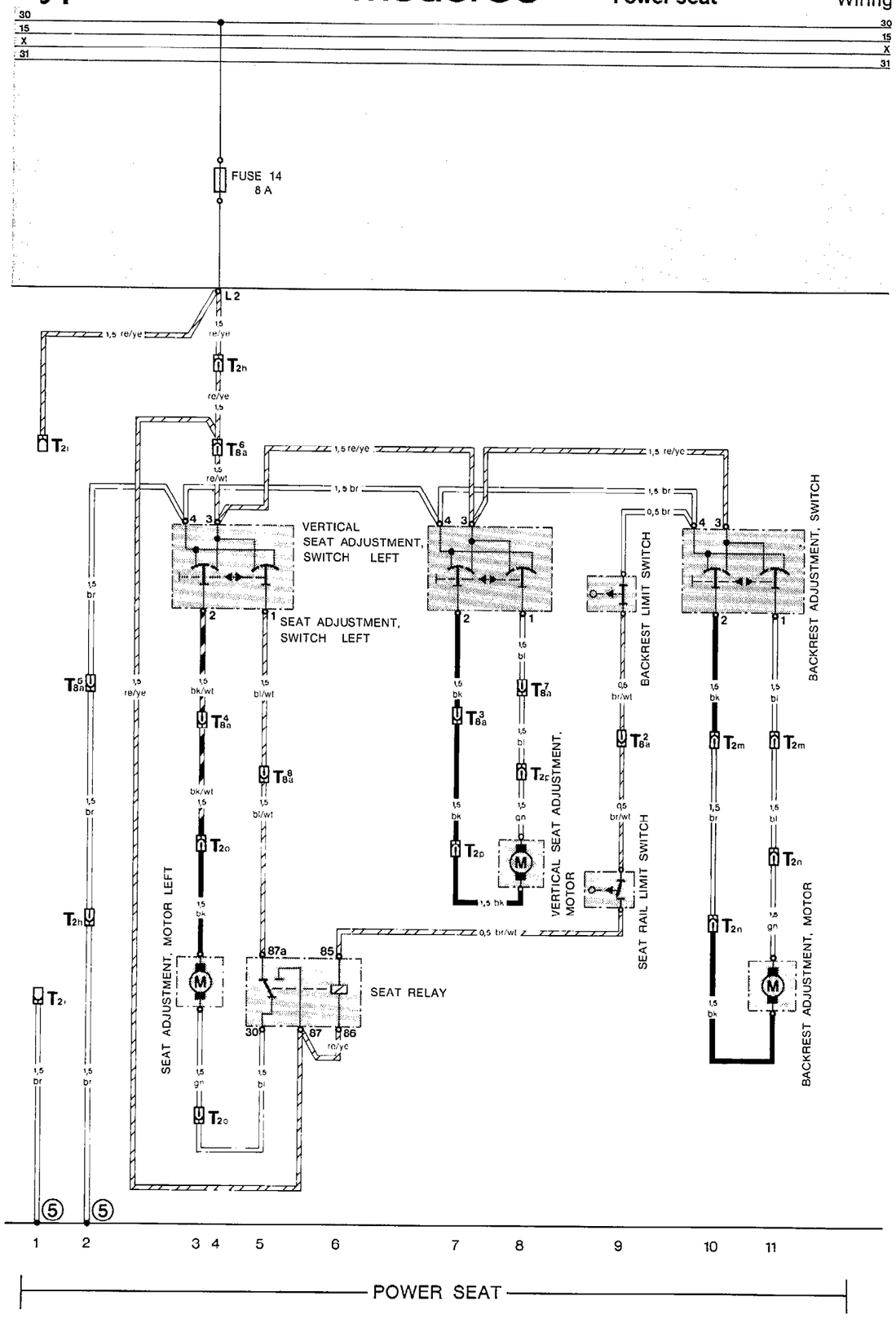


Additional Current Flow Diagram
Type 928 USA Model 80

HEATING/VENTILATION/AC

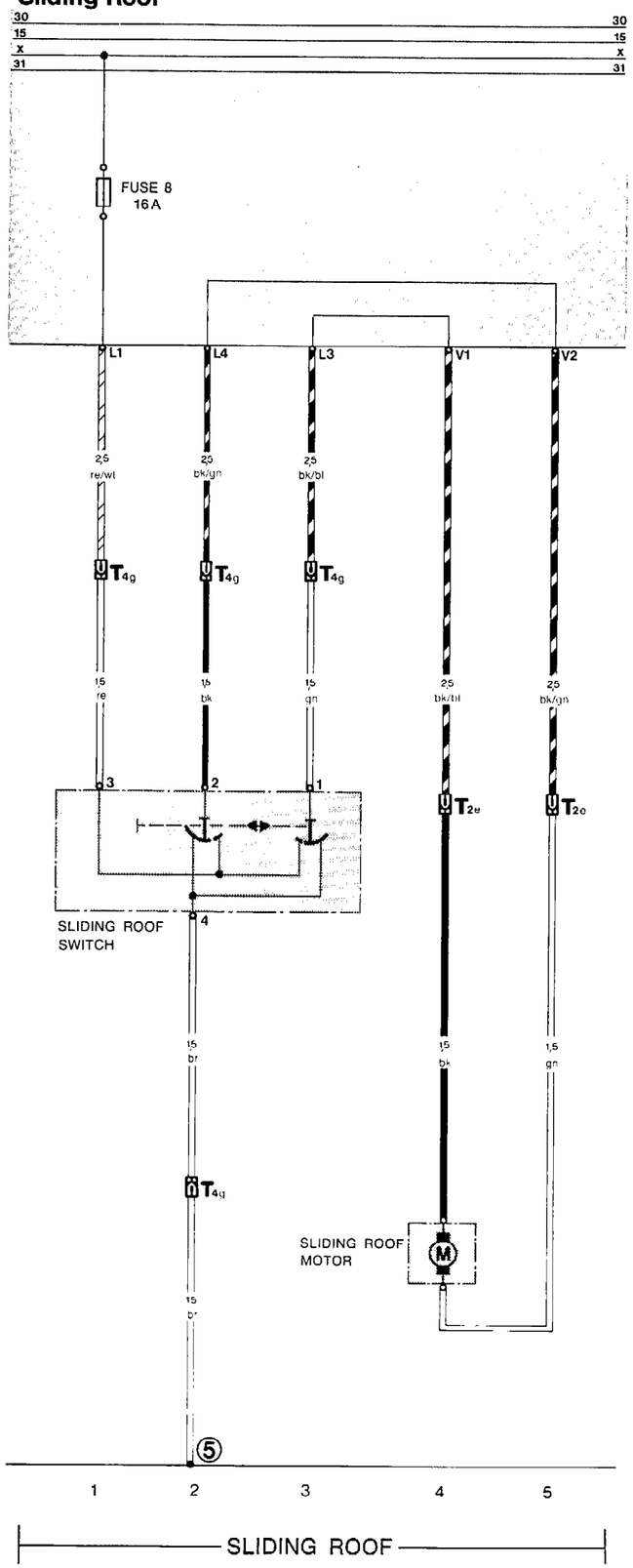

30
15
x
31
F1
FRESH AIR BLOWER RELAY
FUSE 17
25 A
DEFROSTER RELAY
FUSE 16
25 A
COOLING FAN
RELAY
TEMPERATURE
SWITCH, EVAPORATOR
LOW PRESSURE SWITCH, AC
AC SWITCH
FRESH AIR BLOWER
SWITCH
HEATER CONTROL
ASSEMBLY
OFF DEF
FRESH AIR BLOWER, RESISTOR UNIT
HEATER
CONTROL
ASSEMBLY
LIGHT
DIODE
FRESH AIR BLOWER MOTOR
SOLENOID VALVE,
CIRCULATING AIR FLAP
SUPPLEMENTARY AIR VALVE
ELECTROMAGNETIC CLUTCH FOR AC
TEMPERATURE SWITCH,
REFRIGERANT
TEMPERATURE SWITCH,
COOLANT
COOLING FAN
HEATING/VENTILATION/AC

Additional Current Flow Diagram
Type 928 USA Model 80



Additional Current Flow Diagram
Type 928 USA Model 80

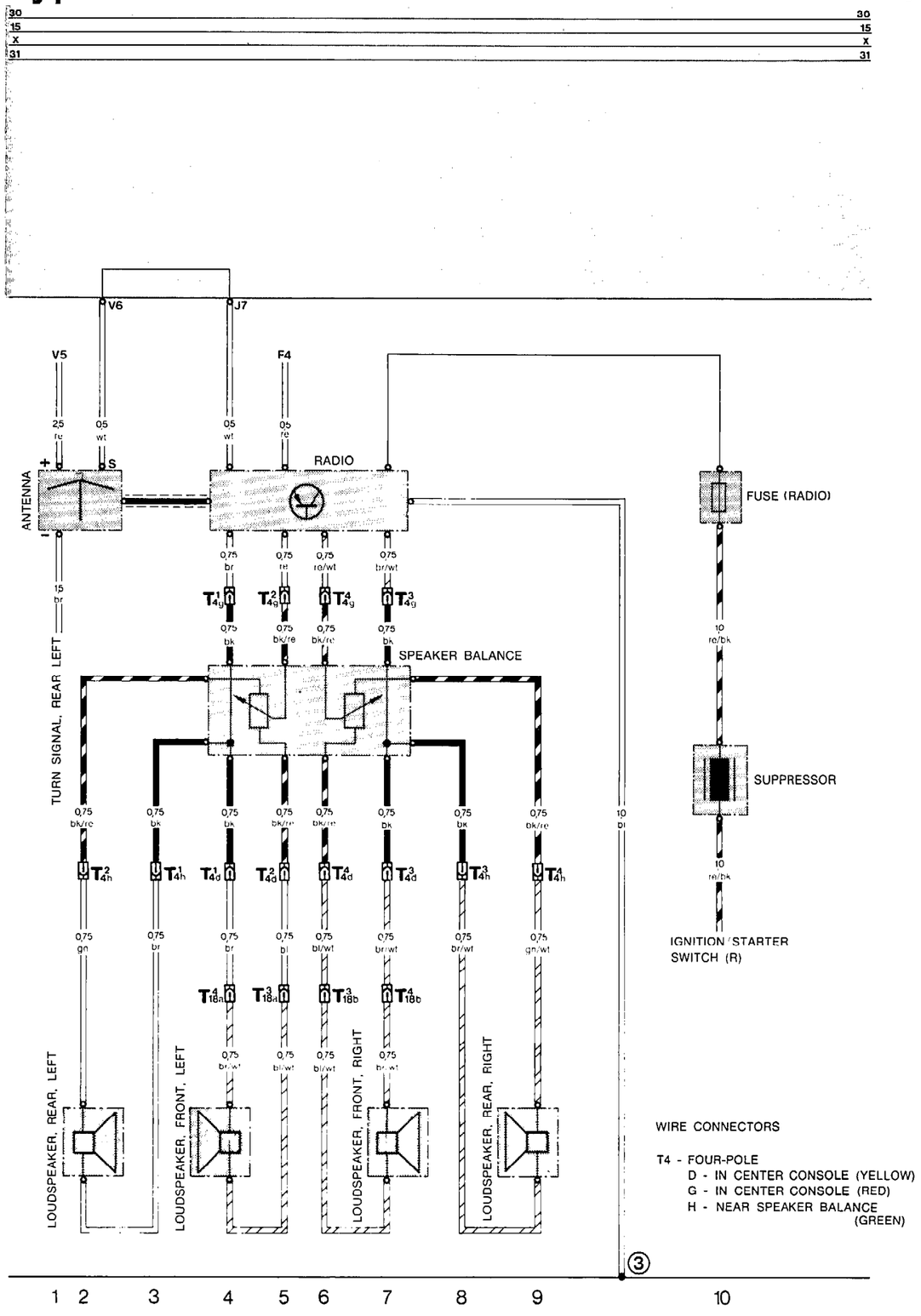
Sliding Roof



Additional Current Flow Diagram 97

Type 928 USA Model 80 RADIO WITH 4 LOUDSPEAKERS

Wiring

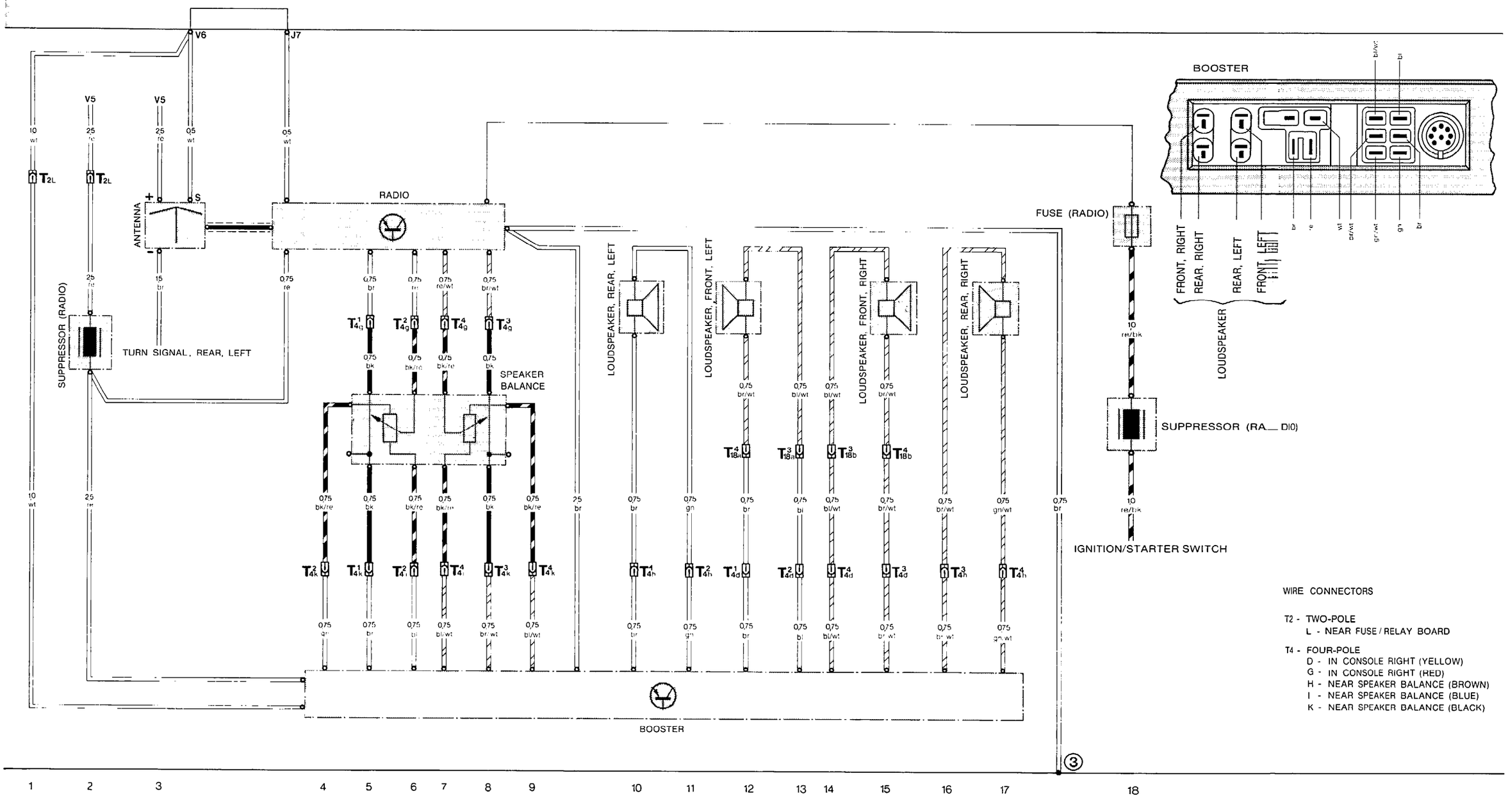


Additional Current Flow Diagram
Type 928 USA Model 80

RADIO WITH 4 LOUDSPEAKERS AND BOOSTER

Additional Current Flow Diagram Type 928 USA Model 80

RADIO WITH 4 LOUDSPEAKERS AND BOOSTER



WIRE CONNECTORS

T2 - TWO-POLE
L - NEAR FUSE / RELAY BOARD

T4 - FOUR-POLE
D - IN CONSOLE RIGHT (YELLOW)
G - IN CONSOLE RIGHT (RED)
H - NEAR SPEAKER BALANCE (BROWN)
I - NEAR SPEAKER BALANCE (BLUE)
K - NEAR SPEAKER BALANCE (BLACK)

Current Flow Diagram Type 928 USA Model 81

PART I POWER SUPPLY, STARTER
IGNITION
FUEL PUMP

PART II FUEL INJECTION SYSTEM

PART III IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT

PART IV HEADLIGHT, PARKING LIGHT
FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

PART V REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

PART VI WASHER PUMPS
REAR WINDOW WIPER
REAR WINDOW DEFOGGER
INTERIOR LIGHT
CENTRAL LOCKING SYSTEM

PART VII DOOR LIGHT
SEAT BELT
OUTSIDE MIRROR
POWER WINDOWS
BRAKE PADS

PART VIII AUTOMATIC AIR CONDITIONER

PART IX AUTOMATIC AIR CONDITIONER
SENDER UNITS

PART X CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

PART XI CLOCK
CIGARETTE LIGHTER
TEMPOSTAT (CRUISE CONTROL)
HORNS
RADIO

Current Flow Diagram
Type 928 USA Model 81

WIRE CONNECTORS

T1 - ONE-POLE

A - NEAR TURN SIGNAL LEFT
B - NEAR TURN SIGNAL RIGHT
C - NEAR AC-COMPRESSOR
F - NEAR FRESH AIR BLOWER
G - NEAR GLOVE COMPARTMENT
H - NEAR FUSE/RELAY BOARD
I - IN TUNNEL
K - NEAR FUEL PUMP

T2 - TWO-POLE

A - BEHIND ACCELERATOR PEDAL
C - BEHIND REAR BUMPER
D - NEAR LEFT BACKWHEEL
E - NEAR RIGHT BACKWHEEL
F - NEAR RIGHT FRONT WHEEL
G - NEAR LEFT FRONT WHEEL
H - NEAR DRIVER SEAT
I - NEAR PASSENGER SEAT
K - NEAR DRIVER SEAT
Q - NEAR LEFT FOG LIGHT
R - NEAR RIGHT FOG LIGHT
U - NEAR LEFT SIDE MARKER
V - NEAR RIGHT SIDE MARKER

T4 - FOUR-POLE

A - IN SPARE WHEEL WELL
B - IN CONSOLE, RIGHT
C - IN CONSOLE RIGHT
D - IN CONSOLE
E - IN CONSOLE
F - IN CONSOLE
G - NEAR RIGHT FRONT WHEEL
H - NEAR LEFT FRONT WHEEL

T6 - SIX-POLE

A - BEHIND SIDE COVERING, RIGHT
B - IN REAR LID, RIGHT
C - IN SPARE WHEEL WELL
D - IN CONSOLE

T7 - SEVEN-POLE

A - BEHIND LUGGAGE COMPARTMENT COVERING LEFT
B - BEHIND LUGGAGE COMPARTMENT COVERING RIGHT

T14 - FOURTEEN-POLE

IN ENGINE COMPARTMENT, RIGHT

T18 - EIGHTEEN-POLE

A - IN FOOT WEEL, DRIVER SIDE
B - IN FOOT WELL, PASSENGER SIDE

GROUND TERMINALS

① ON FRONT LOCK MEMBER, RIGHT

② AT REAR OF WHEEL ARCH UNDERNEATH RIGHT REAR TRIM PANEL

③ ON STEERING CONSOLE

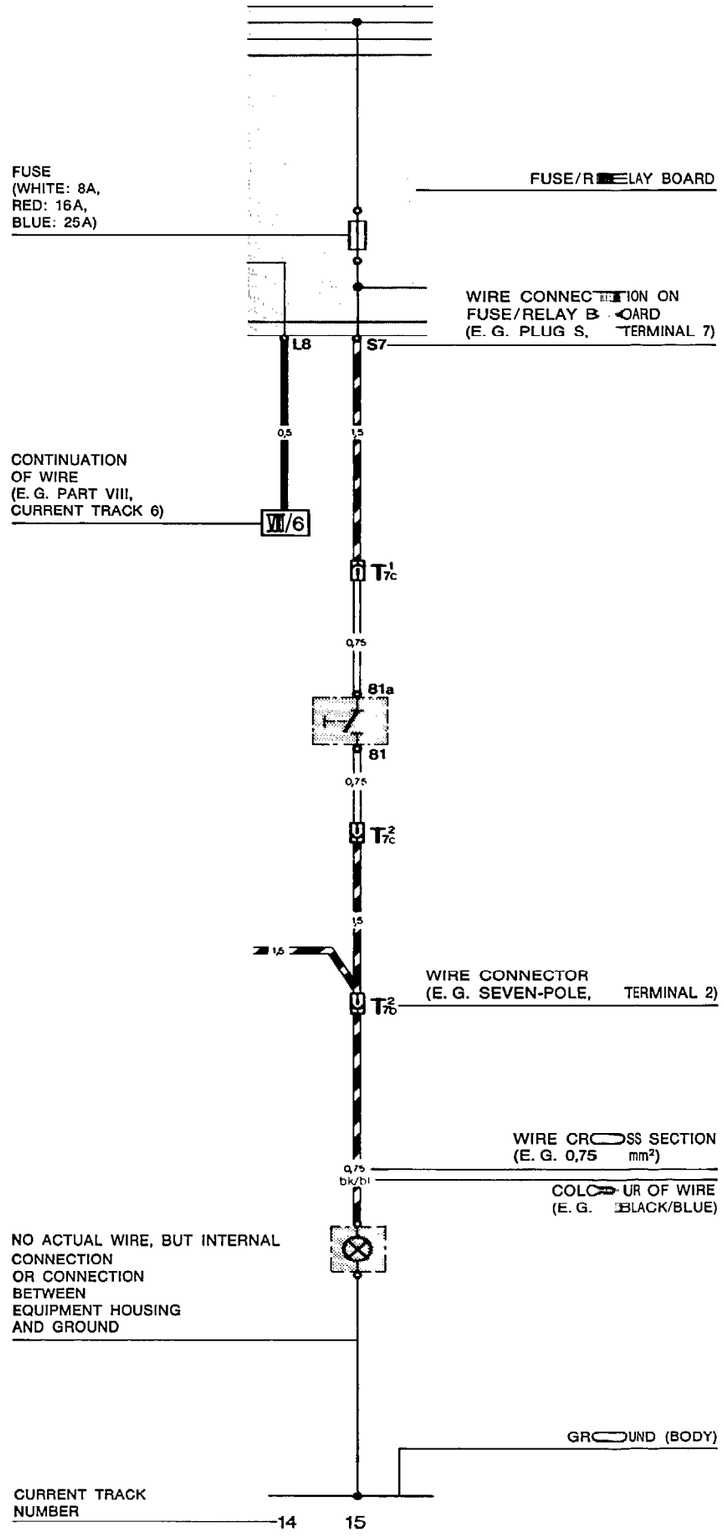
④ ON FRONT LOCK MEMBER, LEFT

⑤ ON UPPER MOUNTING FOR FUSE/RELAY BOARD

⑥ ON FRONT WALL

WIRE COLOURS

BK - BLACK	GN - GREEN	BR - BROWN
WT - WHITE	YE - YELLOW	BL - BLUE
RE - RED	GR - GREY	VI - VIOLET



Current Flow Diagram Type 928 USA

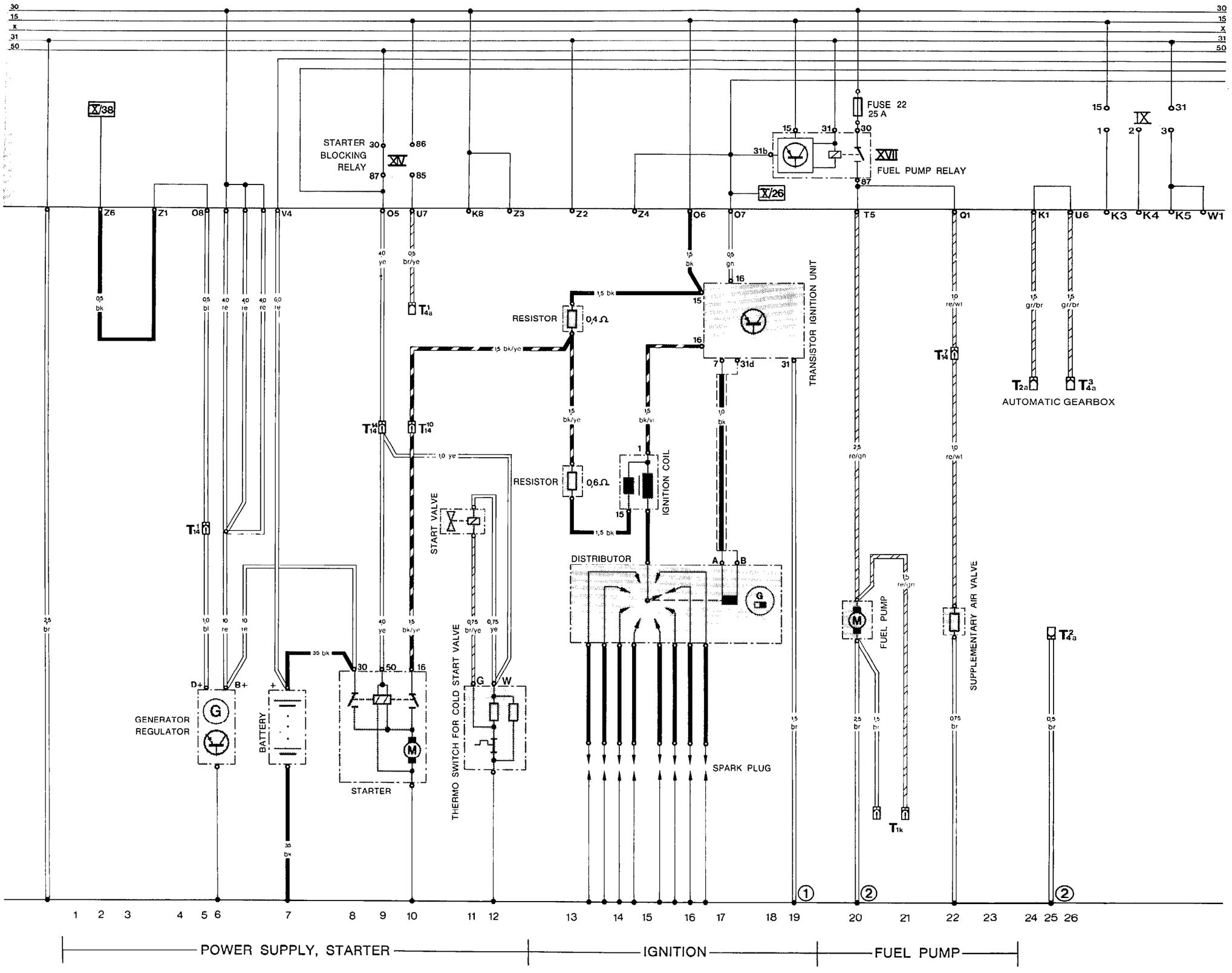
Model 81 Part I

POWER SUPPLY, STARTER

IGNITION

FUEL PUMP

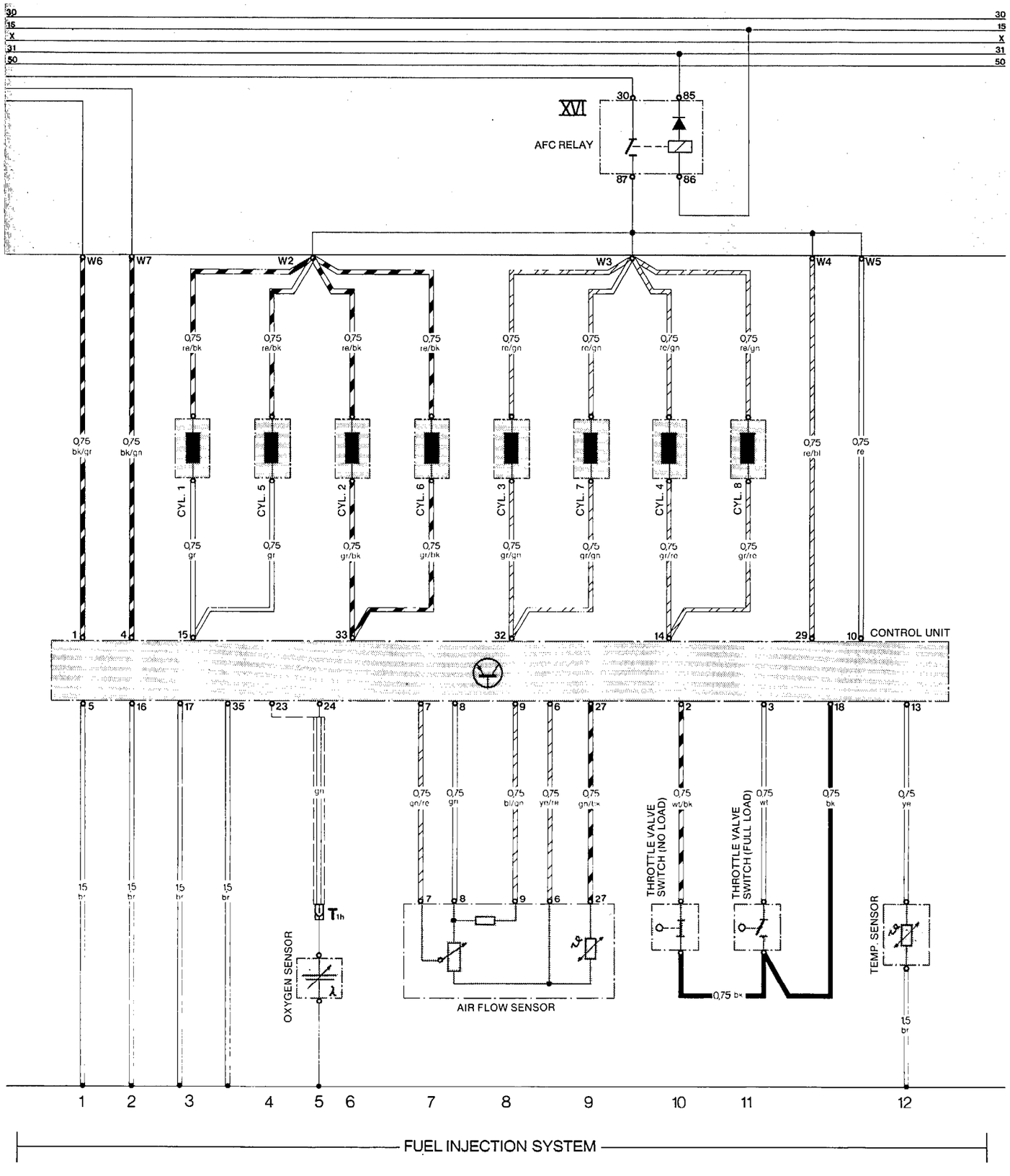
Current Flow Diagram Type 928 USA Model 81 Part I



Current Flow Diagram Type 928 USA
Model 81 Part II

FUEL INJECTION SYSTEM

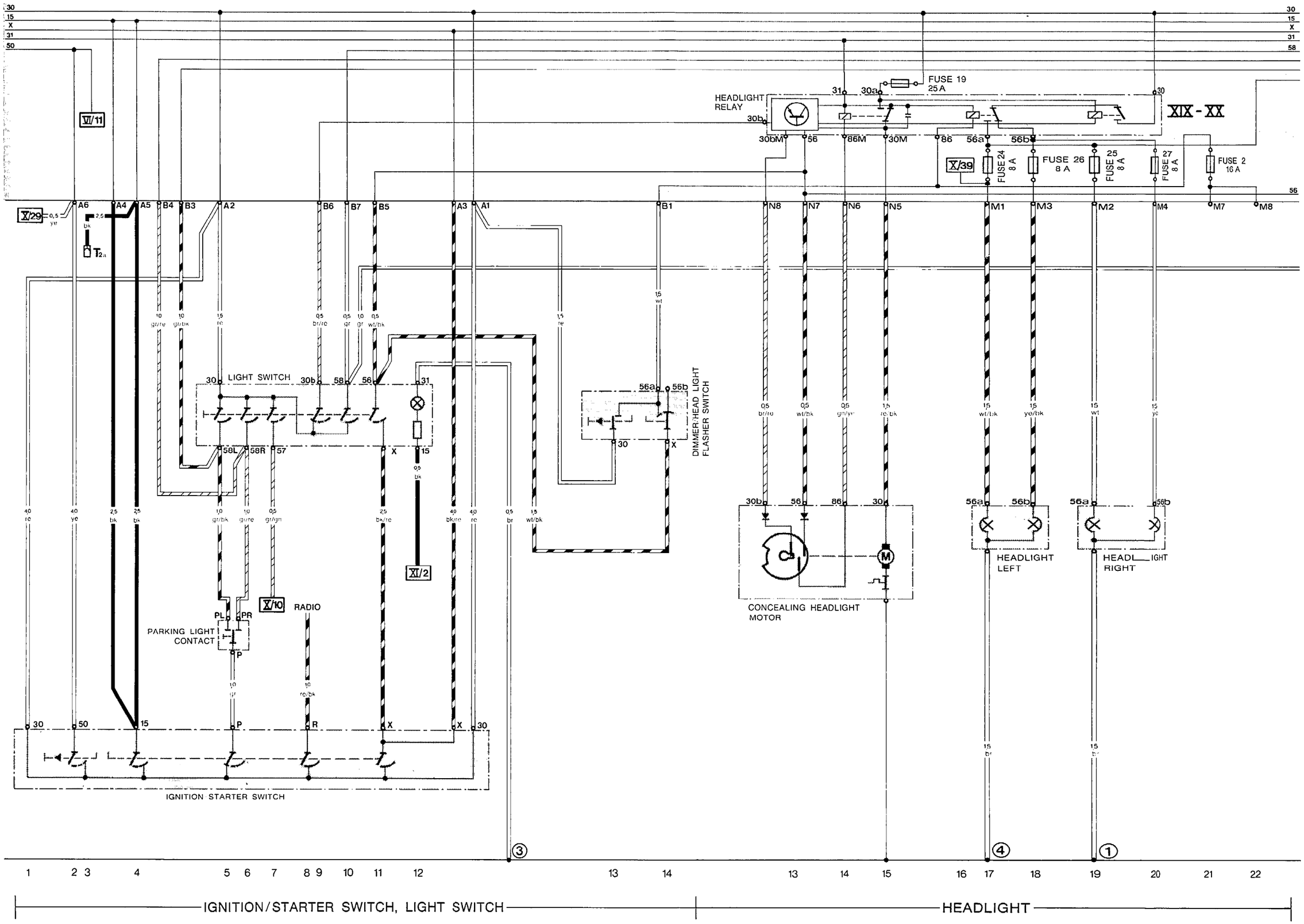
Current Flow Diagram Type 928 USA Model 81 Part II



Current Flow Diagram Type 928 USA
Model 81 Part III

IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT, PARKING LIGHT

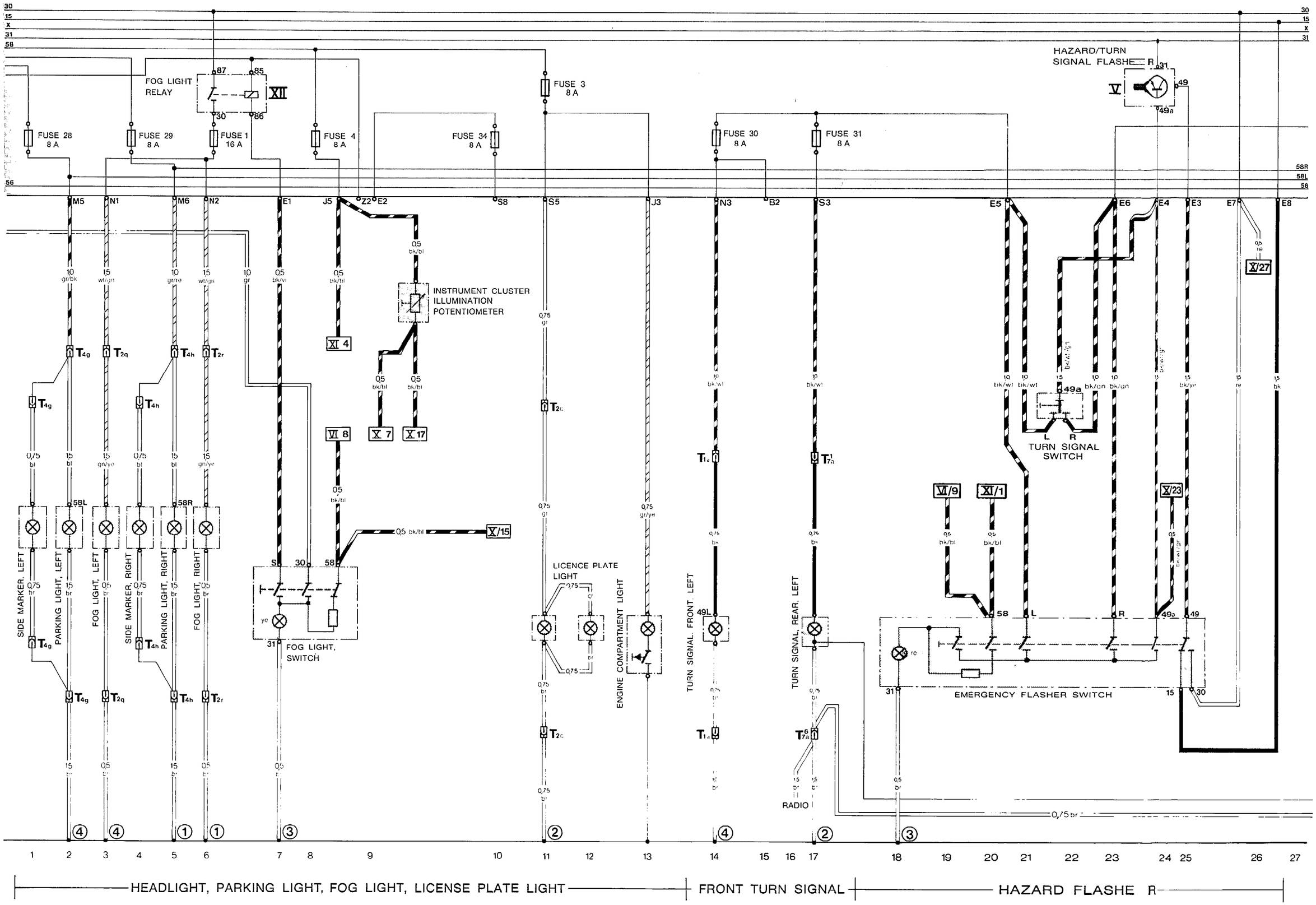
Current Flow Diagram Type 928 USA Model 81 Part III



Current Flow Diagram Type 928 USA
Model 81 Part IV

FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

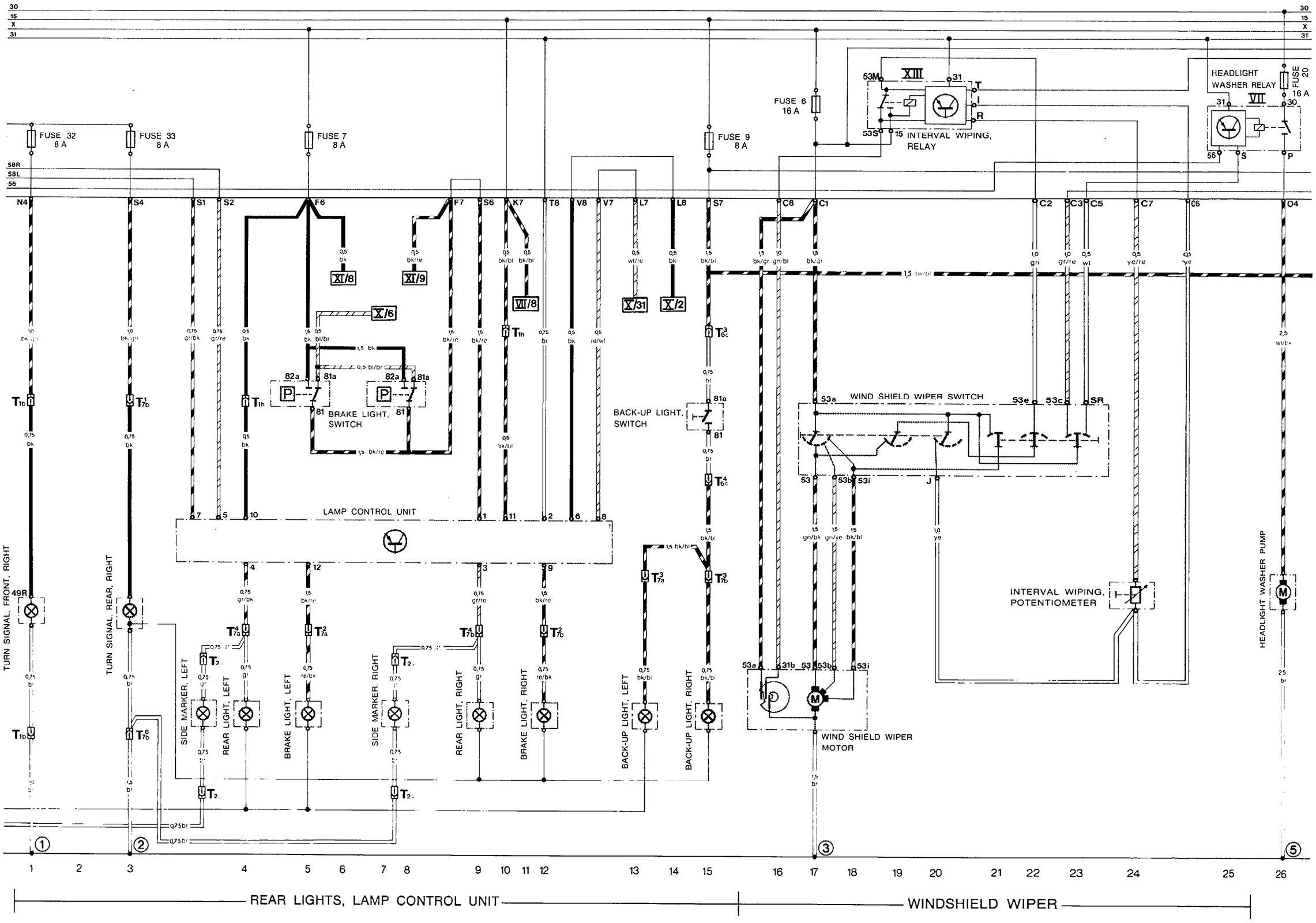
Current Flow Diagram Type 928 USA Model 81 Part IV



Current Flow Diagram Type 928 USA
Model 81 Part V

REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

Current Flow Diagram Type 928 USA Model 81 Part V



Current Flow Diagram Type 928 USA
Model 81 Part VI

WASHER PUMPS

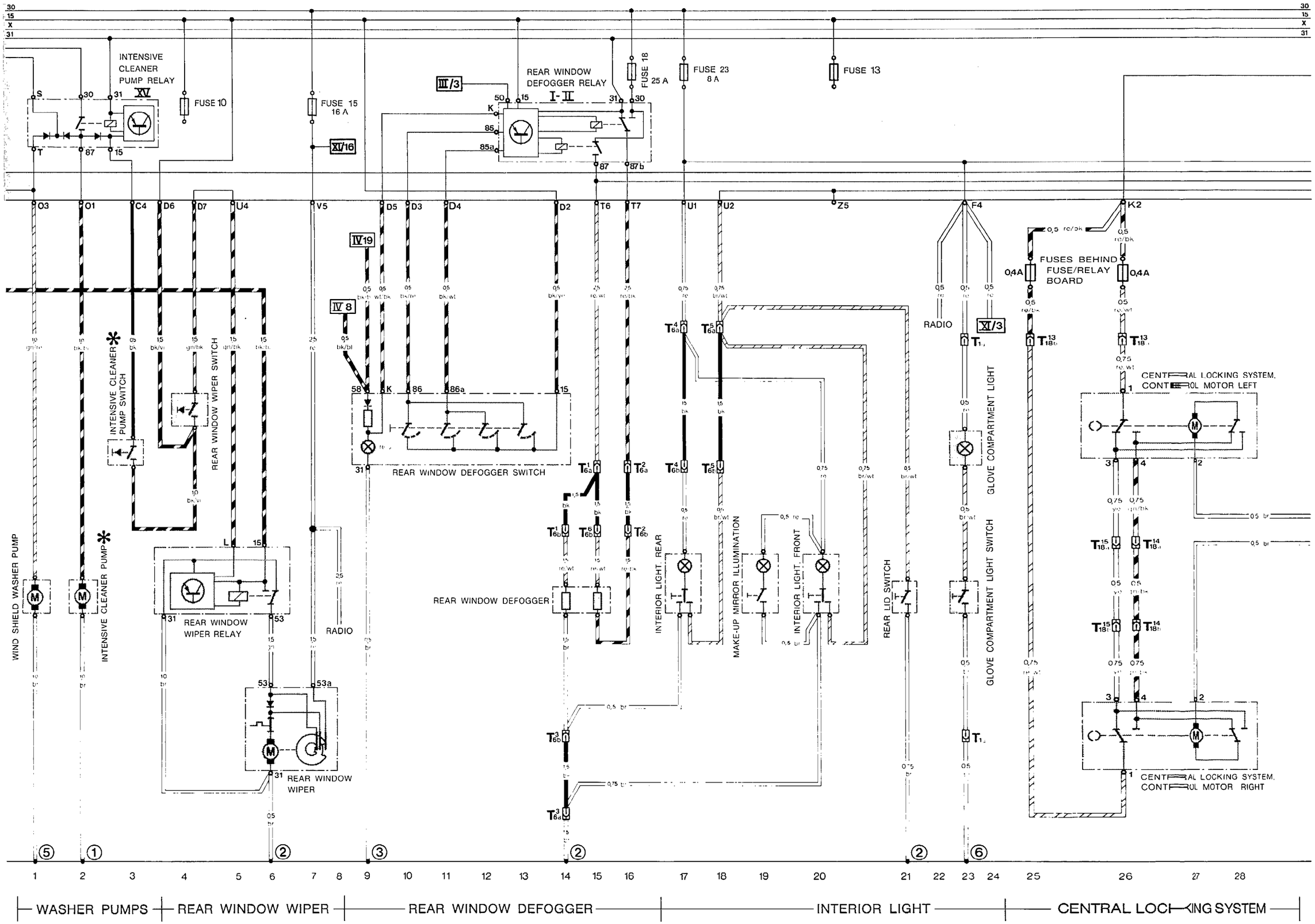
REAR WINDOW WIPER

REAR WINDOW DEFOGGER

INTERIOR LIGHT

SEAT BELT

Current Flow Diagram Type 928 USA Model 81 Part VI



Printed in Germany-V, 1981

* OPTIONAL

Current Flow Diagram Type 928 USA
Model 81 Part VII

DOOR LIGHT

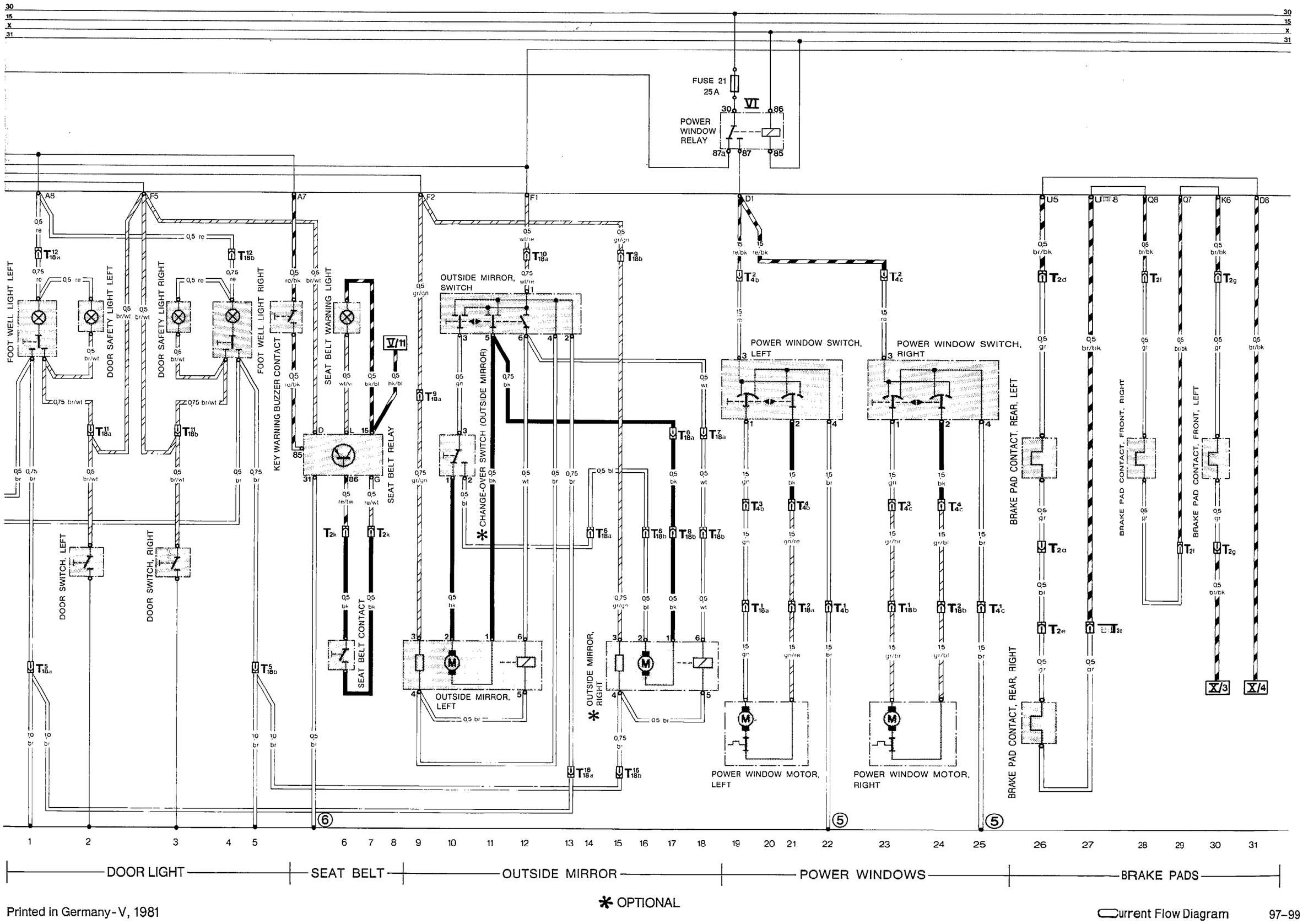
SEAT BELT

OUTSIDE MIRROR

POWER WINDOWS

BRAKE PADS

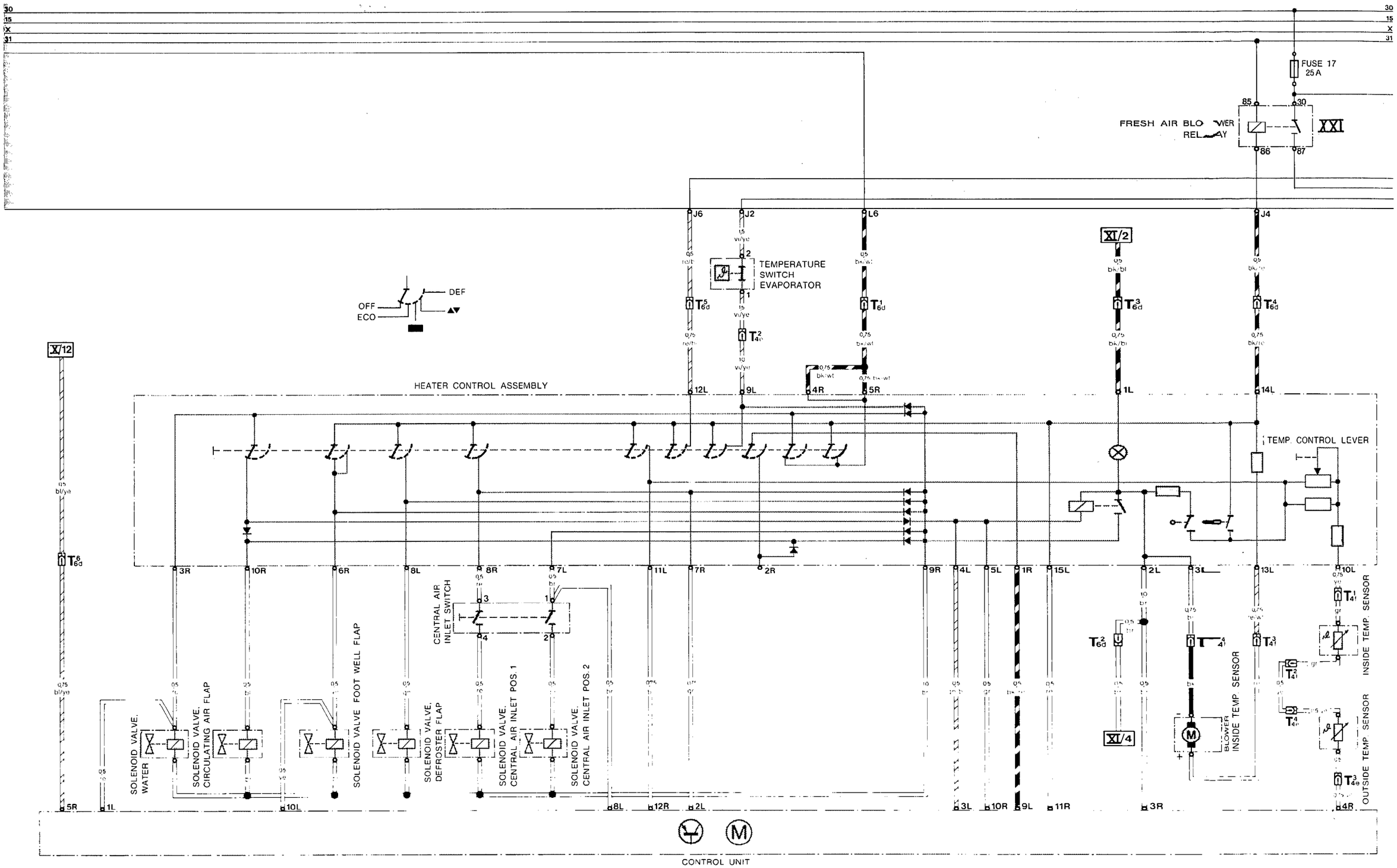
Current Flow Diagram Type 928 USA Model 81 Part VII



Current Flow Diagram Type 928 USA
Model 81 Part VIII

AUTOMATIC AIR CONDITIONER

Current Flow Diagram Type 928 USA Model 81 Part VIII

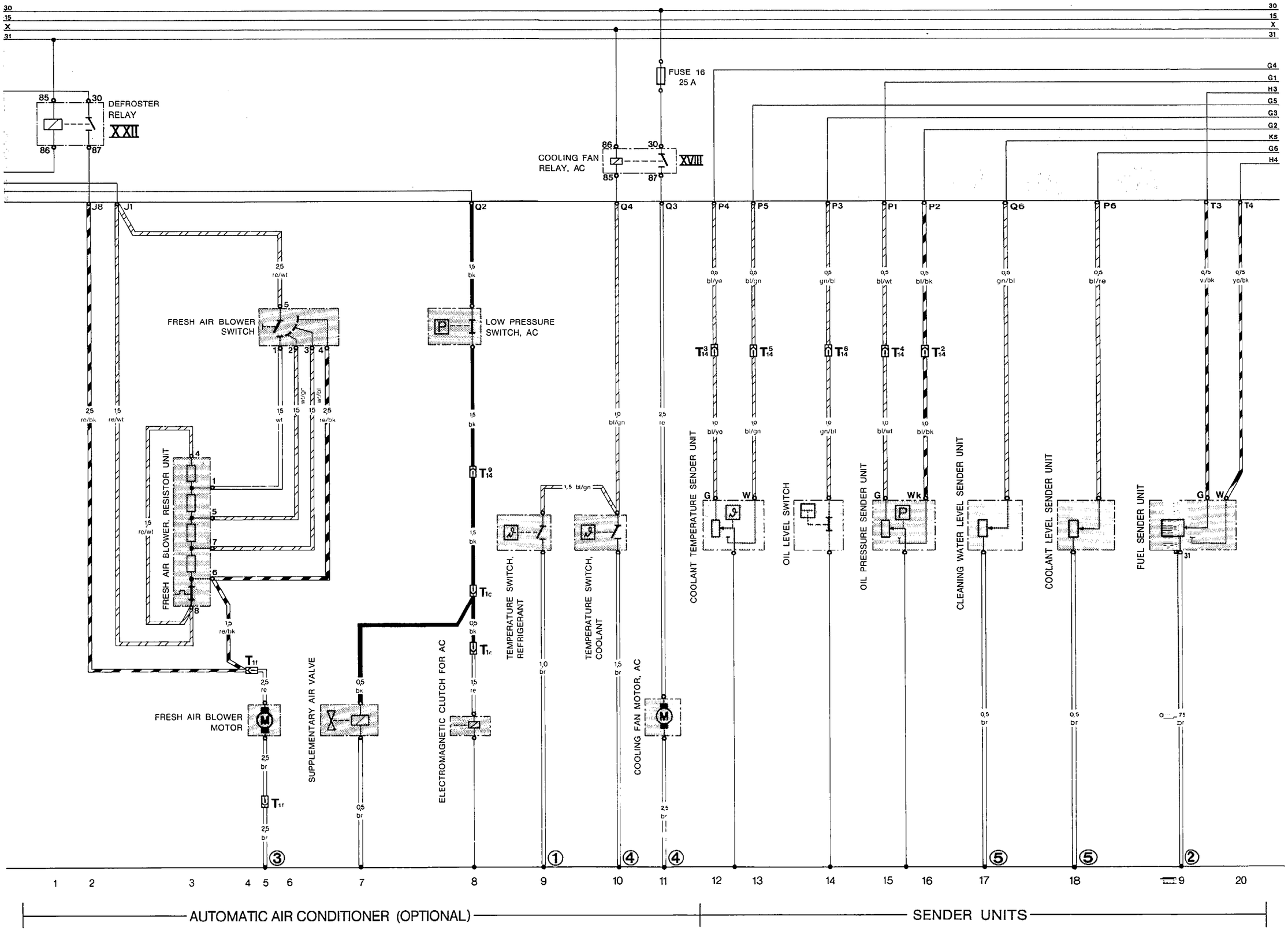


Current Flow Diagram Type 928 USA
Model 81 Part IX

AUTOMATIC AIR CONDITIONER

SENDER UNITS

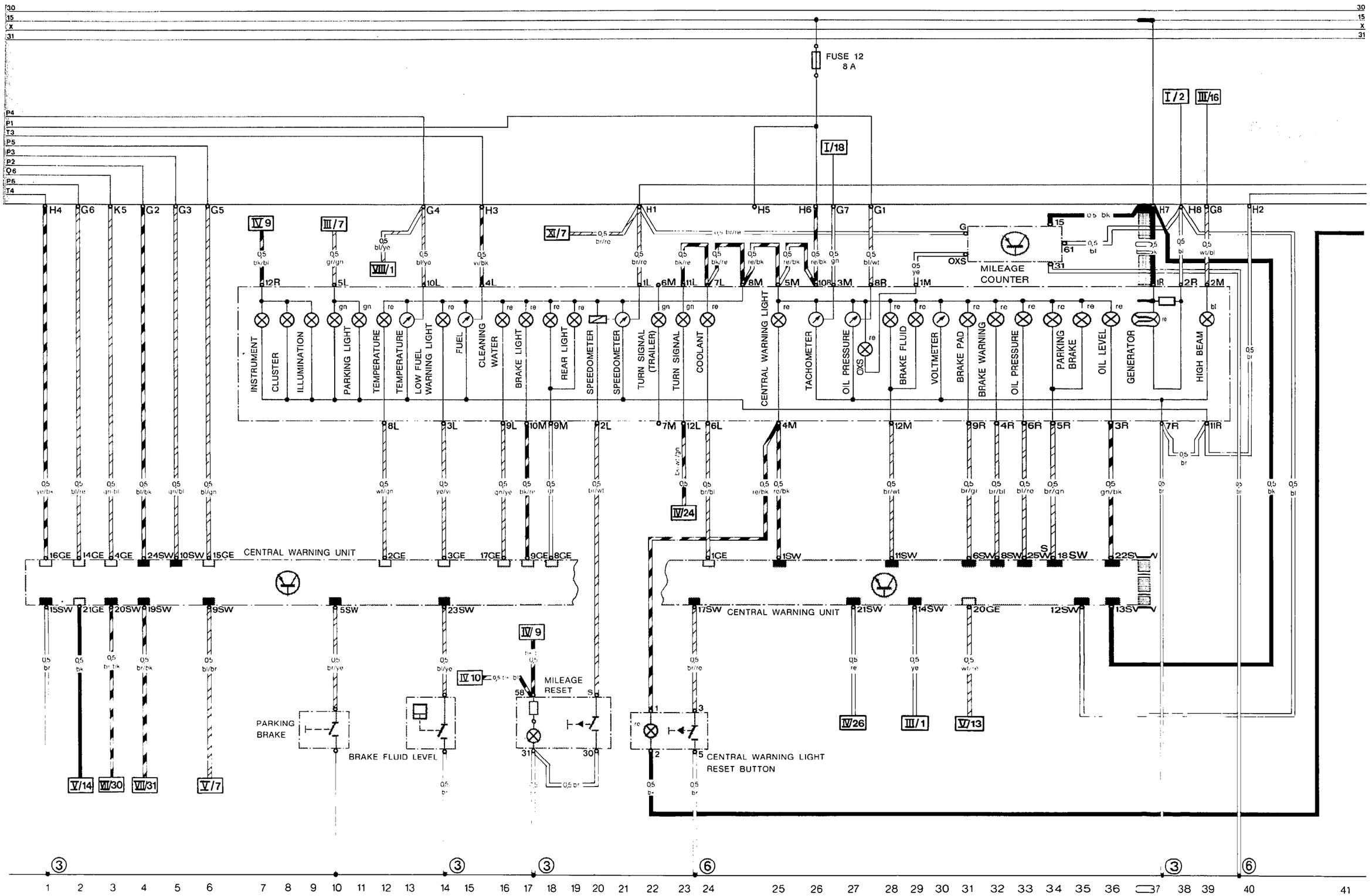
Current Flow Diagram Type 928 USA Model 81 Part XI



Current Flow Diagram Type 928 USA
Model 81 Part X

CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

Current Flow Diagram Type 928 USA Model 81 Part X



Current Flow Diagram Type 928 USA
Model 81 Part XI

CLOCK

CIGARETTE LIGHTER

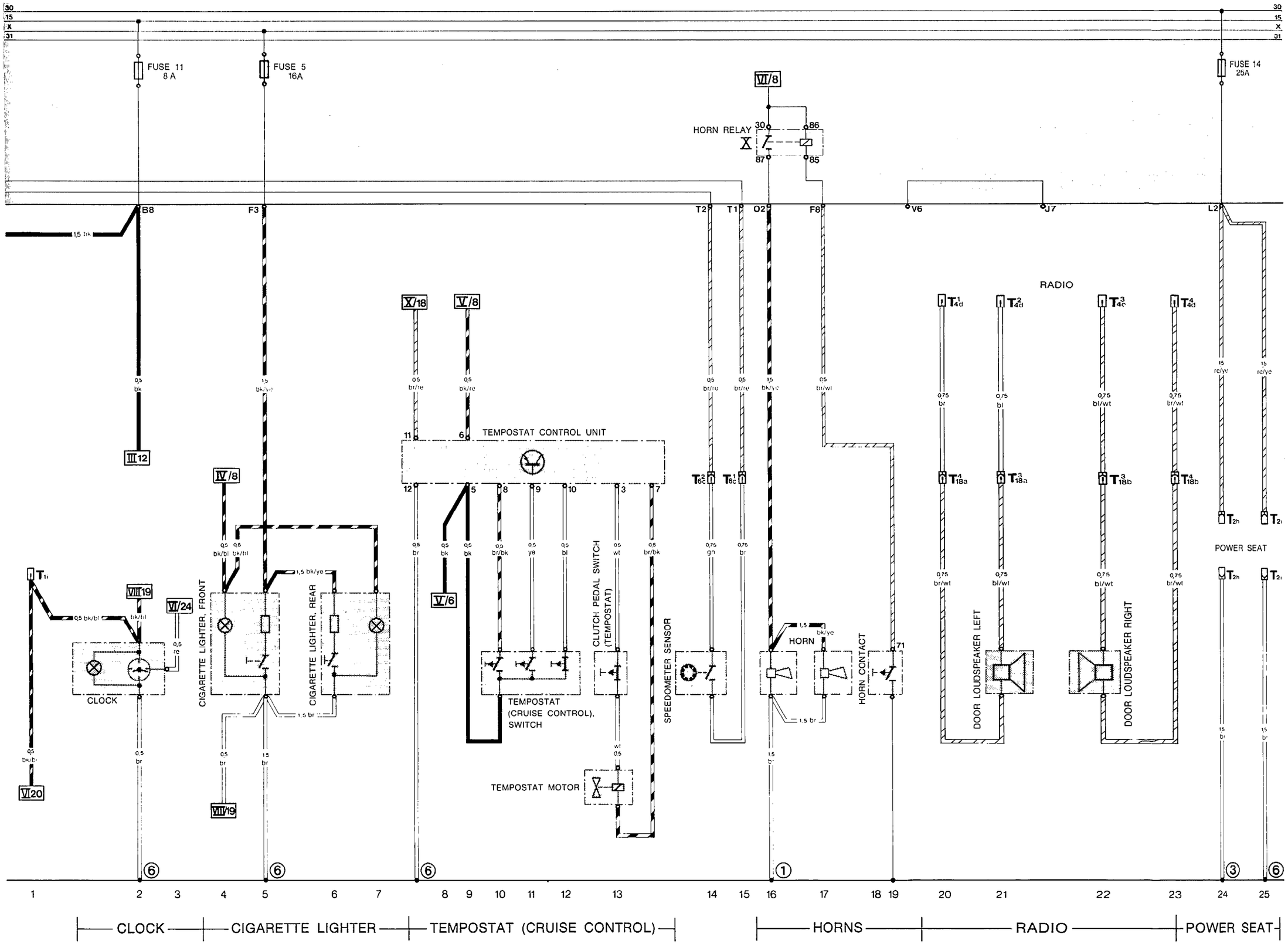
TEMPOSTAT (CRUISE CONTROL)

HORNS

RADIO

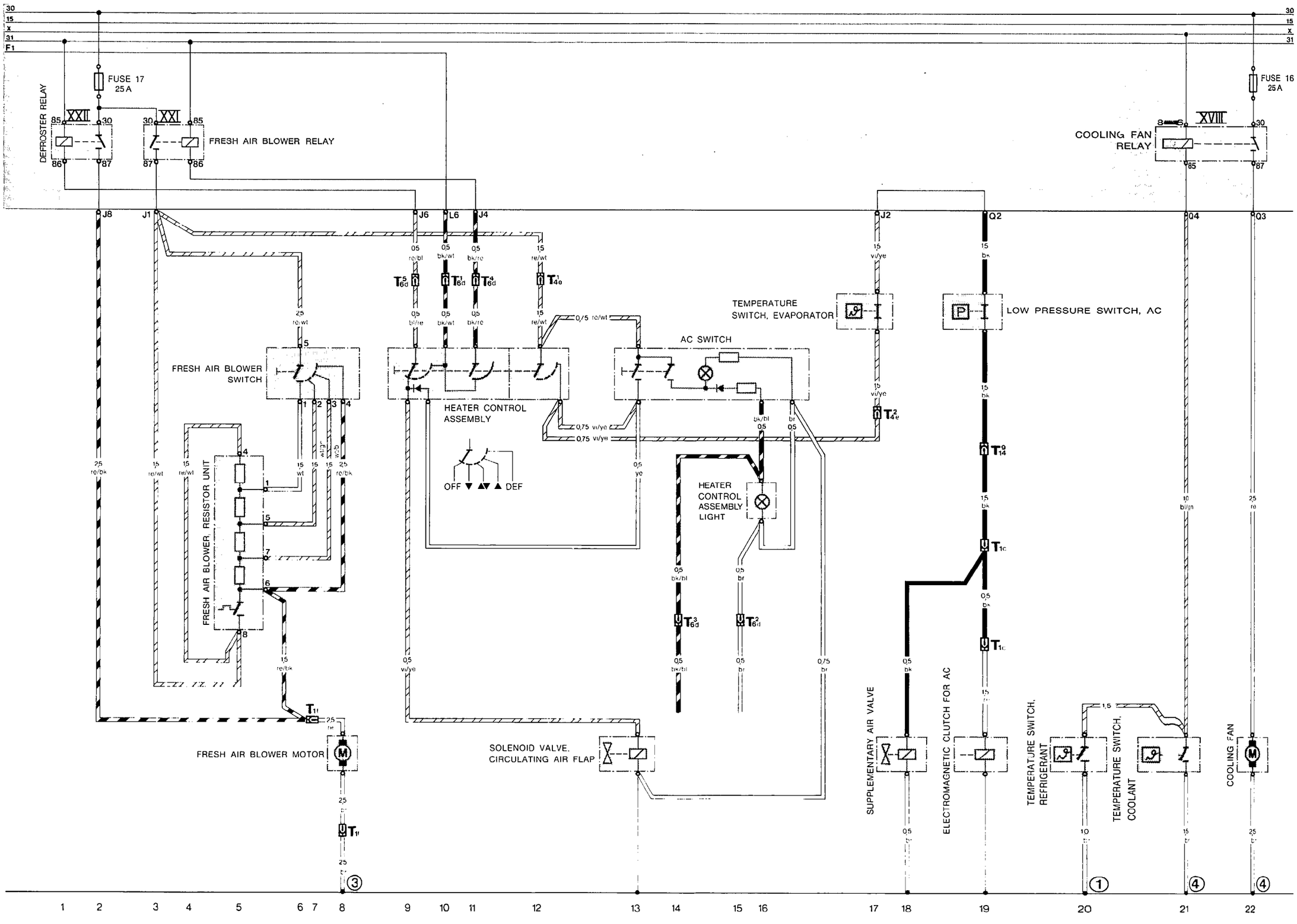
POWER SEAT

Current Flow Diagram Type 928 USA Model 81 Part XI



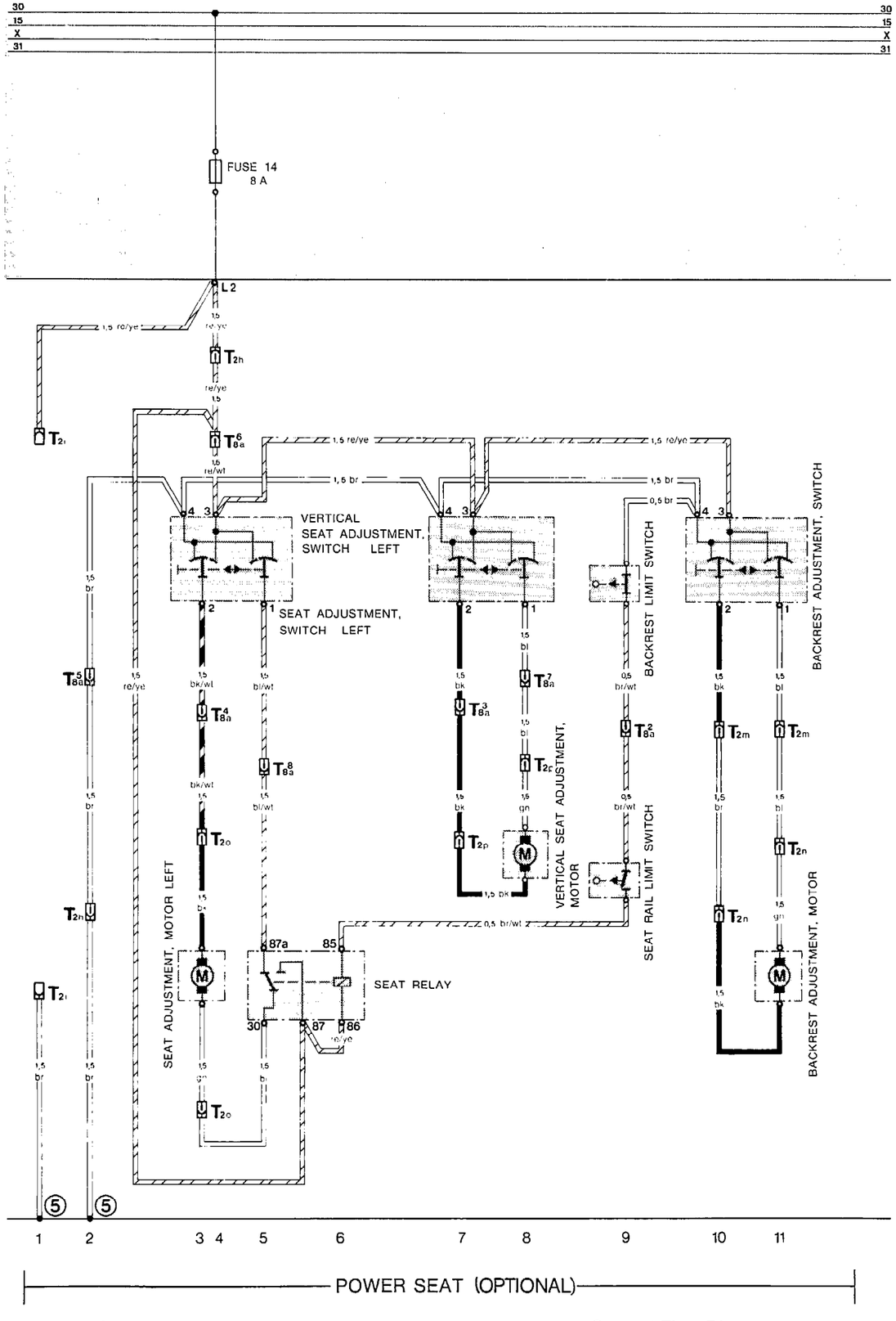
Additional Current Flow Diagram
Type 928 USA Model 81

HEATING/VENTILATION/AC


30
15
x
31
F1
FUSE 17
25 A
DEFROSTER RELAY
FRESH AIR BLOWER RELAY
FUSE 16
25 A
COOLING FAN
RELAY
J8
J1
J6
L6
J4
J2
Q2
Q4
Q3
FRESH AIR BLOWER
SWITCH
HEATER CONTROL
ASSEMBLY
OFF
DEF
TEMPERATURE
SWITCH, EVAPORATOR
AC SWITCH
LOW PRESSURE SWITCH, AC
HEATER
CONTROL
ASSEMBLY
LIGHT
FRESH AIR BLOWER, RESISTOR UNIT
FRESH AIR BLOWER MOTOR
SOLENOID VALVE,
CIRCULATING AIR FLAP
SUPPLEMENTARY AIR VALVE
ELECTROMAGNETIC CLUTCH FOR AC
TEMPERATURE SWITCH,
REFRIGERANT
TEMPERATURE SWITCH,
COOLANT
COOLING FAN
HEATING/VENTILATION/AC

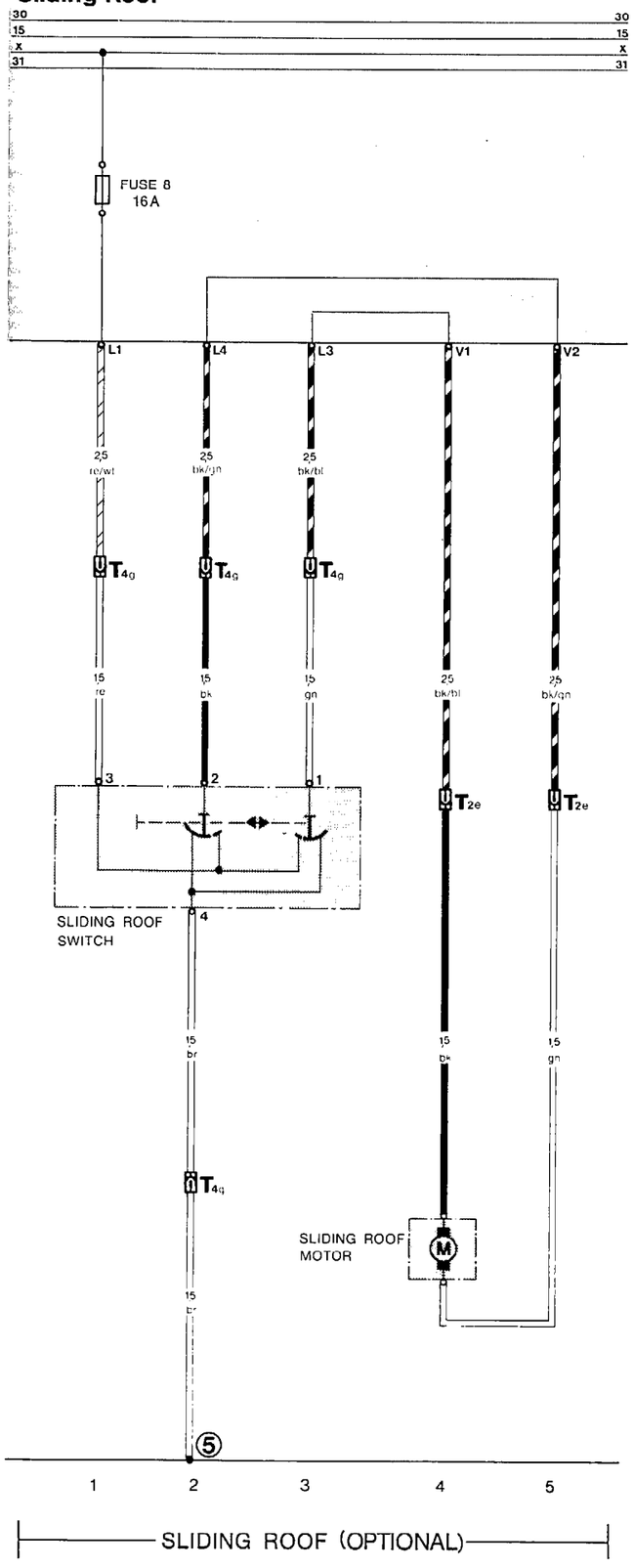
Additional Current Flow Diagram
Type 928 USA Model 81

Power seat



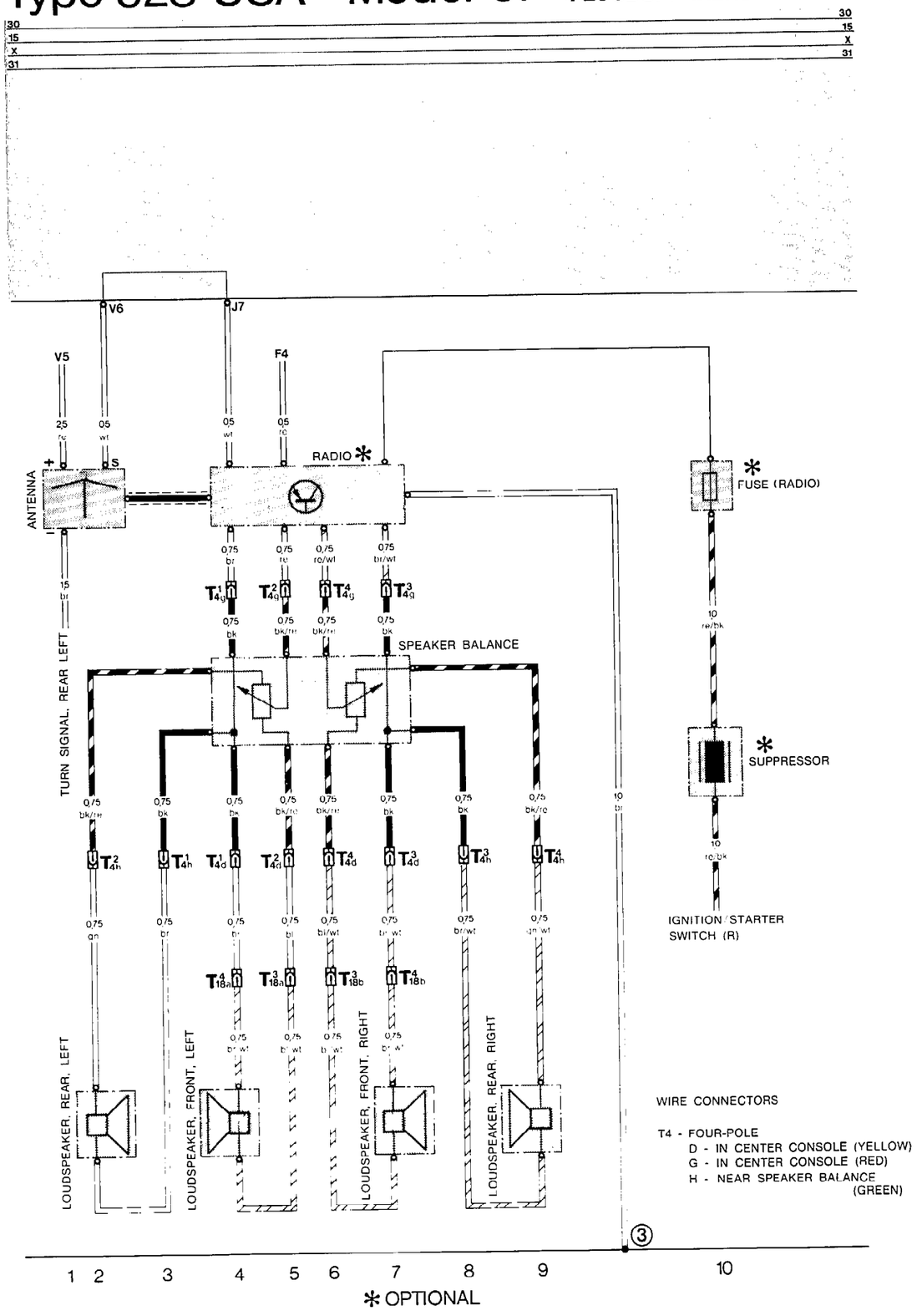
Additional Current Flow Diagram
Type 928 USA Model 81

Sliding Roof



Additional Current Flow Diagram
Type 928 USA Model 81

RADIO WITH 4 LOUDSPEAKERS

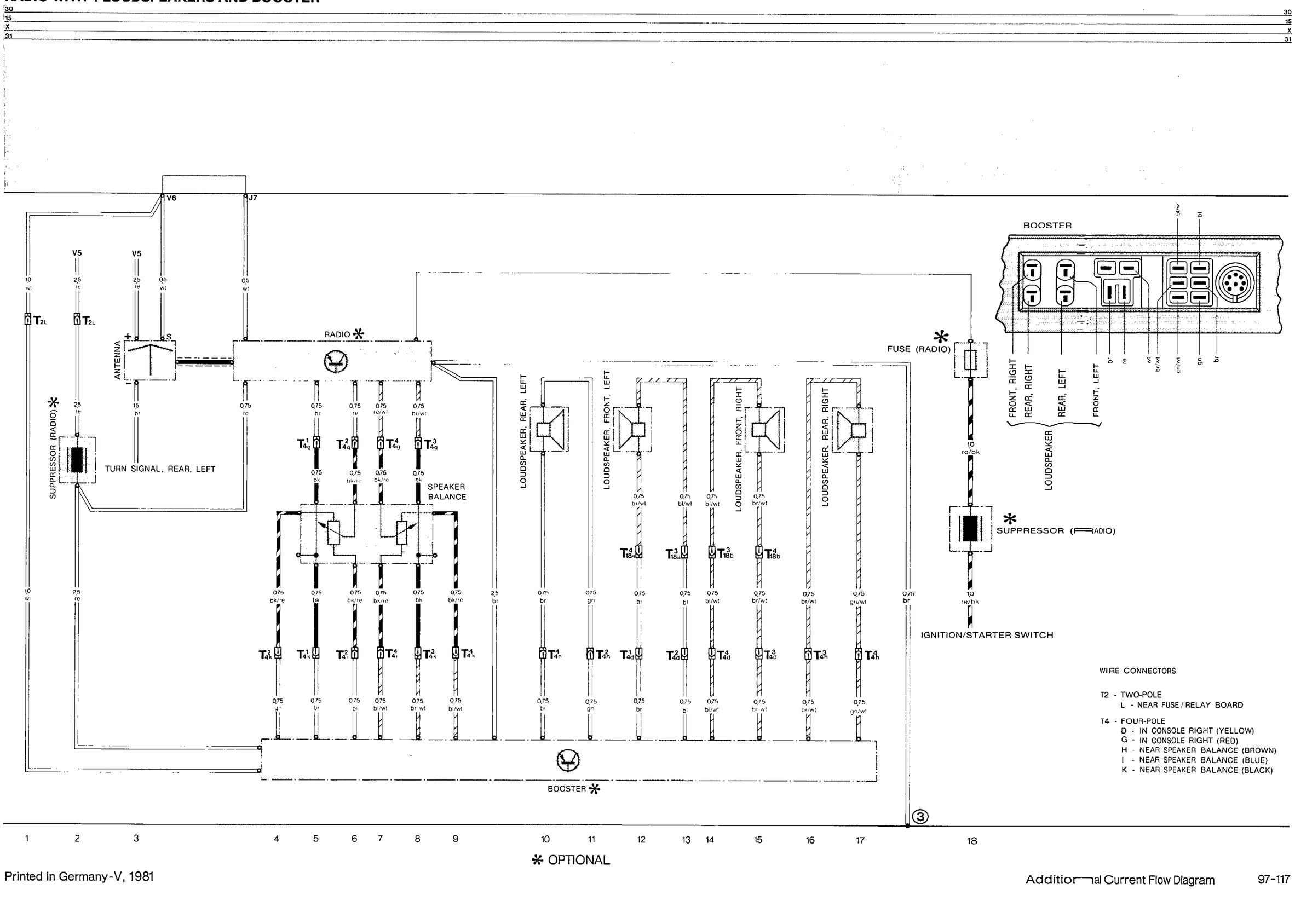


Additional Current Flow Diagram
Type 928 USA Model 81

RADIO WITH 4 LOUDSPEAKERS AND BOOSTER

Additional Current Flow Diagram Type 928 USA Model 81

RADIO WITH 4 LOUDSPEAKERS AND BOOSTER



Current Flow Diagram Type 928 USA Model 82

PART I POWER SUPPLY, STARTER
IGNITION
FUEL PUMP

PART II FUEL INJECTION SYSTEM

PART III IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT

PART IV HEADLIGHT, PARKING LIGHT
FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

PART V REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

PART VI WASHER PUMPS
REAR WINDOW WIPER
REAR WINDOW DEFOGGER
INTERIOR LIGHT
CENTRAL LOCKING SYSTEM

PART VII DOOR LIGHT
SEAT BELT
OUTSIDE MIRROR
POWER WINDOWS
BRAKE PADS

PART VIII AUTOMATIC AIR CONDITIONER

PART IX AUTOMATIC AIR CONDITIONER
SENDER UNITS

PART X CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

PART XI CLOCK
CIGARETTE LIGHTER
TEMPOSTAT (CRUISE CONTROL)
HORNS

Current Flow Diagram
Type 928 USA Model 82

WIRE CONNECTORS

T1 - ONE-POLE

A - NEAR TURN SIGNAL LEFT
B - NEAR TURN SIGNAL RIGHT
C - NEAR AC-COMPRESSOR
F - NEAR FRESH AIR BLOWER
G - NEAR GLOVE COMPARTMENT
H - NEAR FUSE/RELAY BOARD
I - IN TUNNEL
K - NEAR FUEL PUMP

T2 - TWO-POLE

A - BEHIND ACCELERATOR PEDAL
C - BEHIND REAR BUMPER
D - NEAR LEFT BACKWHEEL
E - NEAR RIGHT BACKWHEEL
F - NEAR RIGHT FRONT WHEEL
G - NEAR LEFT FRONT WHEEL
H - NEAR DRIVER SEAT
I - NEAR PASSENGER SEAT
K - NEAR DRIVER SEAT
Q - NEAR LEFT FOG LIGHT
R - NEAR RIGHT FOG LIGHT
U - NEAR LEFT SIDE MARKER
V - NEAR RIGHT SIDE MARKER

T4 - FOUR-POLE

A - IN SPARE WHEEL WELL
B - IN CONSOLE, RIGHT
C - IN CONSOLE RIGHT
D - IN CONSOLE
E - IN CONSOLE
F - IN CONSOLE
G - NEAR RIGHT FRONT WHEEL
H - NEAR LEFT FRONT WHEEL

T6 - SIX-POLE

A - BEHIND SIDE COVERING, RIGHT
B - IN REAR LID, RIGHT
C - IN SPARE WHEEL WELL
D - IN CONSOLE

T7 - SEVEN-POLE

A - BEHIND LUGGAGE COMPARTMENT COVERING LEFT
B - BEHIND LUGGAGE COMPARTMENT COVERING RIGHT

T14 - FOURTEEN-POLE

IN ENGINE COMPARTMENT, RIGHT

T18 - EIGHTEEN-POLE

A - IN FOOT WEEL, DRIVER SIDE
B - IN FOOT WELL, PASSENGER SIDE

GROUND TERMINALS

① ON FRONT LOCK MEMBER, RIGHT

② AT REAR OF WHEEL ARCH UNDERNEATH RIGHT REAR TRIM PANEL

③ ON STEERING CONSOLE

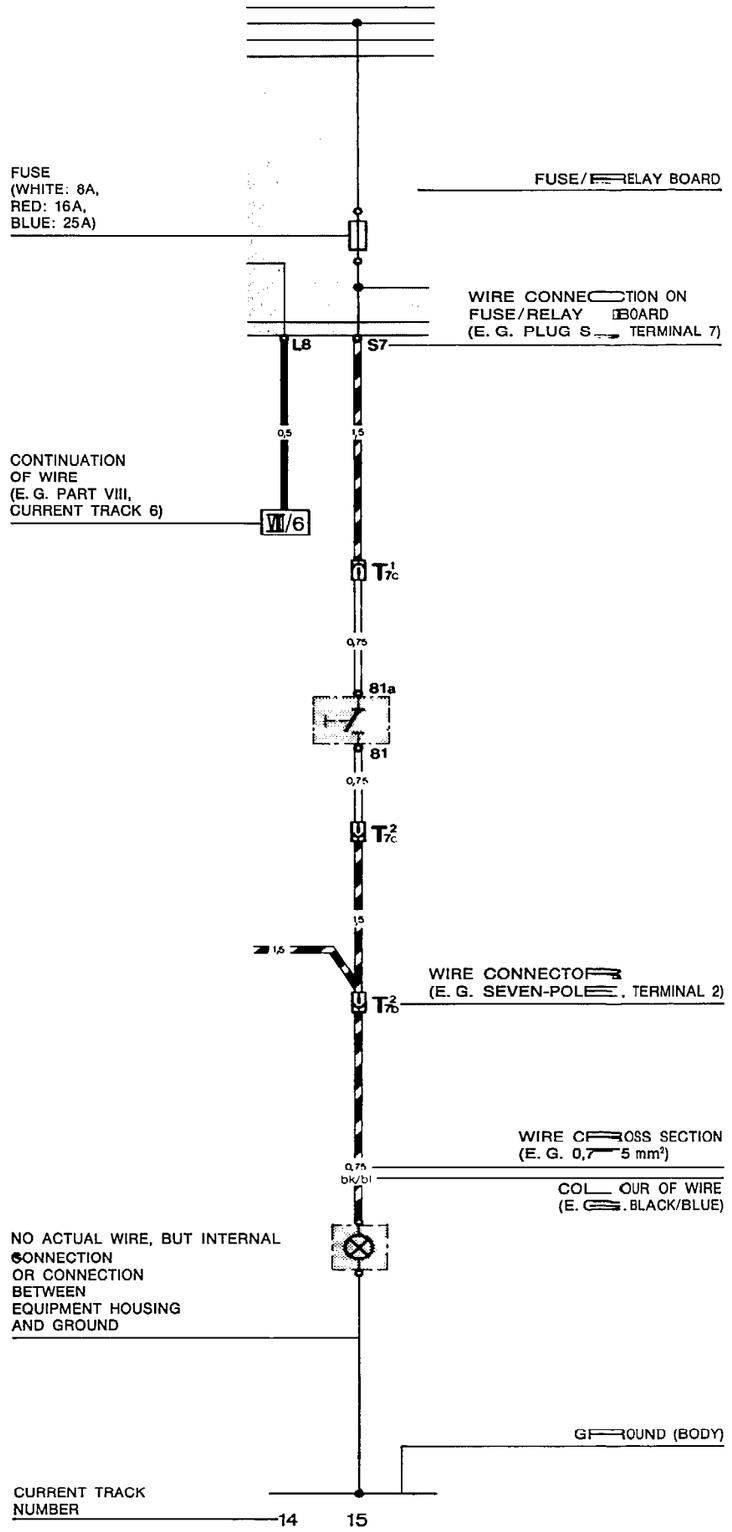
④ ON FRONT LOCK MEMBER, LEFT

⑤ ON UPPER MOUNTING FOR FUSE/RELAY BOARD

⑥ ON FRONT WALL

WIRE COLOURS

BK - BLACK	GN - GREEN	BR - BROWN
WT - WHITE	YE - YELLOW	BL - BLUE
RE - RED	GR - GREY	VI - VIOLET

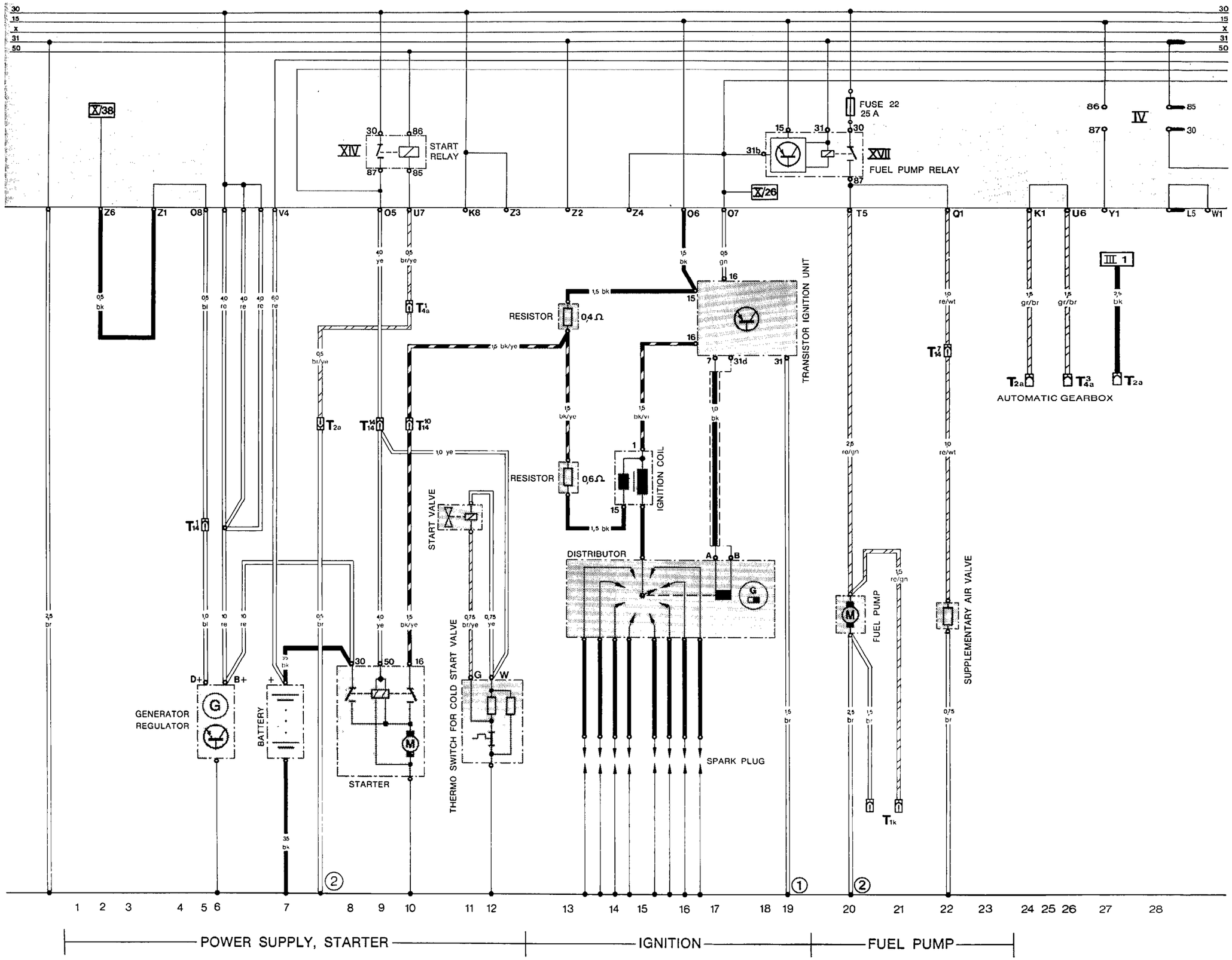


Printed in Germany-Va, 1981

Current Flow Diagram Type 928 USA
Model 82 Part I

POWER SUPPLY, STARTER
IGNITION
FUEL PUMP

Current Flow Diagram Type 928 USA Model 82 Part I

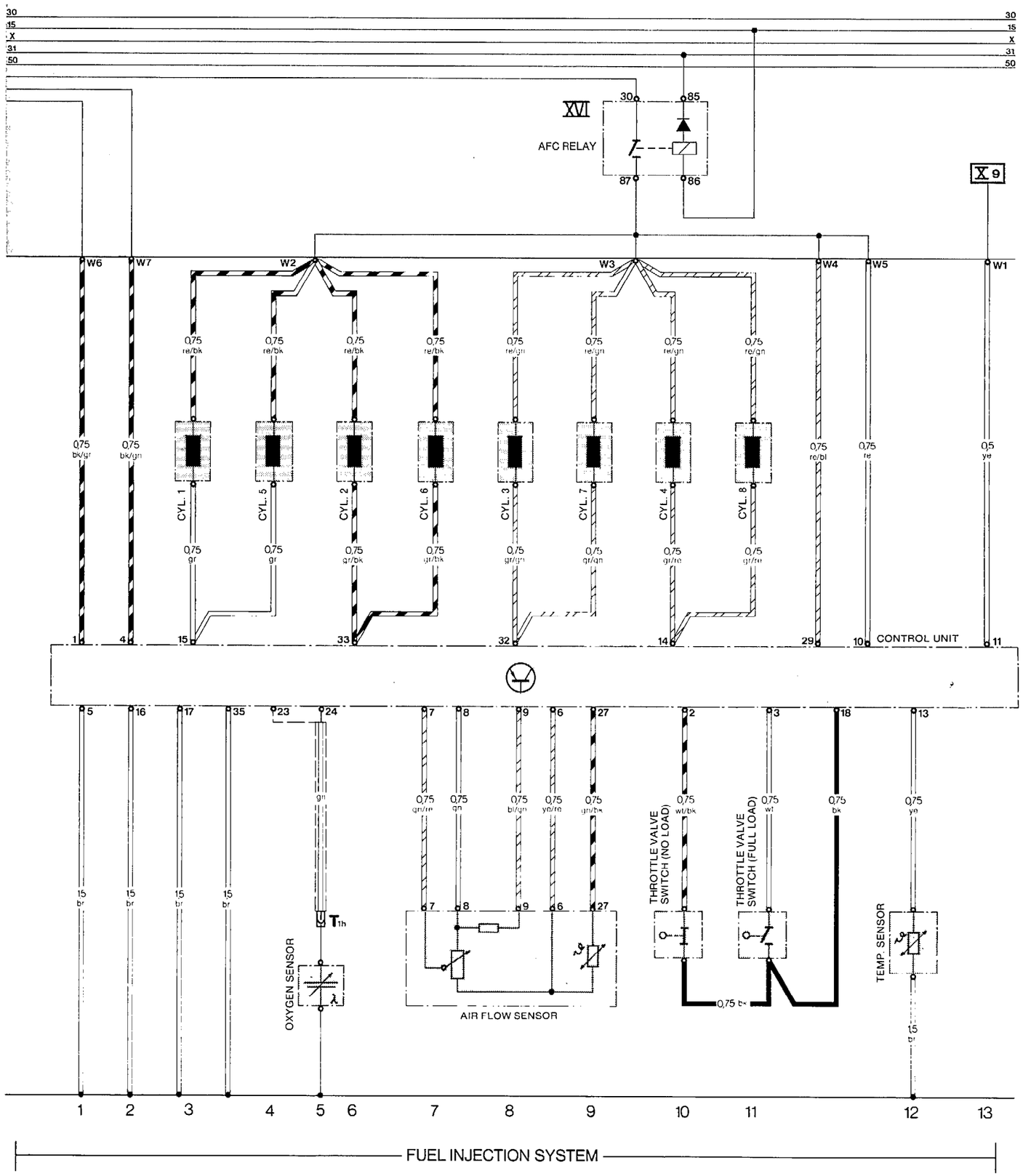


Printed in Germany-Va, 1981

Current Flow Diagram Type 928 USA
Model 82 Part II

FUEL INJECTION SYSTEM

Current Flow Diagram Type 928 USA Model 82 Part II

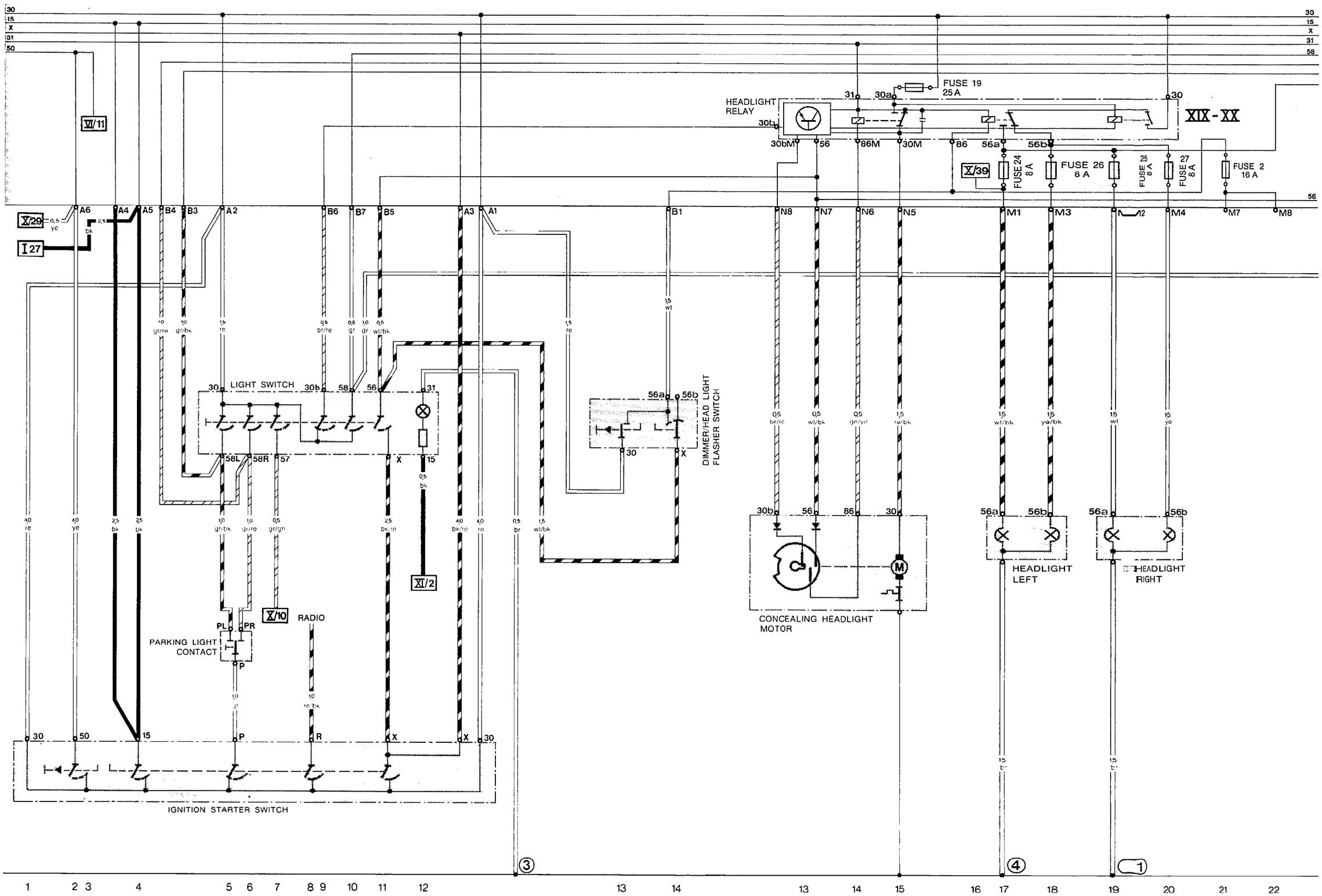


Printed in Germany - Va, 1981

Current Flow Diagram Type 928 USA
Model 82 Part III

IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT, PARKING LIGHT

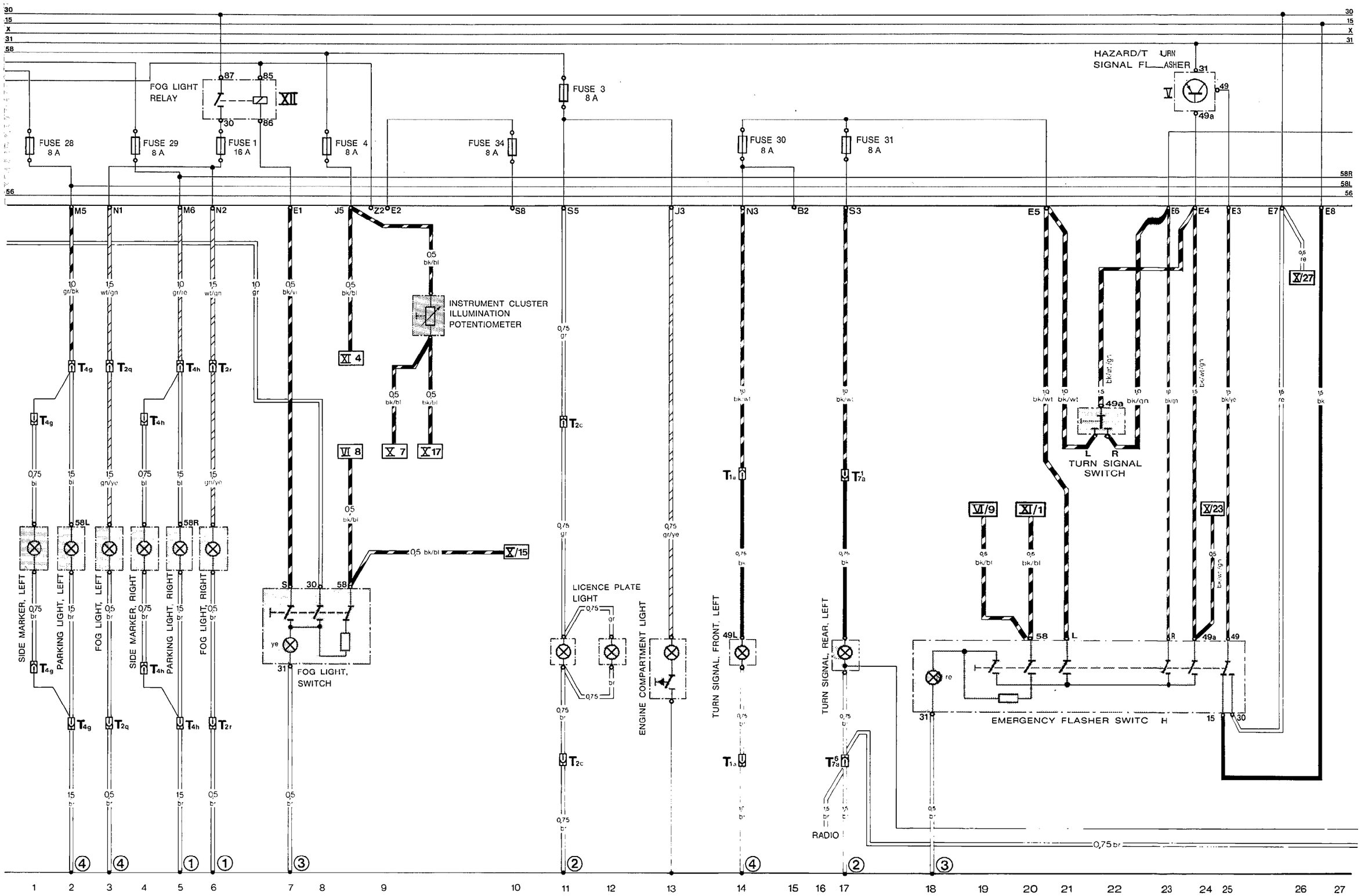
Current Flow Diagram Type 928 USA Model 82 Part III



Current Flow Diagram Type 928 USA
Model 82 Part IV

FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

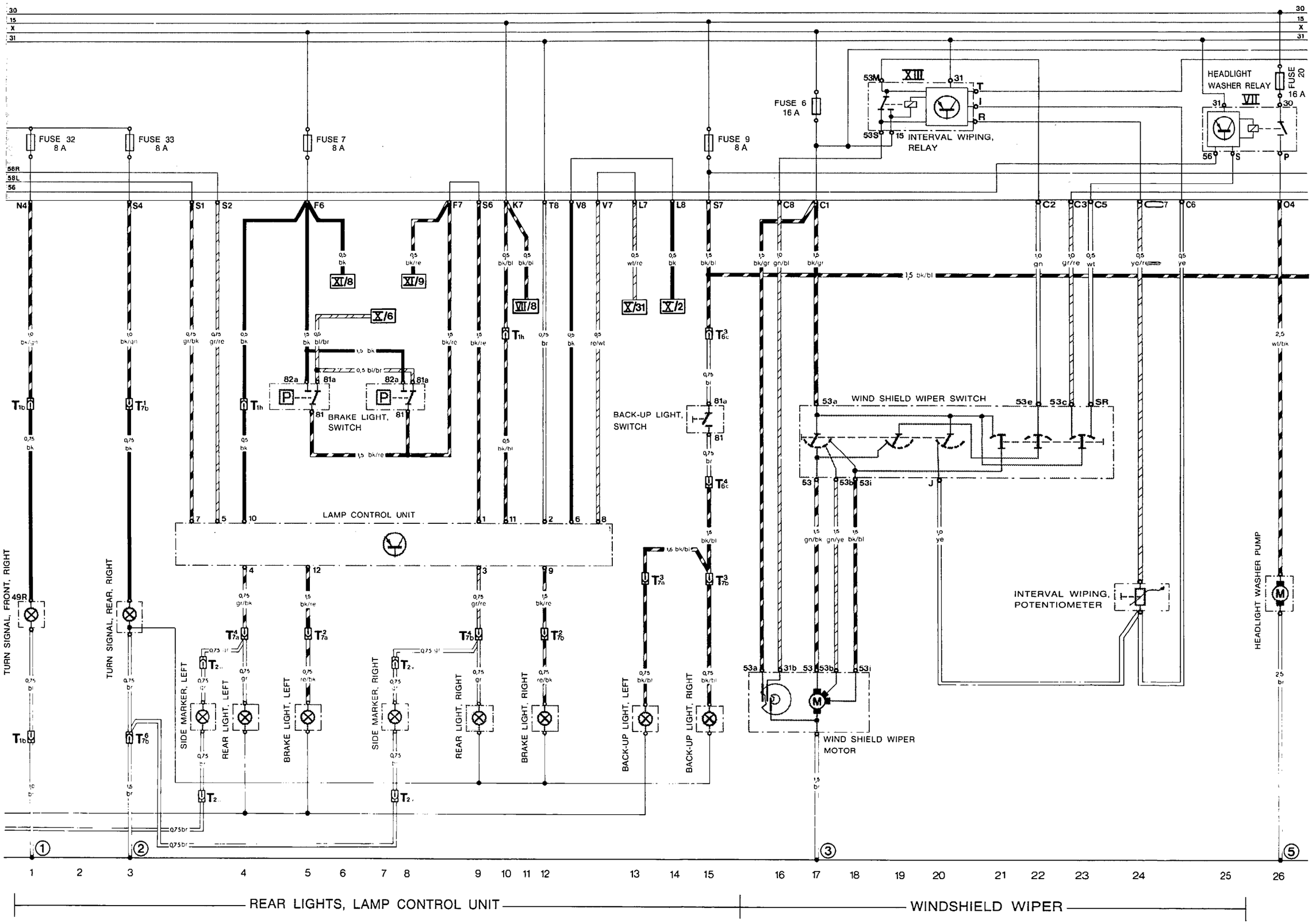
Current Flow Diagram Type 928 USA Model 82 Part IV



Current Flow Diagram Type 928 USA
Model 82 Part V

REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

Current Flow Diagram Type 928 USA Model 82 Part V



Current Flow Diagram Type 928 USA
Model 82 Part VI

WASHER PUMPS

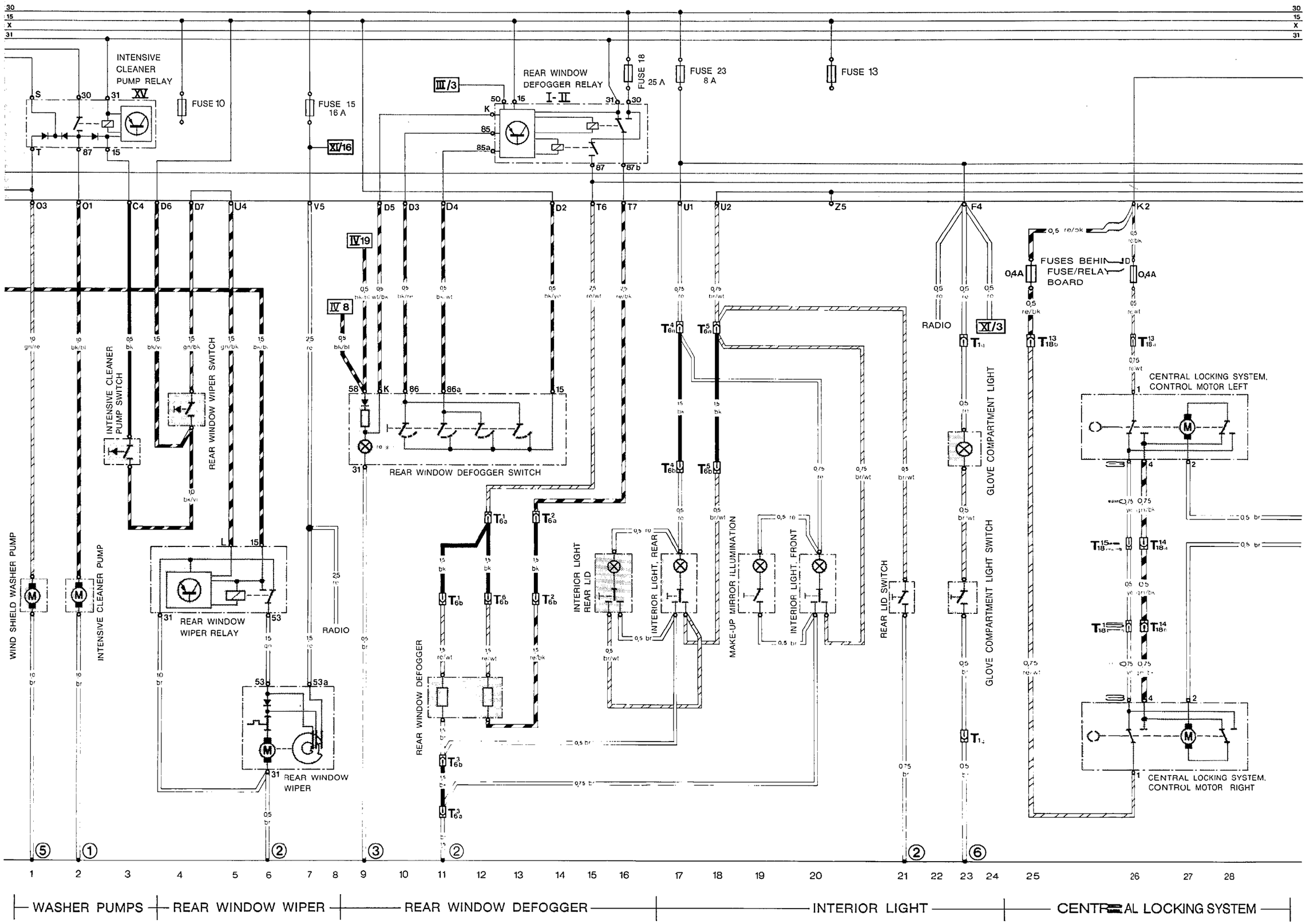
REAR WINDOW WIPER

REAR WINDOW DEFOGGER

INTERIOR LIGHT

SEAT BELT

Current Flow Diagram Type 928 USA Model 82 Part VI



Current Flow Diagram Type 928 USA
Model 82 Part VII

DOOR LIGHT

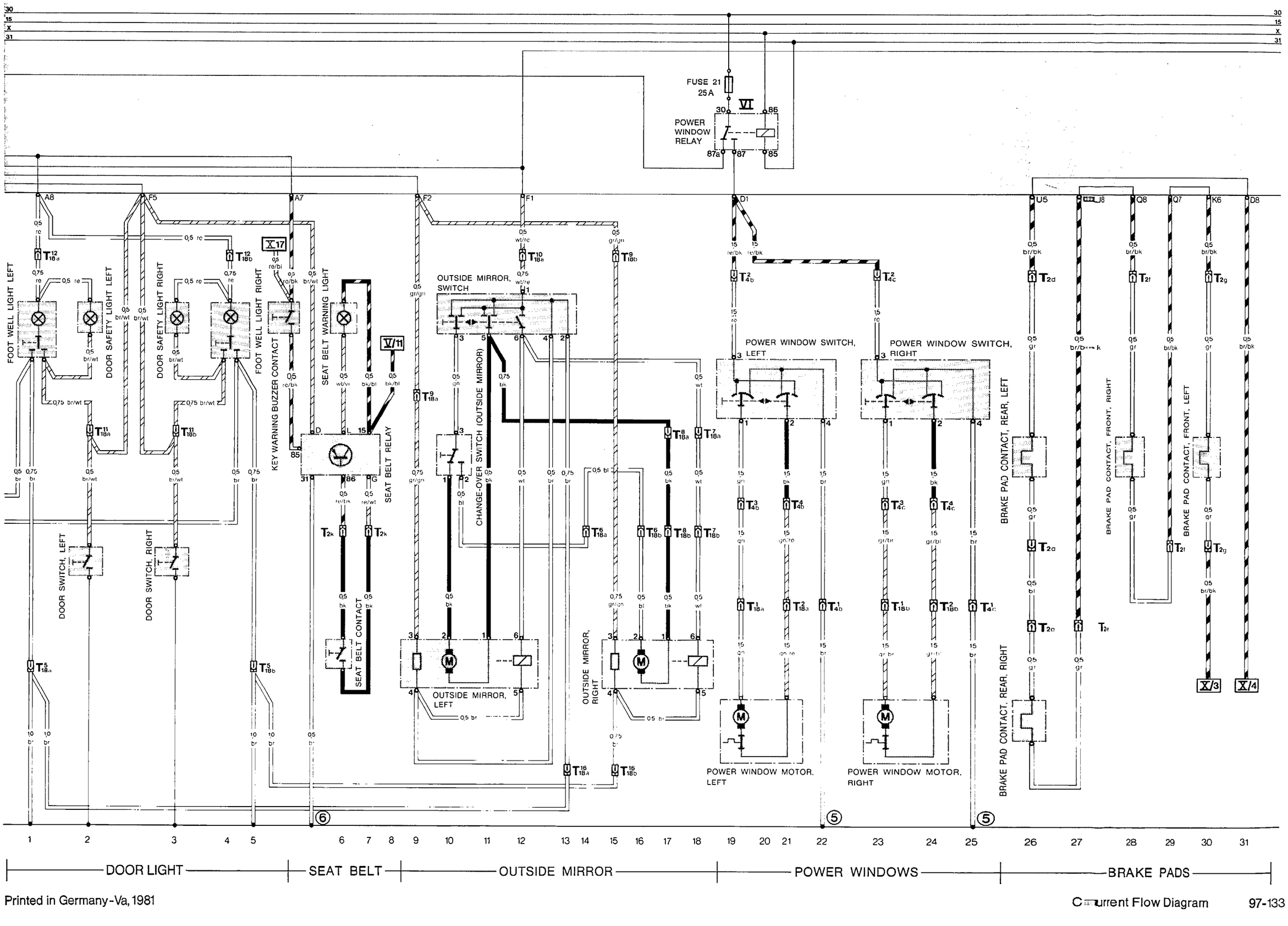
SEAT BELT

OUTSIDE MIRROR

POWER WINDOWS

BRAKE PADS

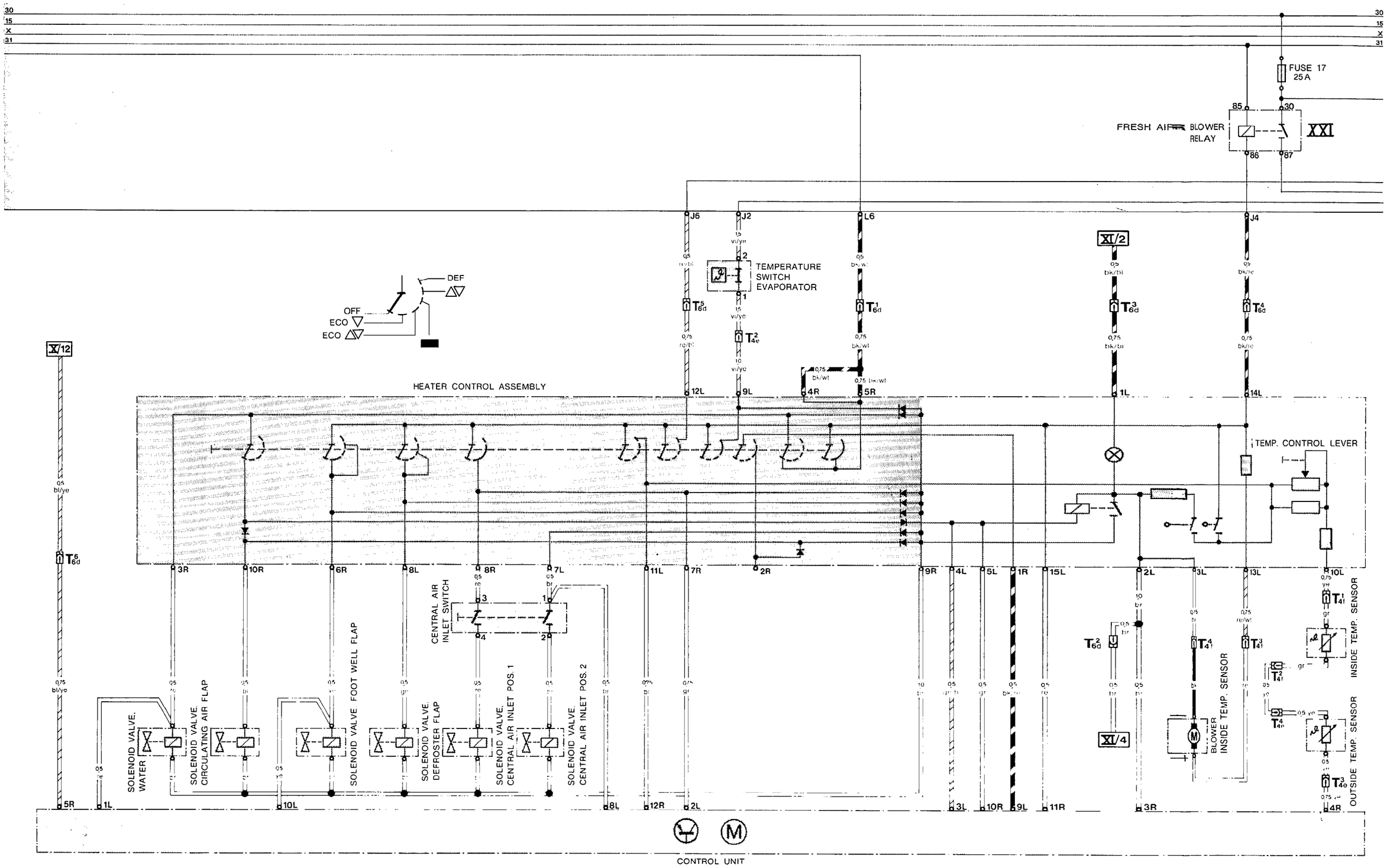
Current Flow Diagram Type 928 USA Model 82 Part VII



Current Flow Diagram Type 928 USA
Model 82 Part VIII

AUTOMATIC AIR CONDITIONER

Current Flow Diagram Type 928 USA Model 82 Part VIII

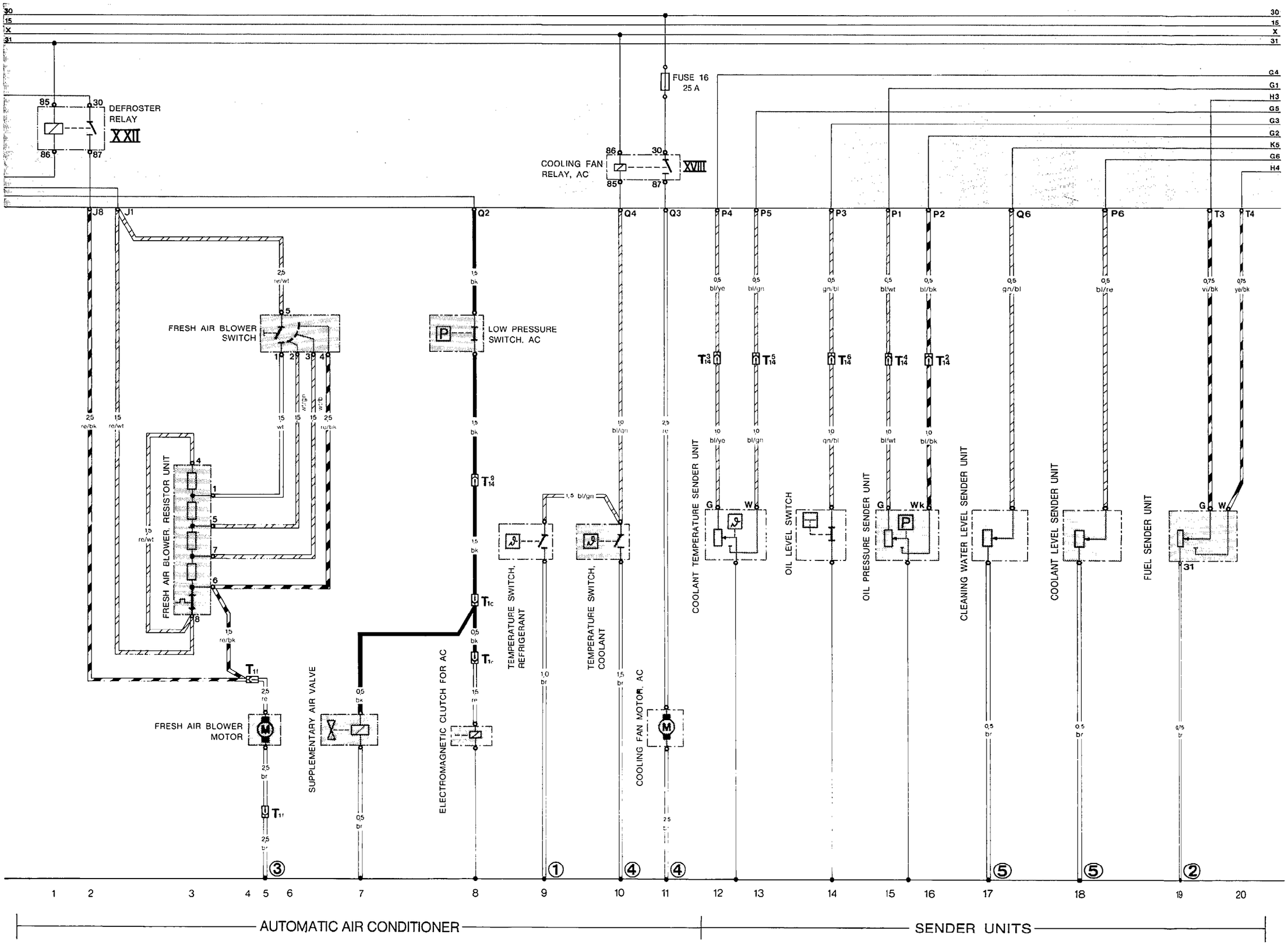


Current Flow Diagram Type 928 USA
Model 82 Part IX

AUTOMATIC AIR CONDITIONER

SENDER UNITS

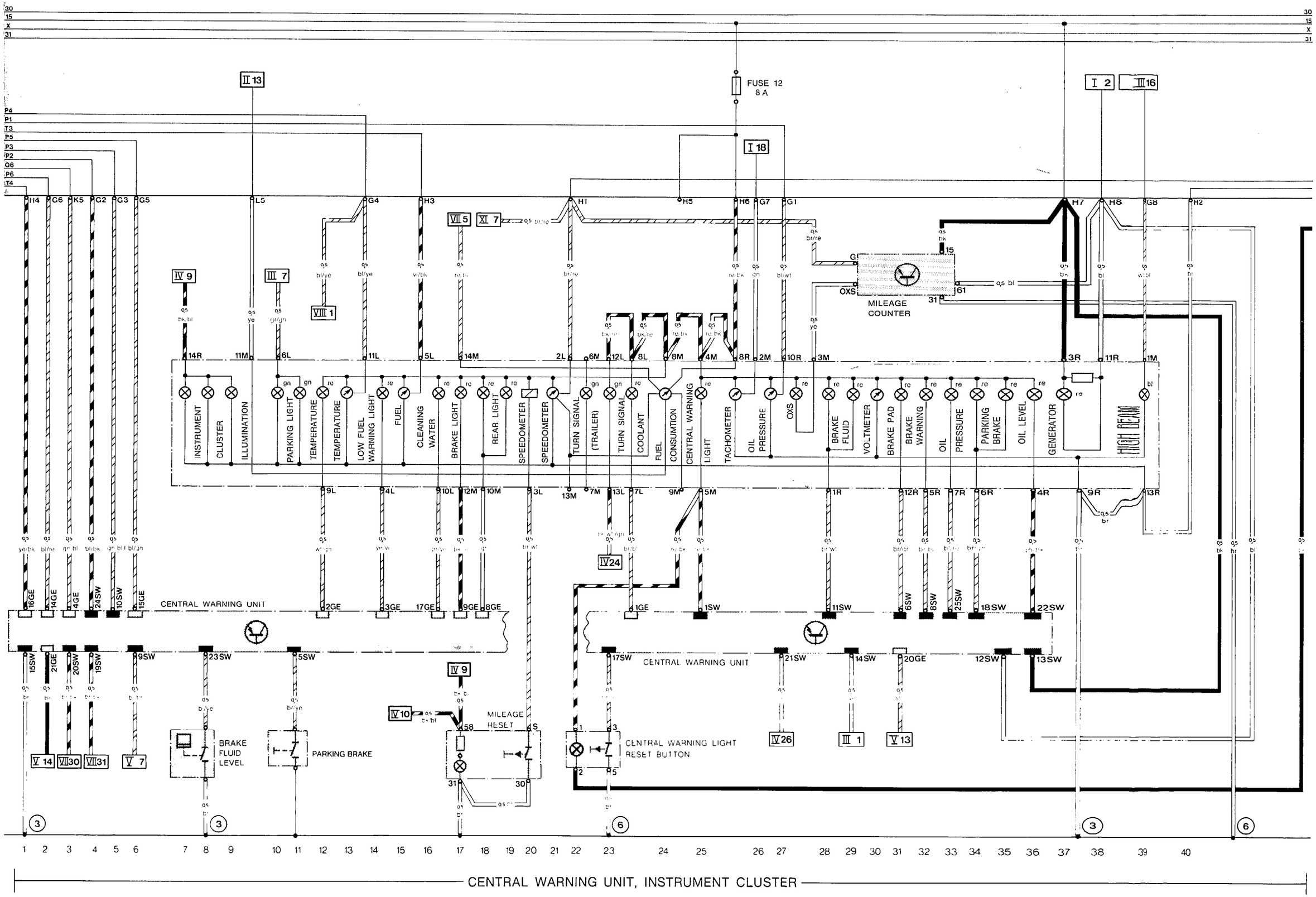
Current Flow Diagram Type 928 USA Model 82 Part IX



Current Flow Diagram Type 928 USA
Model 82 Part X

CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

Current Flow Diagram Type 928 USA Model 82 Part X



Current Flow Diagram Type 928 USA
Model 82 Part XI

CLOCK

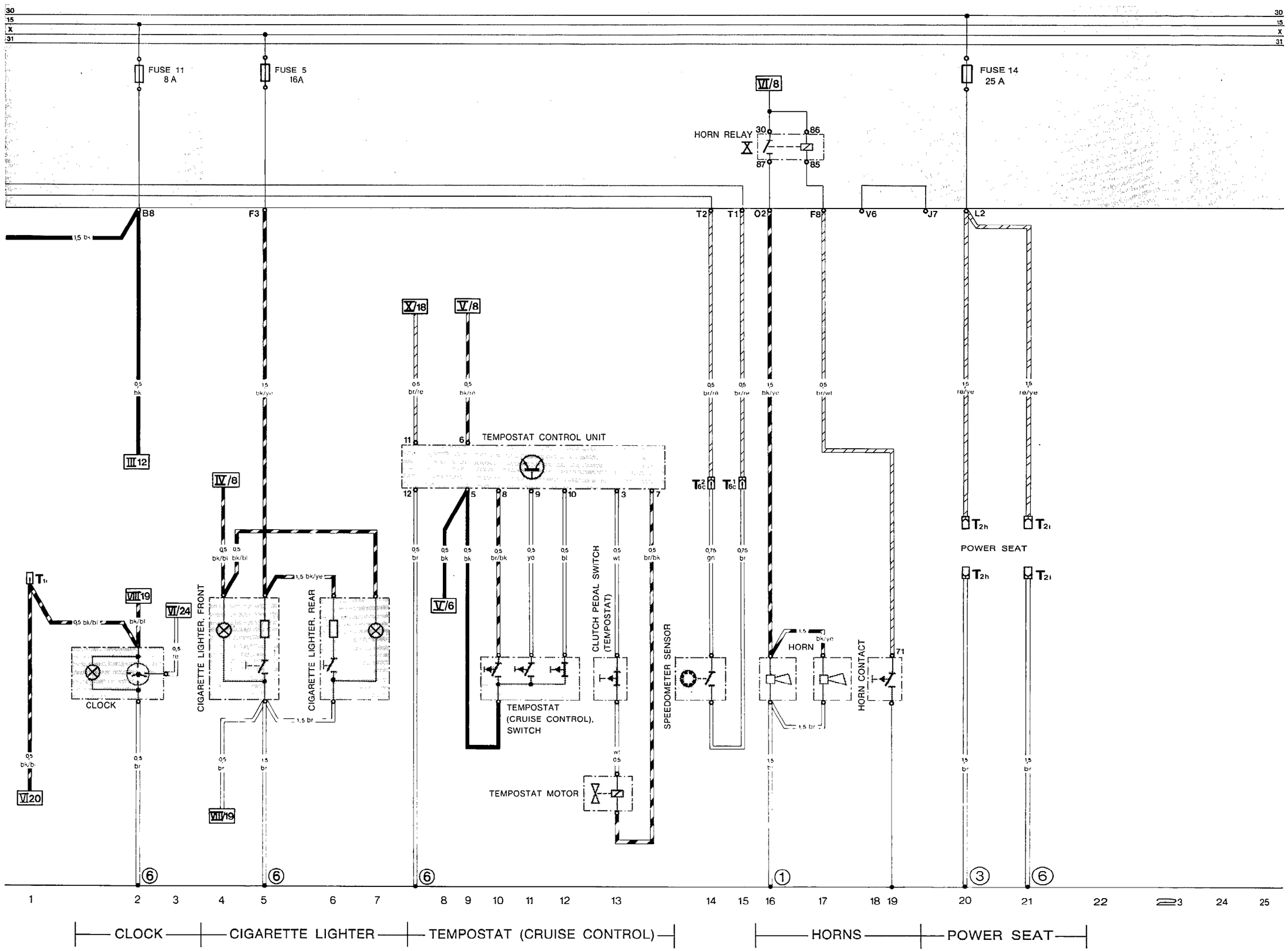
CIGARETTE LIGHTER

TEMPOSTAT (CRUISE CONTROL)

HORNS

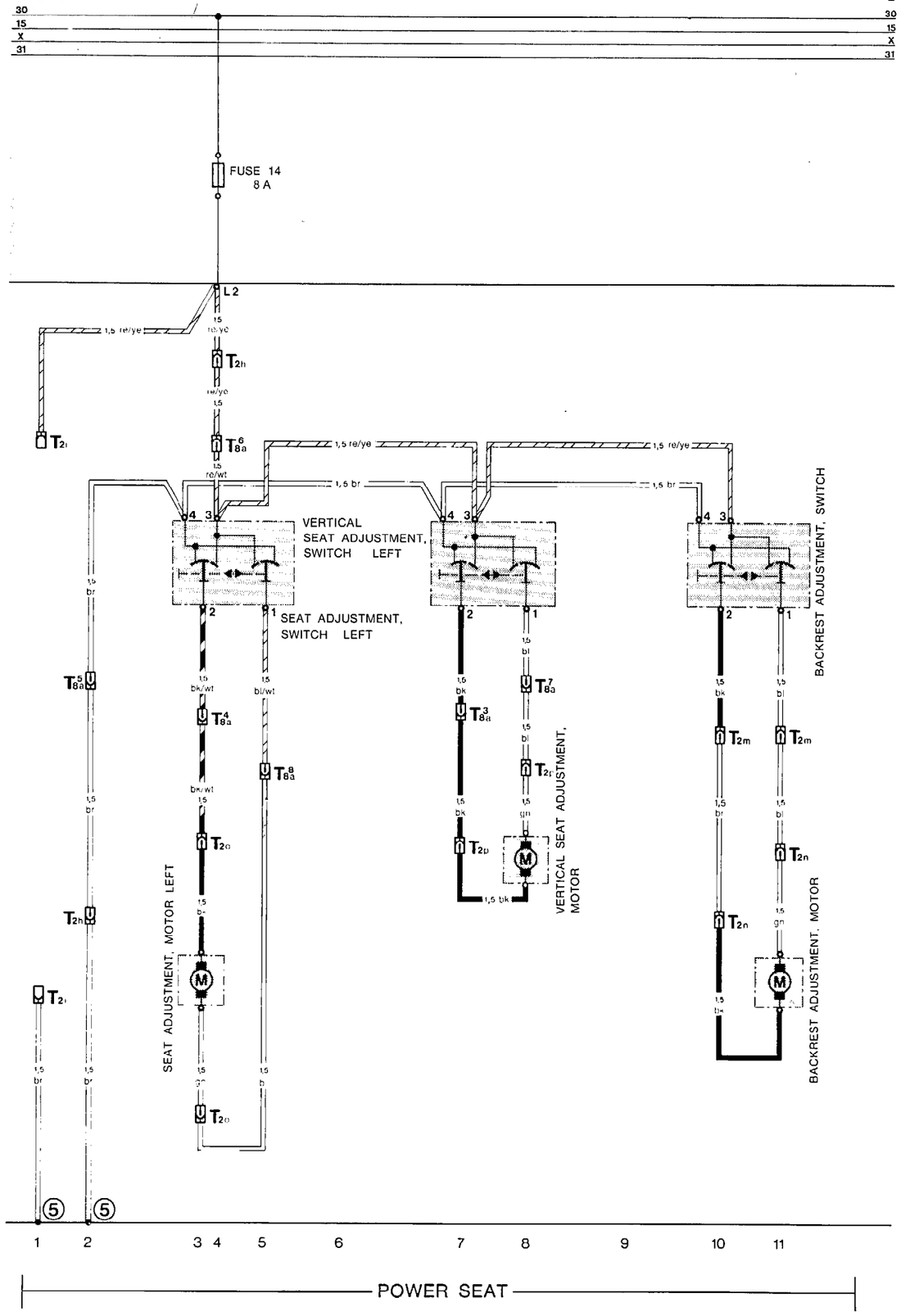
POWER SEAT

Current Flow Diagram Type 928 USA Model 82 Part XI



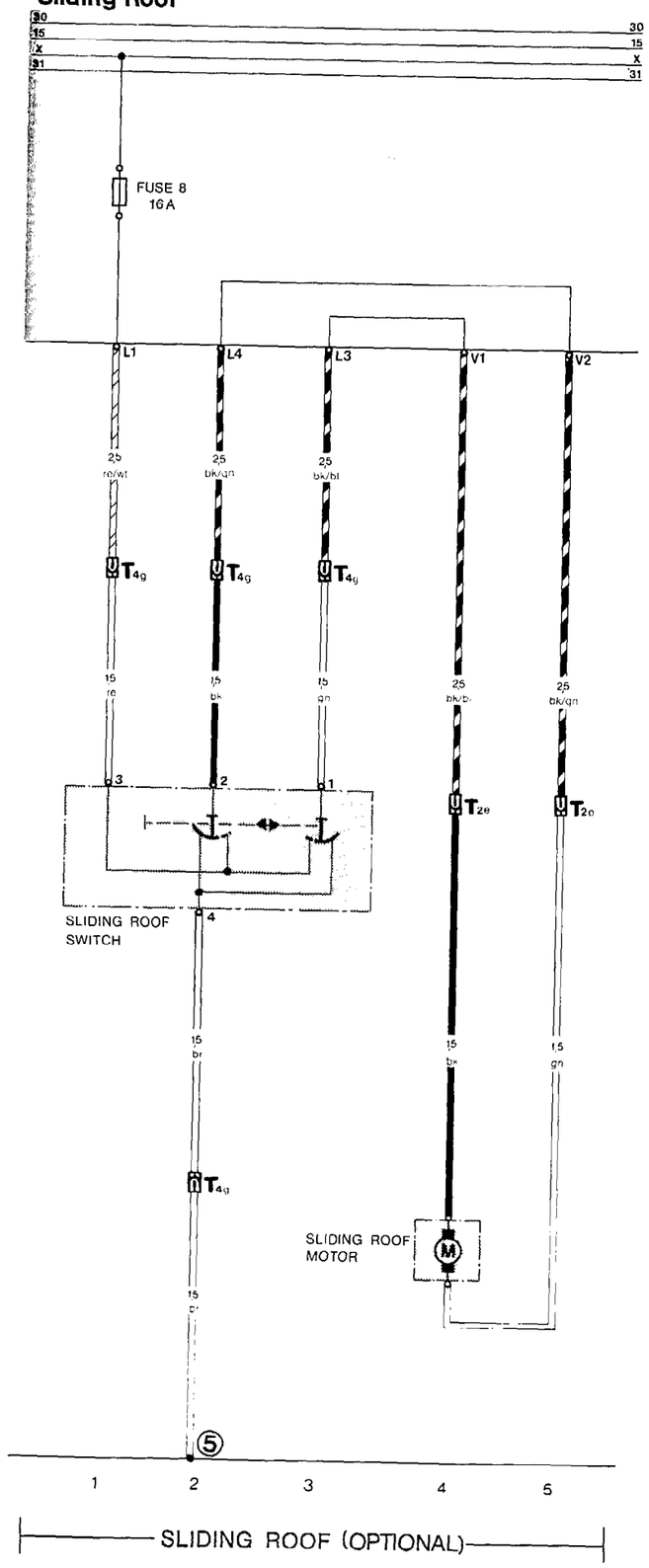
Additional Current Flow Diagram
Type 928 USA Model 82

Power seat



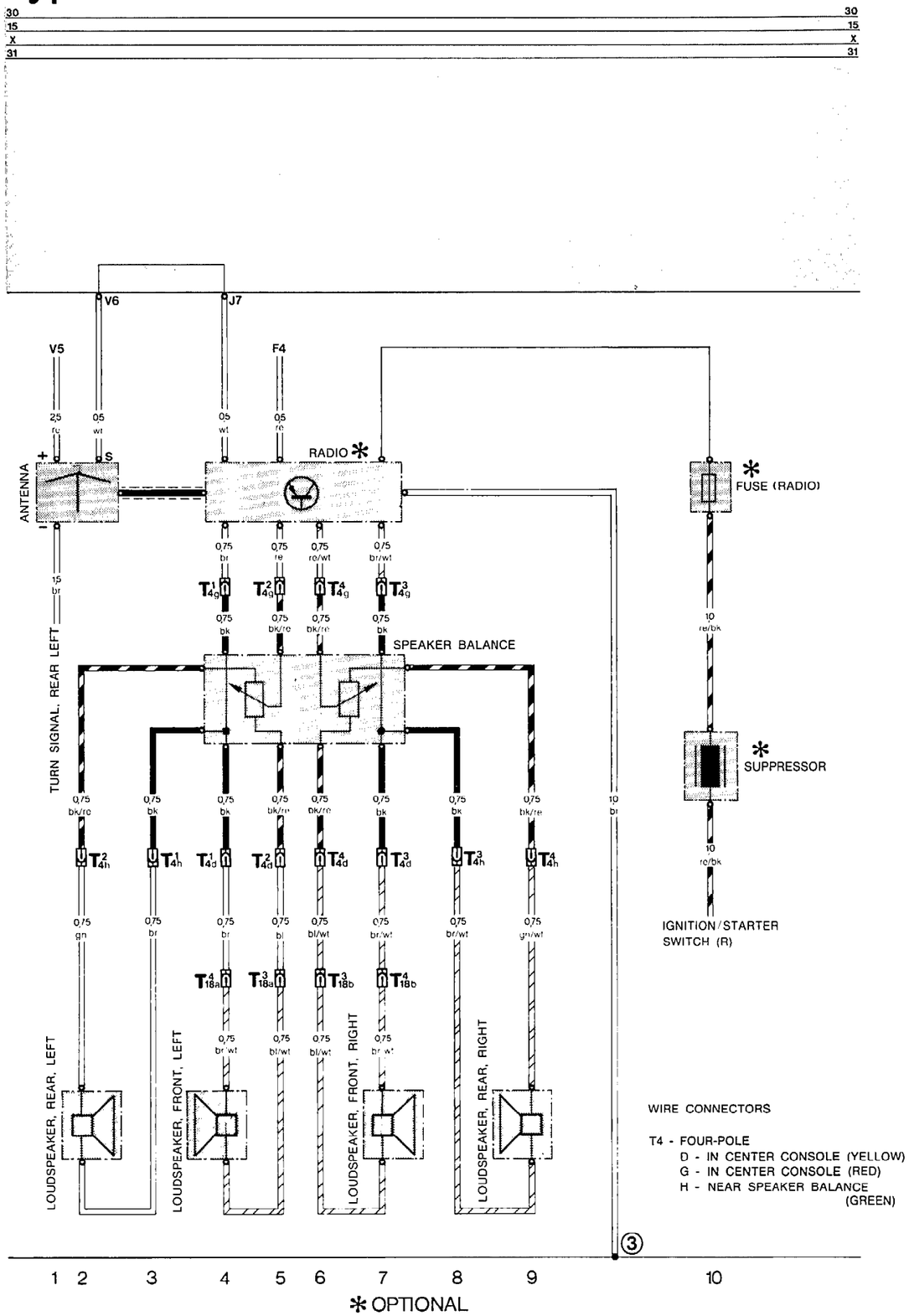
Additional Current Flow Diagram
Type 928 USA Model 82

Sliding Roof



Additional Current Flow Diagram

Type 928 USA Model 82 RADIO

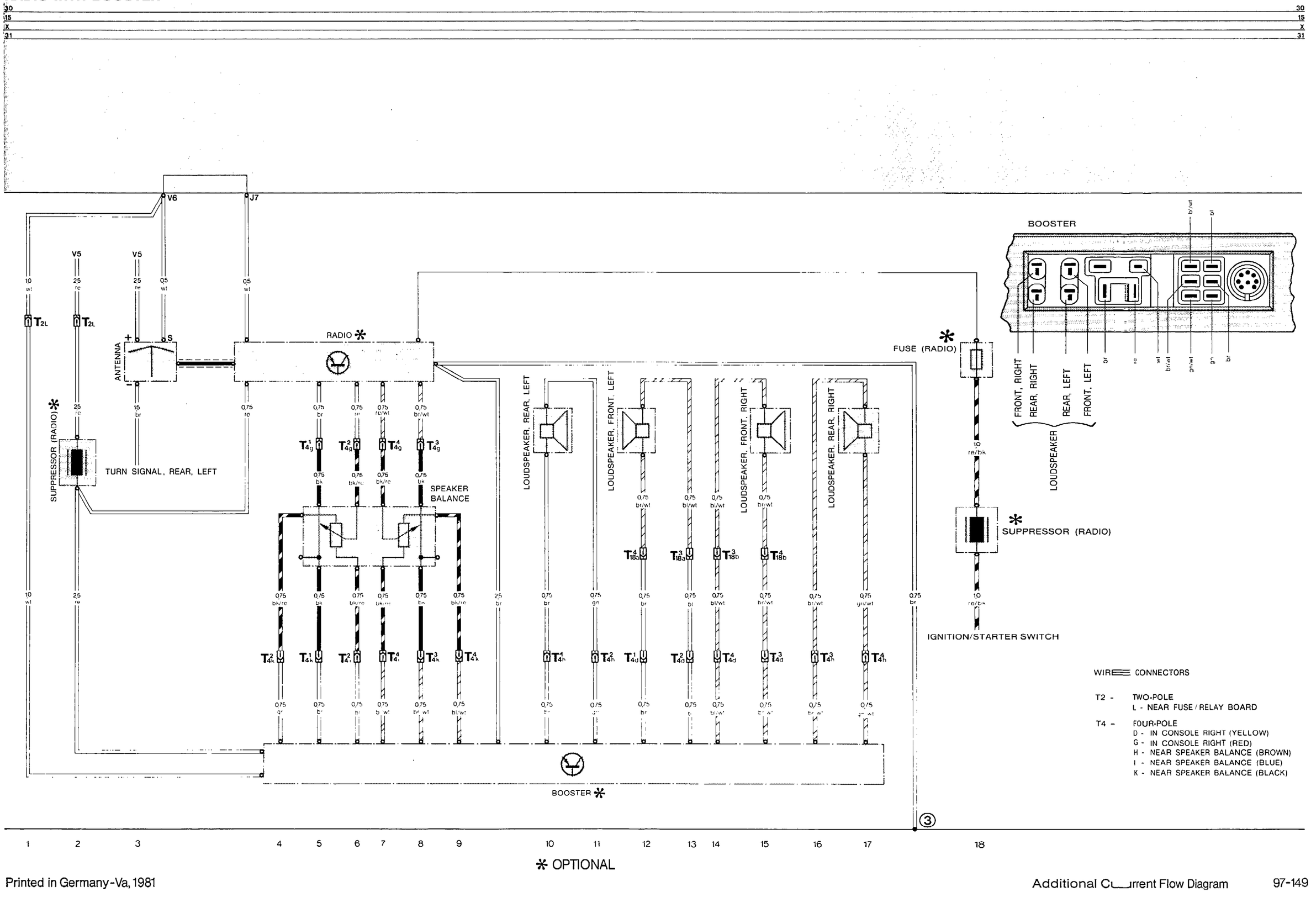


Additional Current Flow Diagram
Type 928 USA Model 82

RADIO WITH BOOSTER

Additional Current Flow Diagram Type 928 USA Model 82

RADIO WITH BOOSTER



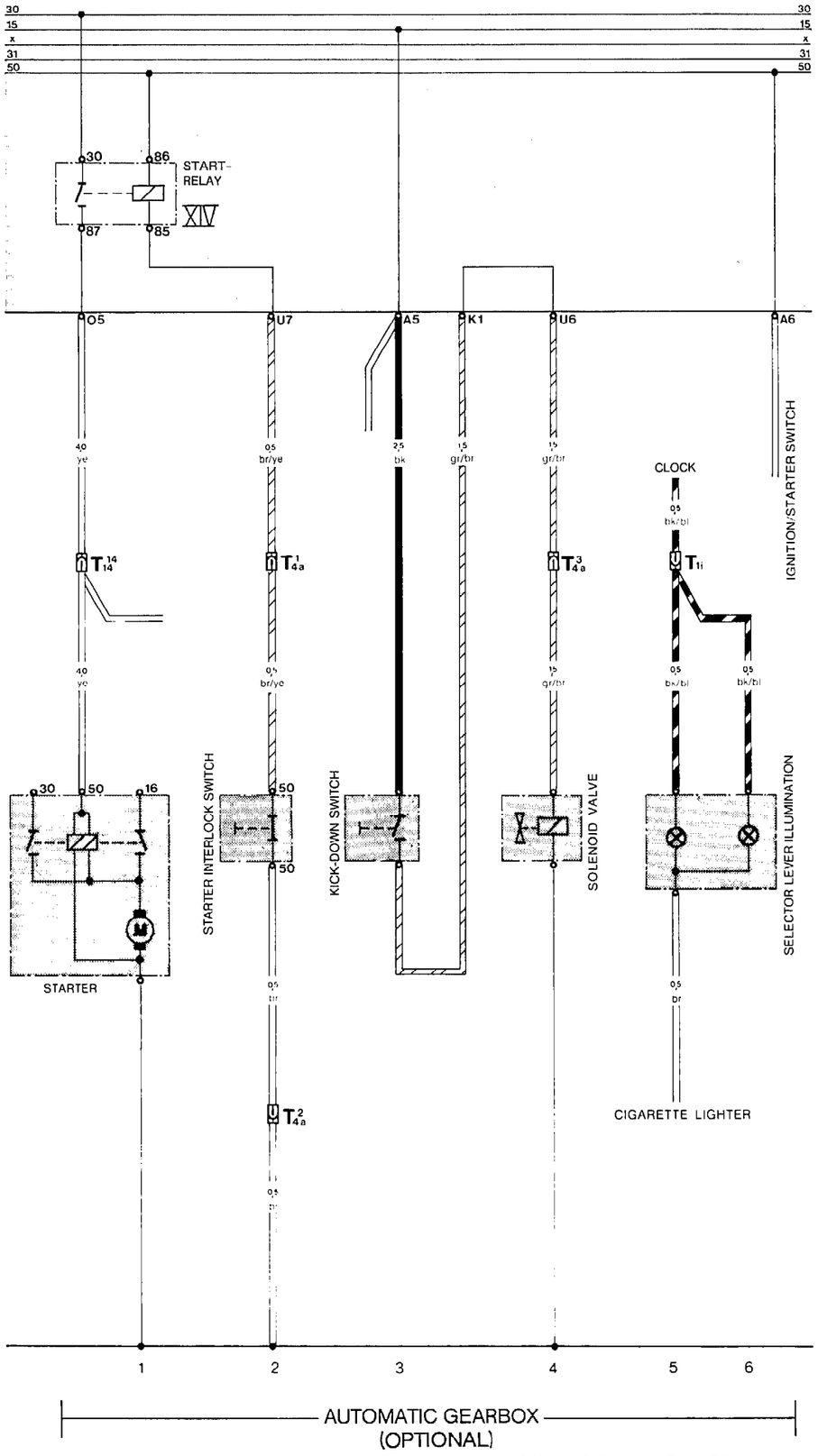
WIRE CONNECTORS

T2 - TWO-POLE
L - NEAR FUSE / RELAY BOARD

T4 - FOUR-POLE
D - IN CONSOLE RIGHT (YELLOW)
G - IN CONSOLE RIGHT (RED)
H - NEAR SPEAKER BALANCE (BROWN)
I - NEAR SPEAKER BALANCE (BLUE)
K - NEAR SPEAKER BALANCE (BLACK)

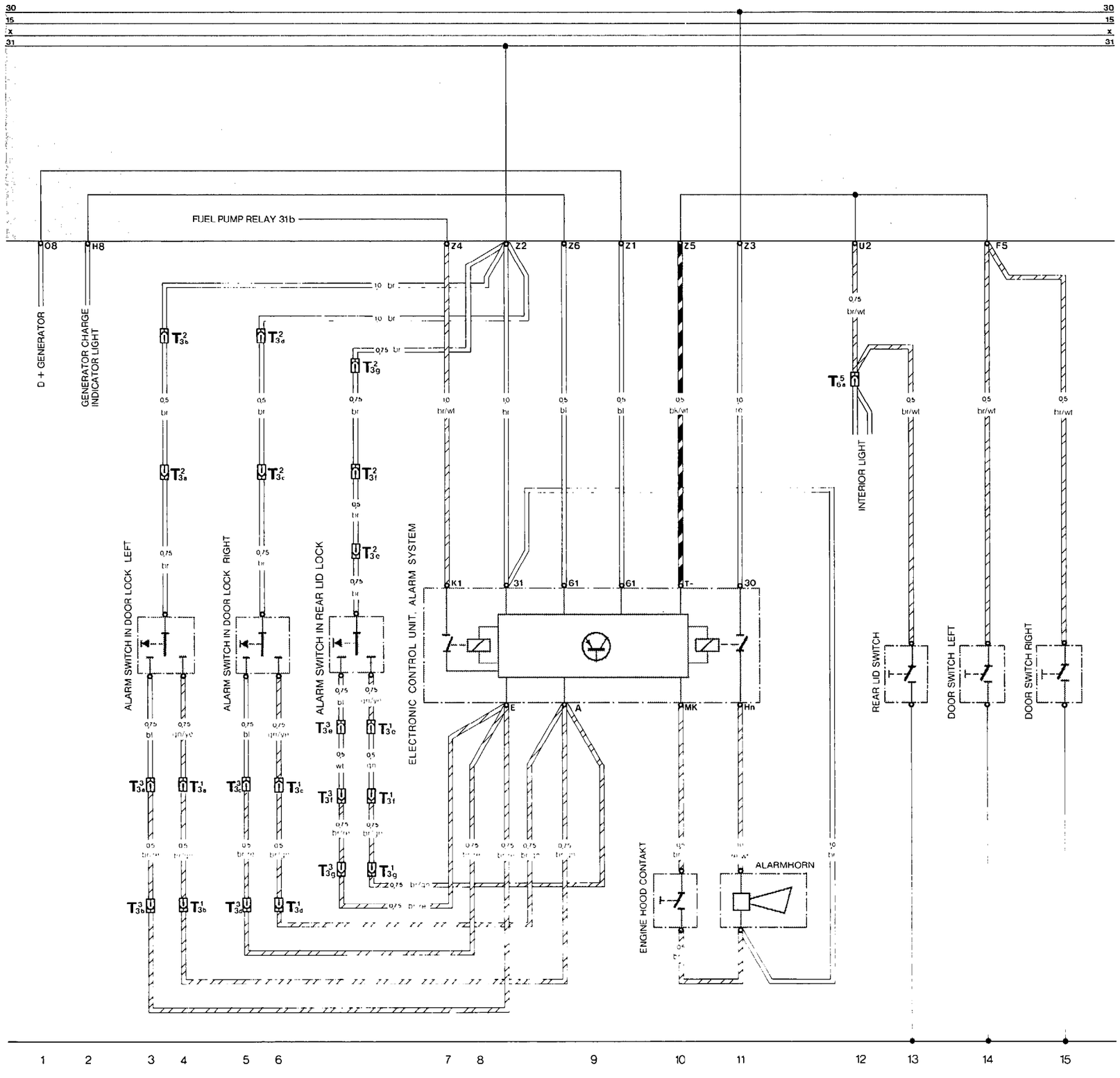
* OPTIONAL

Additional Current Flow Diagram
Type 928 USA Model 82 **Automatic gearbox**



Additional Current Flow Diagram
Type 928 USA
Alarm system

Additional Current Flow Diagram Type 928 USA Alarm system



WIRE CONNECTORS

T3 – THREE-POLE
- A – IN DOOR, DRIVER SIDE
- B – BELOW INSTRUMENT PANEL LEFT
- C – IN DOOR, PASSENGER SIDE
- D – BELOW INSTRUMENT PANEL RIGHT
- E – IN REAR LID
- F – IN REAR LID
- G – DOOR LOCK PILLAR, RIGHT

Current Flow Diagram Type 928 S USA Model 83

PART I POWER SUPPLY, STARTER
IGNITION
FUEL PUMP

PART II FUEL INJECTION SYSTEM

PART III IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT

PART IV HEADLIGHT, PARKING LIGHT
FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

PART V REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

PART VI WASHER PUMPS
REAR WINDOW WIPER
REAR WINDOW DEFOGGER
INTERIOR LIGHT
CENTRAL LOCKING SYSTEM

PART VII DOOR LIGHT
SEAT BELT
OUTSIDE MIRROR
POWER WINDOWS
BRAKE PADS

PART VIII AUTOMATIC AIR CONDITIONER

PART IX AUTOMATIC AIR CONDITIONER
SENDER UNITS

PART X CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

PART XI CLOCK
CIGARETTE LIGHTER
TEMPOSTAT (CRUISE CONTROL)
HORNS

Current Flow Diagram
Type 928 S USA Model 83

WIRE CONNECTORS

T1 - ONE-POLE

A - NEAR TURN SIGNAL LEFT
B - NEAR TURN SIGNAL RIGHT
C - NEAR AC-COMPRESSOR
F - NEAR FRESH AIR BLOWER
G - NEAR GLOVE COMPARTMENT
H - NEAR FUSE/RELAY BOARD
I - IN TUNNEL
K - NEAR FUEL PUMP

T2 - TWO-POLE

A - BEHIND ACCELERATOR PEDAL
C - BEHIND REAR BUMPER
D - NEAR LEFT BACKWHEEL
E - NEAR RIGHT BACKWHEEL
F - NEAR RIGHT FRONT WHEEL
G - NEAR LEFT FRONT WHEEL
H - NEAR DRIVER SEAT
I - NEAR PASSENGER SEAT
K - NEAR DRIVER SEAT
Q - NEAR LEFT FOG LIGHT
R - NEAR RIGHT FOG LIGHT
U - NEAR LEFT SIDE MARKER
V - NEAR RIGHT SIDE MARKER
W - NEAR FUSE/RELAY BOARD

T4 - FOUR-POLE

A - IN SPARE WHEEL WELL
B - IN CONSOLE, RIGHT
C - IN CONSOLE RIGHT
D - IN CONSOLE
E - IN CONSOLE
F - IN CONSOLE
G - NEAR RIGHT FRONT WHEEL
H - NEAR LEFT FRONT WHEEL

T6 - SIX-POLE

A - BEHIND SIDE COVERING, RIGHT
B - IN REAR LID, RIGHT
C - IN SPARE WHEEL WELL
D - IN CONSOLE

T7 - SEVEN-POLE

A - BEHIND LUGGAGE COMPARTMENT COVERING LEFT
B - BEHIND LUGGAGE COMPARTMENT COVERING RIGHT

T14 - FOURTEEN-POLE

IN ENGINE COMPARTMENT, RIGHT

T18 - EIGHTEEN-POLE

A - IN FOOT WEEL, DRIVER SIDE
B - IN FOOT WELL, PASSENGER SIDE

GROUND TERMINALS

① ON FRONT LOCK MEMBER, RIGHT

② AT REAR OF WHEEL ARCH UNDERNEATH RIGHT REAR TRIM PANEL

③ ON STEERING CONSOLE

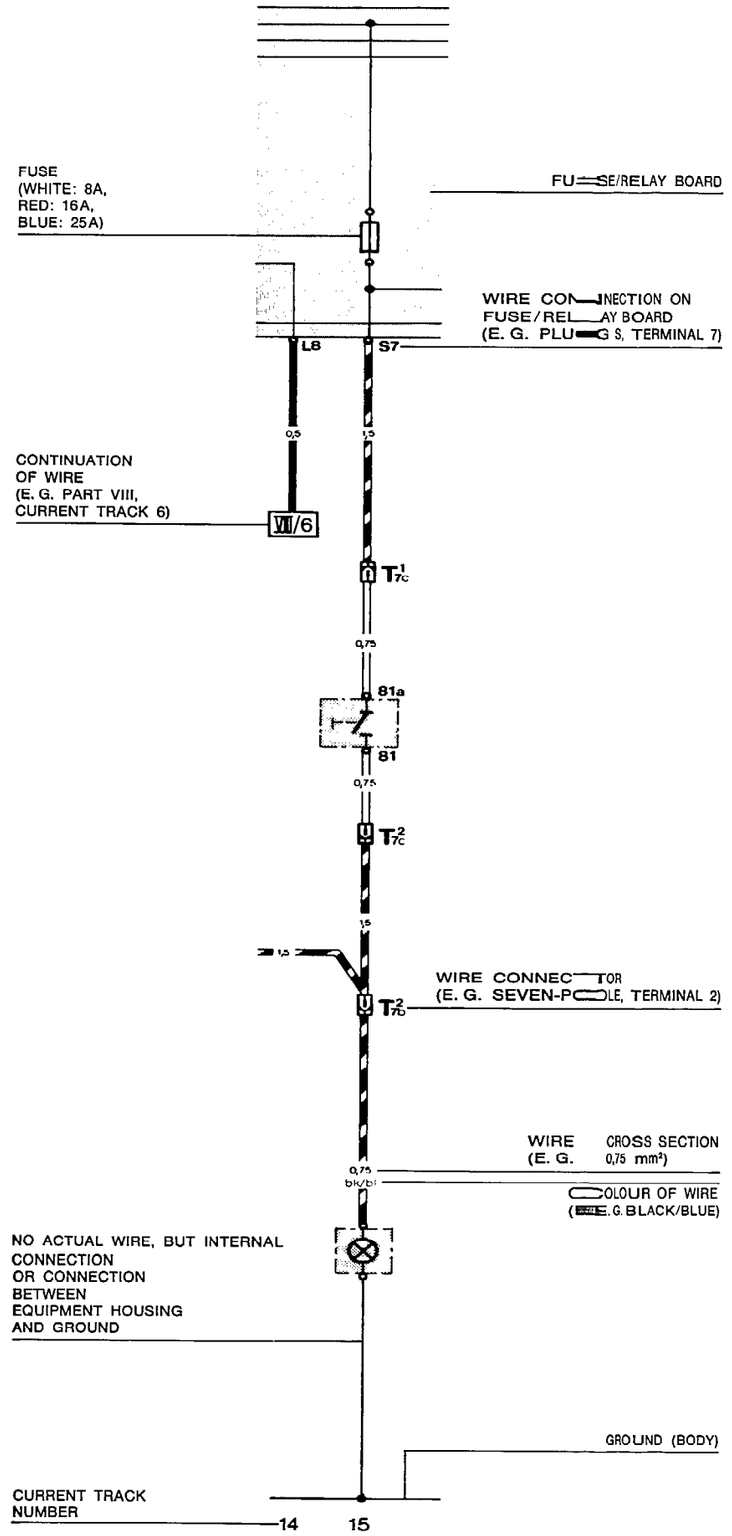
④ ON FRONT LOCK MEMBER, LEFT

⑤ ON UPPER MOUNTING FOR FUSE/RELAY BOARD

⑥ ON FRONT WALL

WIRE COLOURS

BK - BLACK	GN - GREEN	BR - BROWN
WT - WHITE	YE - YELLOW	BL - BLUE
RE - RED	GR - GREY	VI - VIOLET

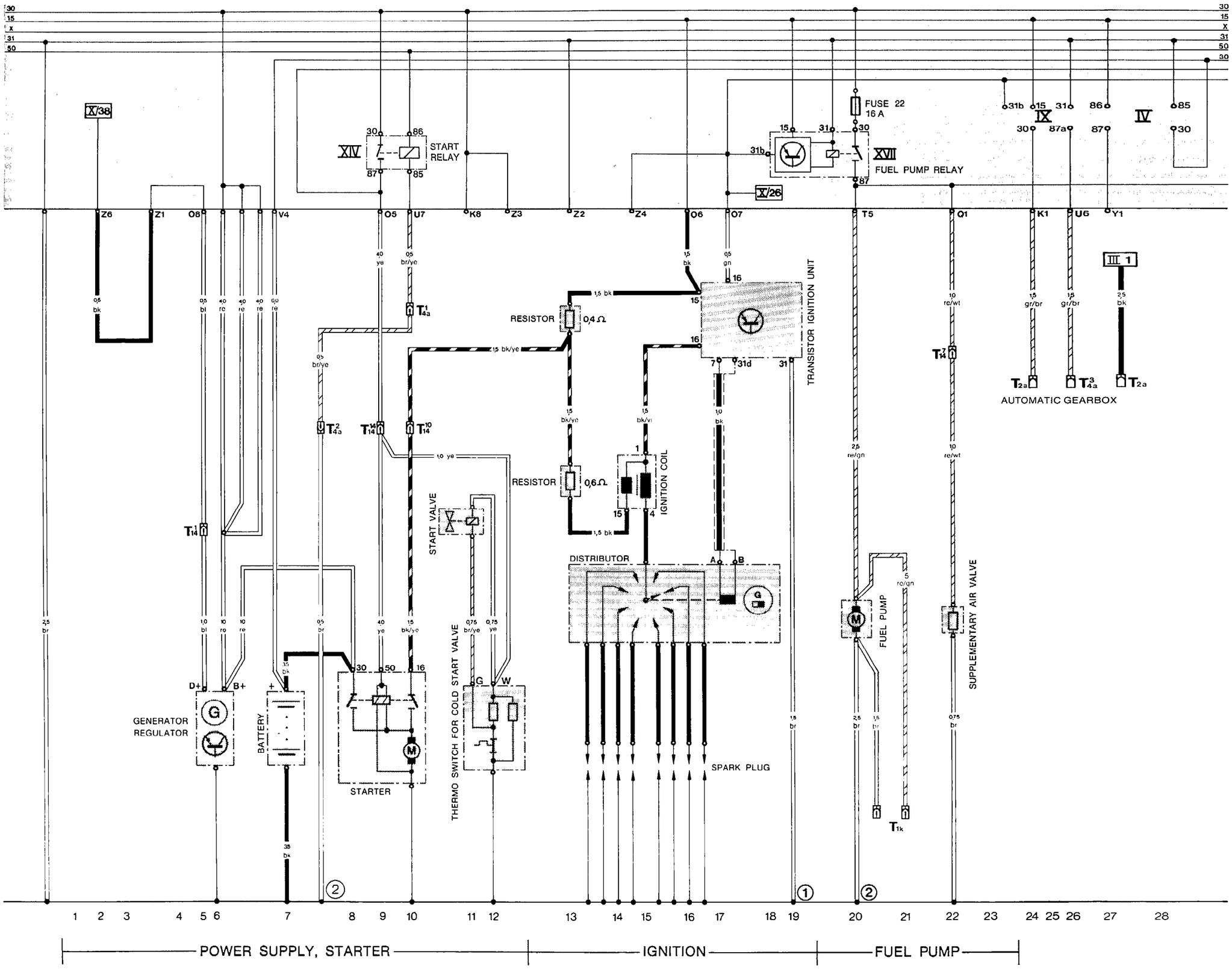


Printed in Germany-VII, 1983

Current Flow Diagram Type 928 S USA
Model 83 Part I

POWER SUPPLY, STARTER
IGNITION
FUEL PUMP

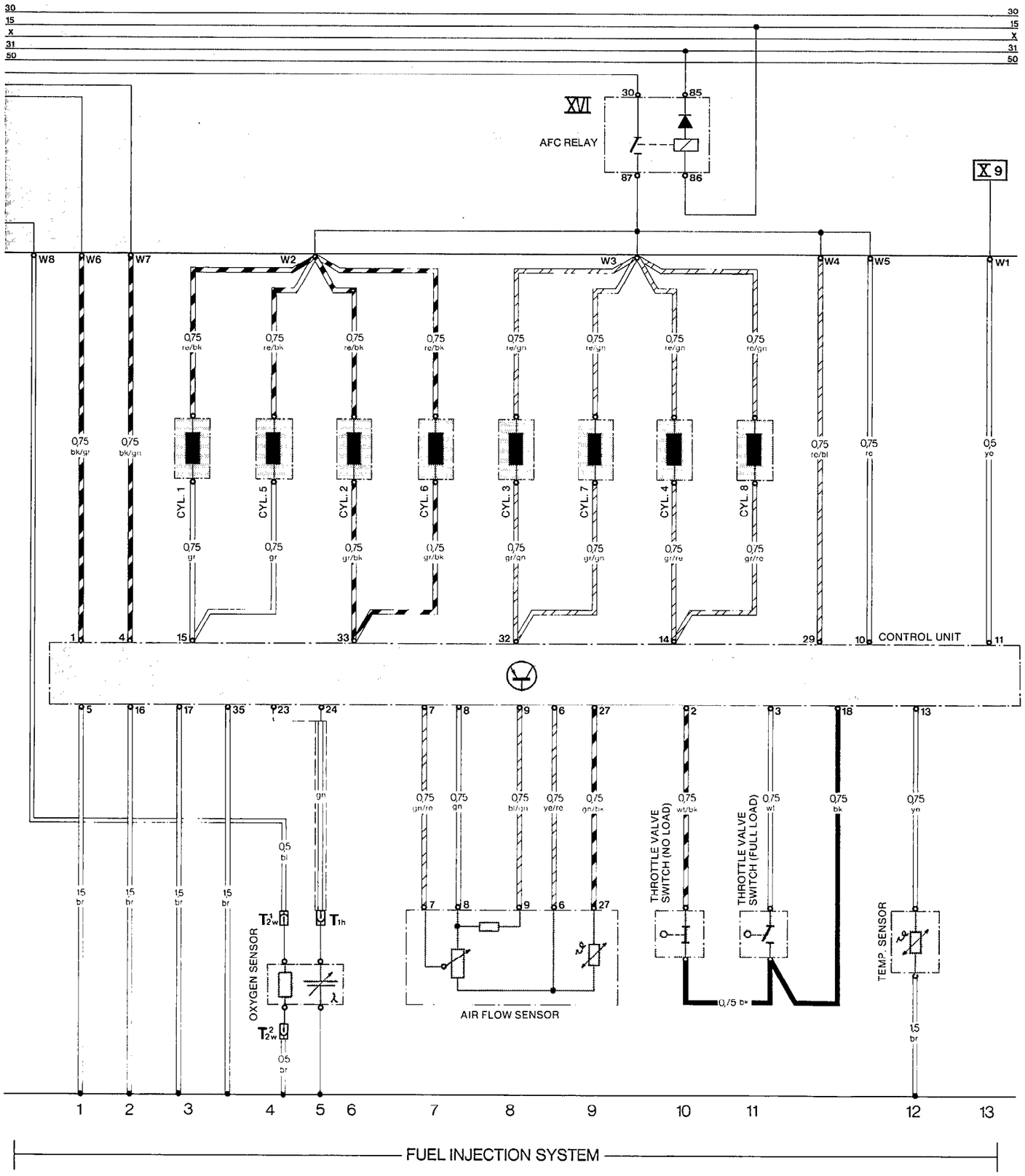
Current Flow Diagram Type 928 S USA Model 83 Part I



Current Flow Diagram Type 928 S USA
Model 83 Part II

FUEL INJECTION SYSTEM

Current Flow Diagram Type 928 S USA Model 83 Part II

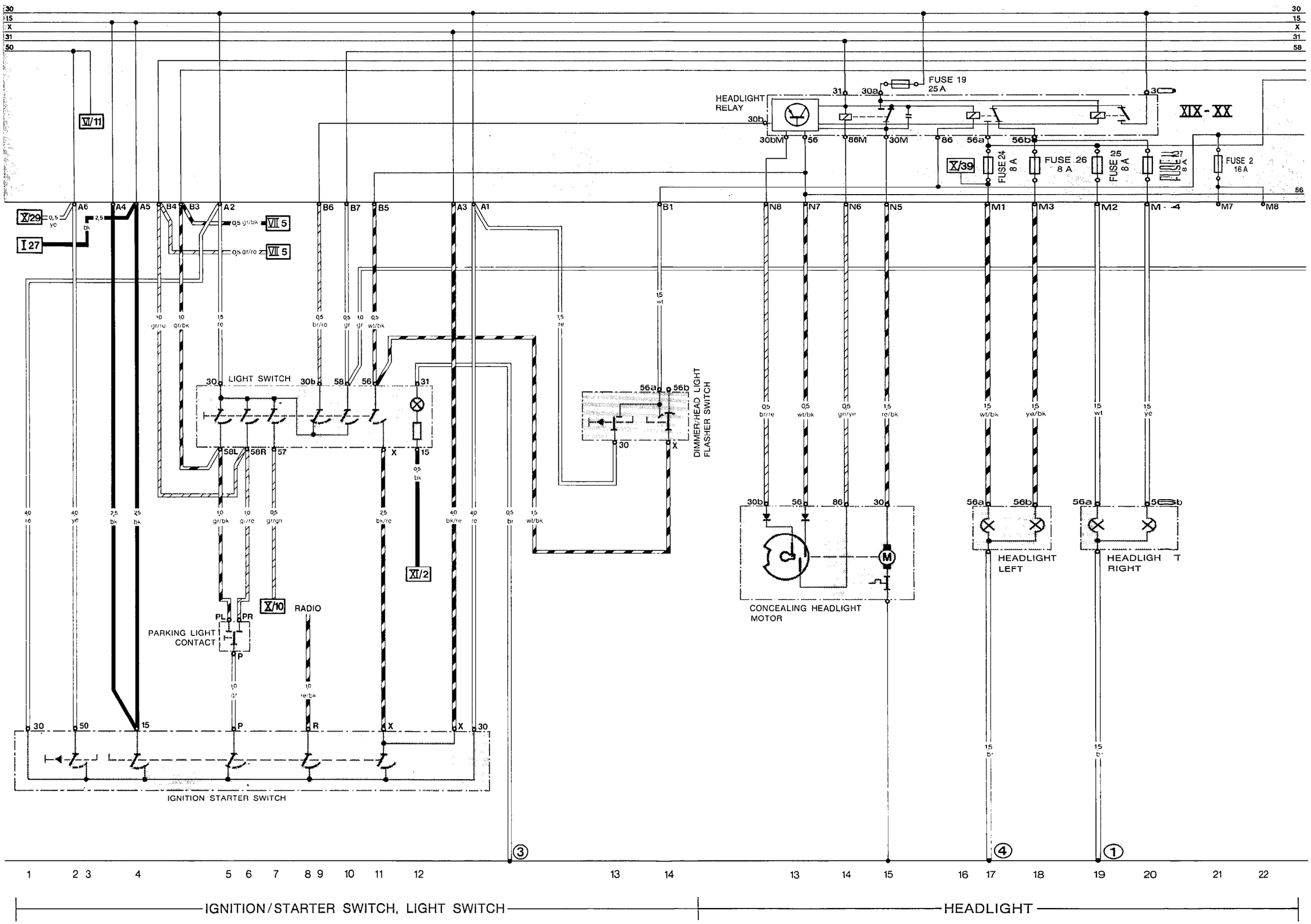


Printed in Germany - VII, 1983

Current Flow Diagram Type 928 S USA
Model 83 Part III

IGNITION/STARTER SWITCH, LIGHT SWITCH
HEADLIGHT, PARKING LIGHT

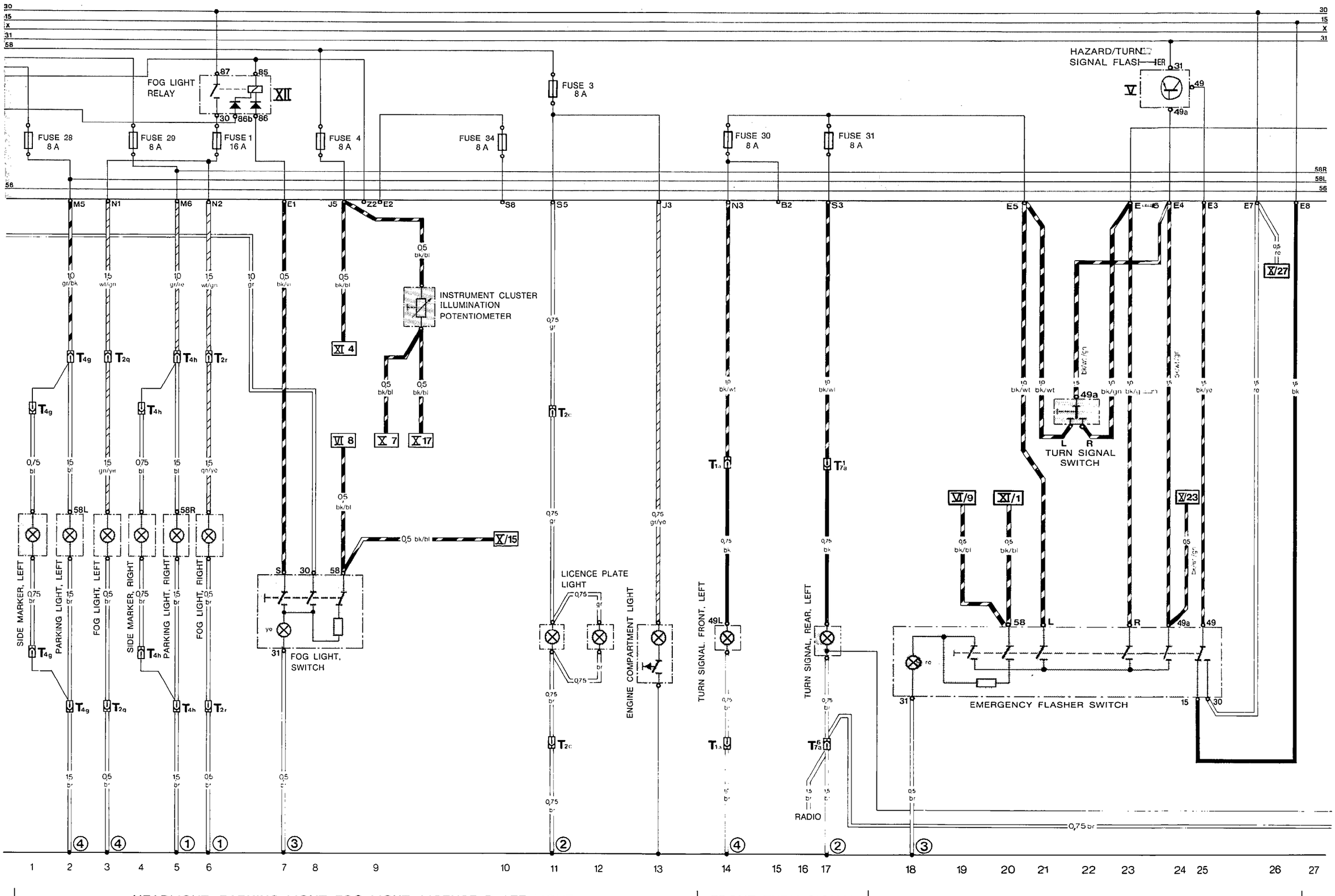
Current Flow Diagram Type 928 S USA Model 83 Part III



Current Flow Diagram Type 928 S USA
Model 83 Part IV

FOG LIGHT, LICENSE PLATE LIGHT
FRONT TURN SIGNAL
HAZARD FLASHER

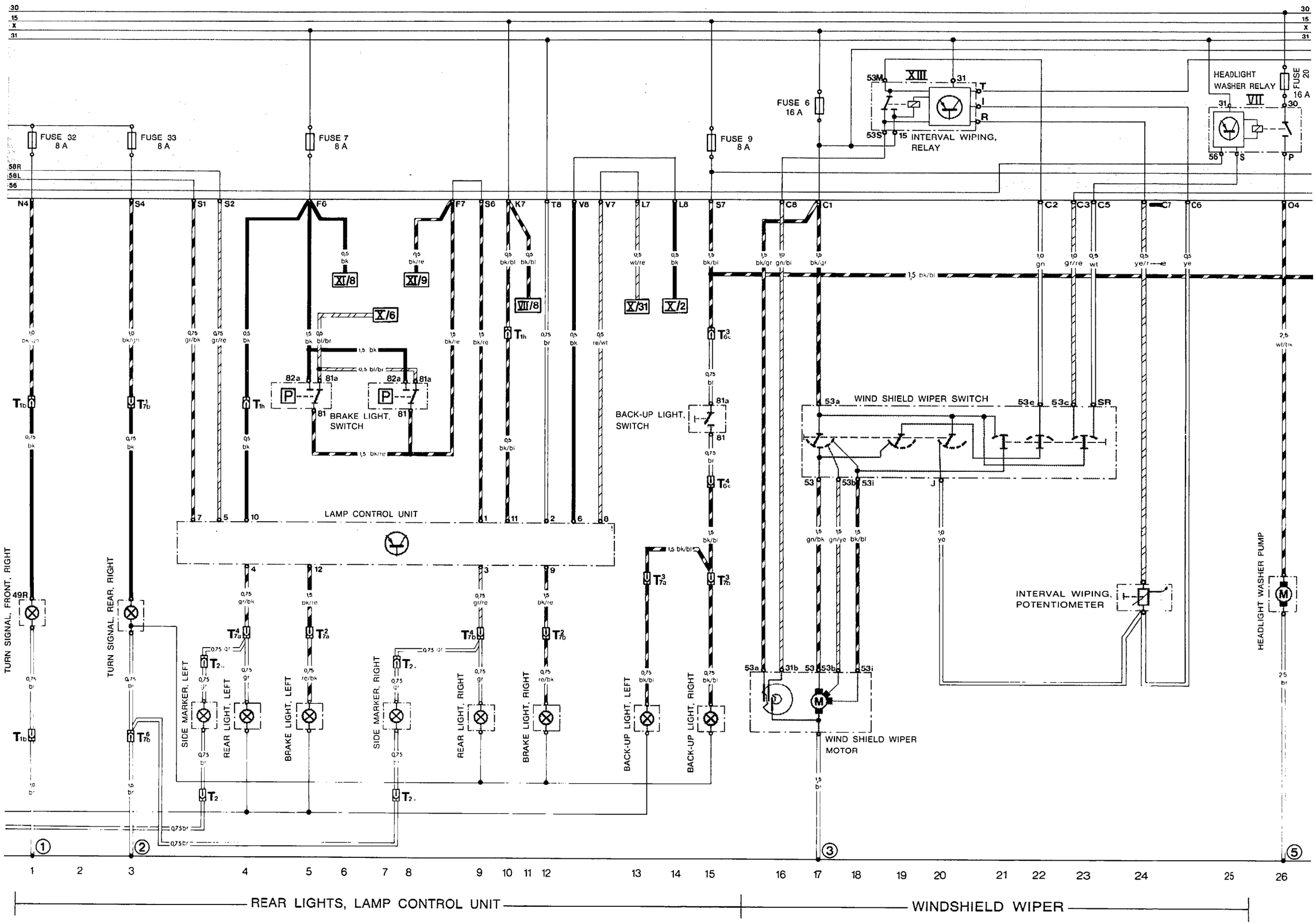
Current Flow Diagram Type 928 S USA Model 83 Part IV



Current Flow Diagram Type 928 S USA
Model 83 Part V

REAR LIGHTS, LAMP CONTROL UNIT
WINDSHIELD WIPER

Current Flow Diagram Type 928 S USA Model 83 Part V



Current Flow Diagram Type 928 S USA
Model 83 Part VI

WASHER PUMPS

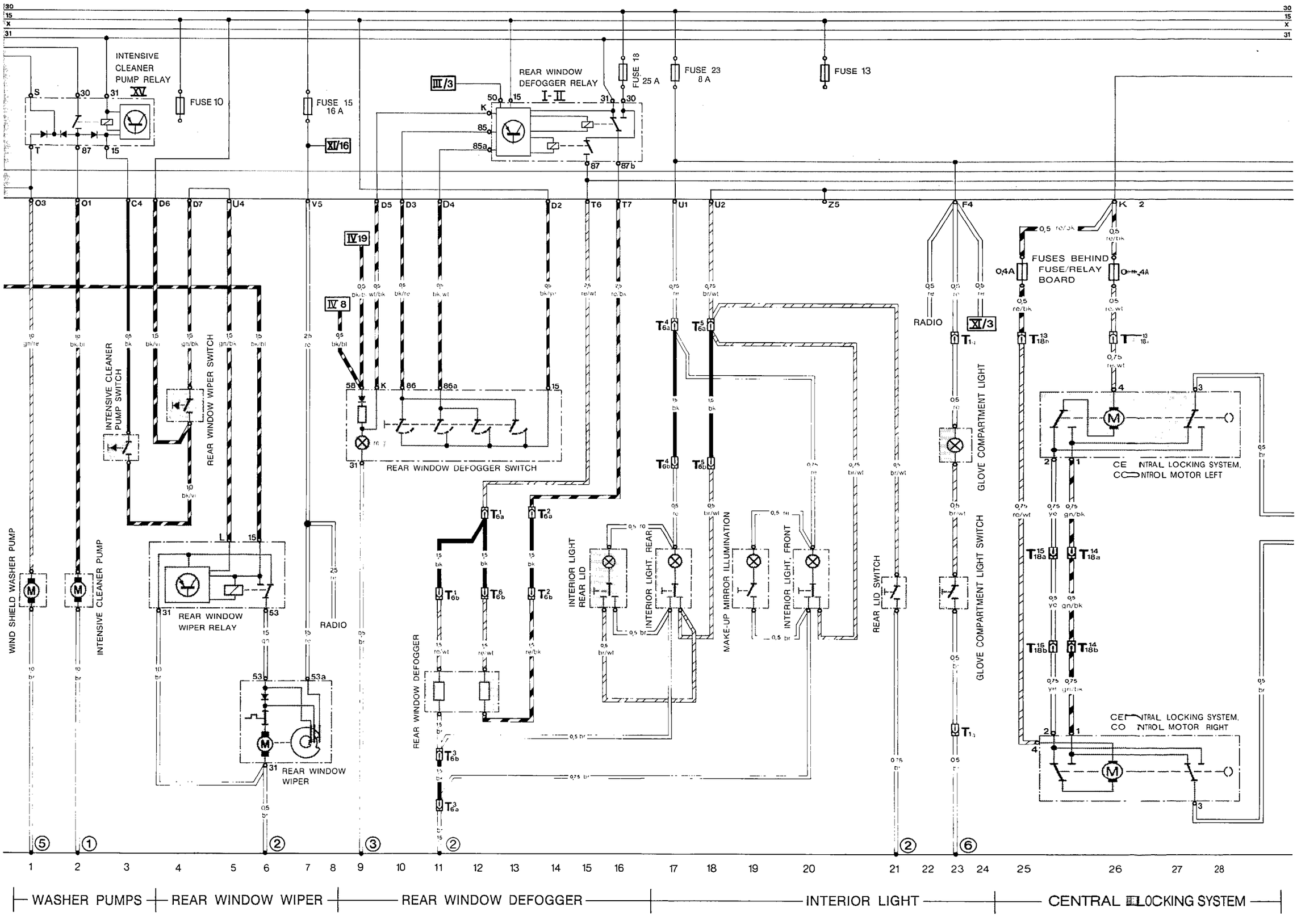
REAR WINDOW WIPER

REAR WINDOW DEFOGGER

INTERIOR LIGHT

CENTRAL LOCKING SYSTEM

Current Flow Diagram Type 928 S USA Model 83 Part VI



Current Flow Diagram Type 928 S USA
Model 83 Part VII

DOOR LIGHT

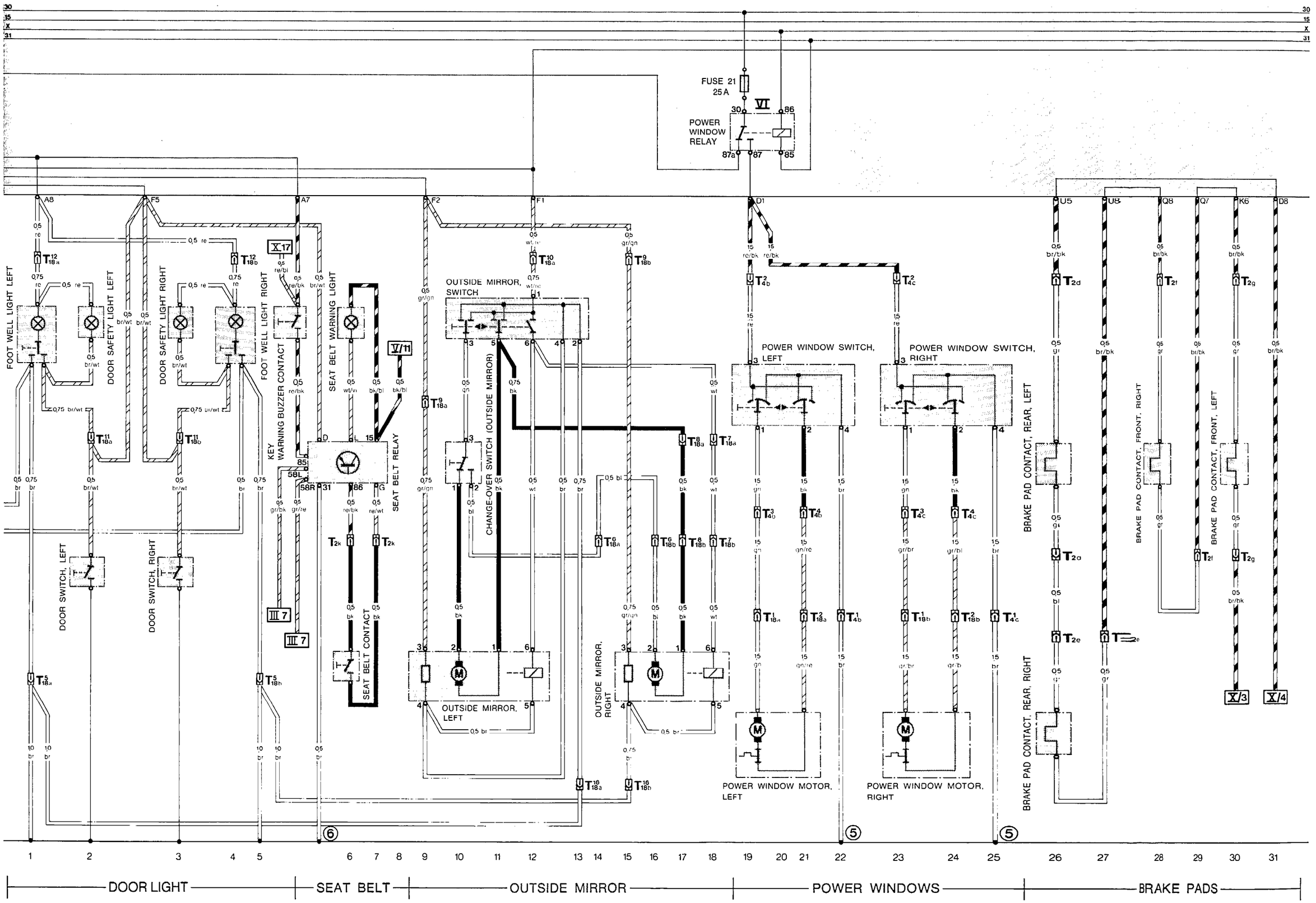
SEAT BELT

OUTSIDE MIRROR

POWER WINDOWS

BRAKE PADS

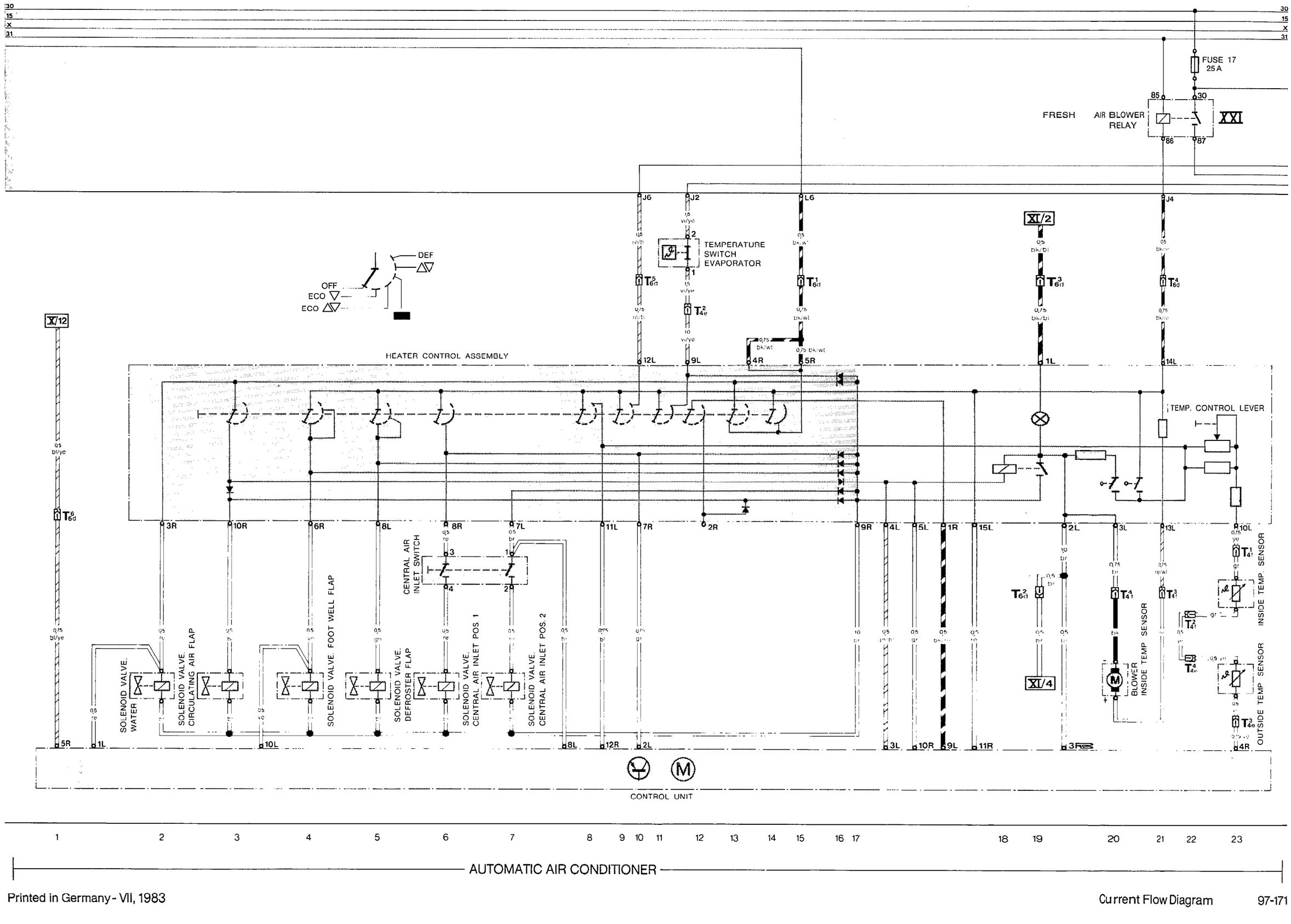
Current Flow Diagram Type 928 S USA Model 83 Part VII



Current Flow Diagram Type 928 S USA
Model 83 Part VIII

AUTOMATIC AIR CONDITIONER

Current Flow Diagram Type 928 S USA Model 83 Part VIII

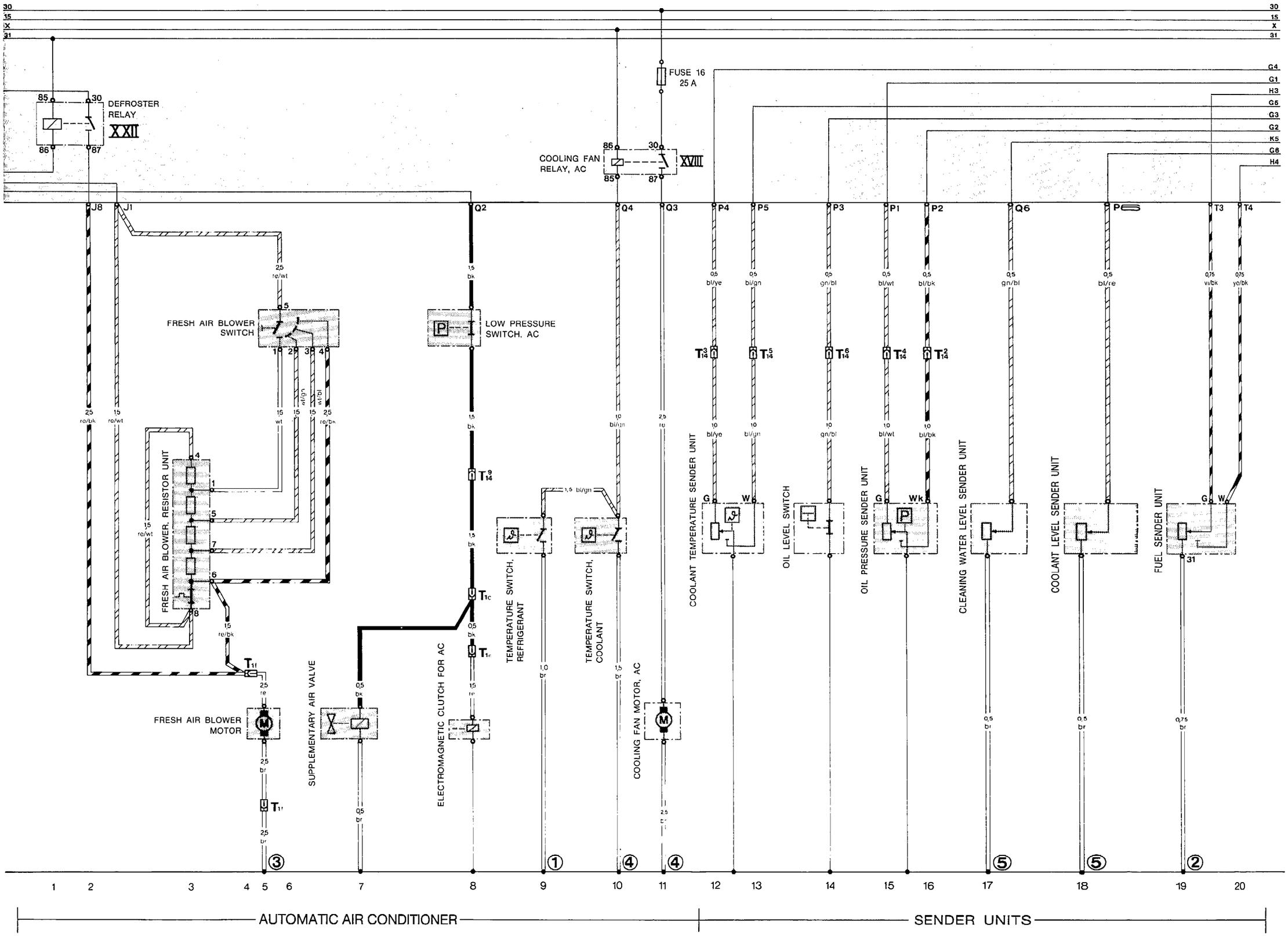


Current Flow Diagram Type 928 S USA
Model 83 Part IX

AUTOMATIC AIR CONDITIONER

SENDER UNITS

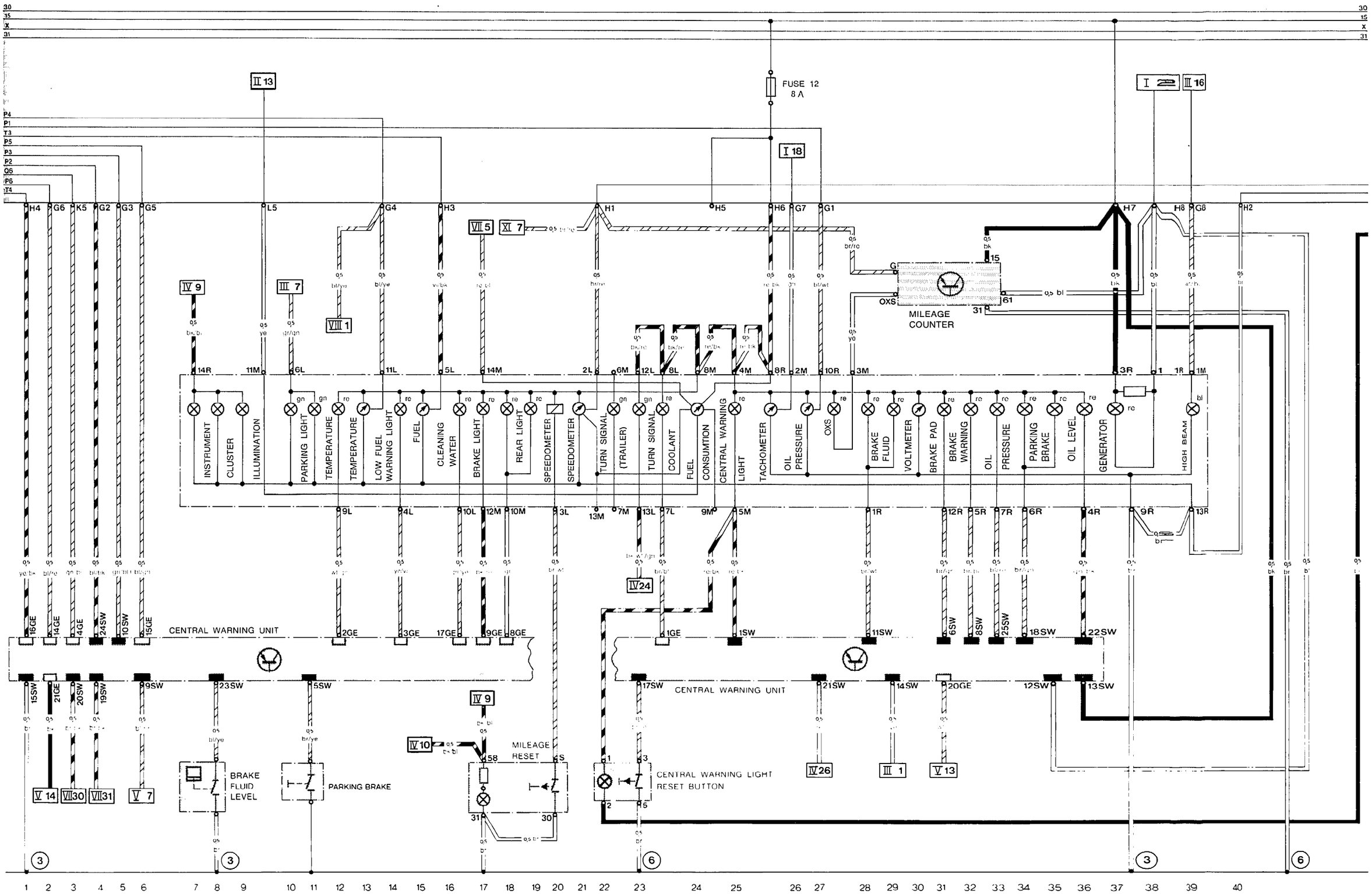
Current Flow Diagram Type 928 S USA Model 83 Part IX



Current Flow Diagram Type 928 S USA
Model 83 Part X

CENTRAL WARNING UNIT, INSTRUMENT CLUSTER

Current Flow Diagram Type 928 S USA Model 83 Part X



Current Flow Diagram Type 928 S USA
Model 83 Part XI

CLOCK

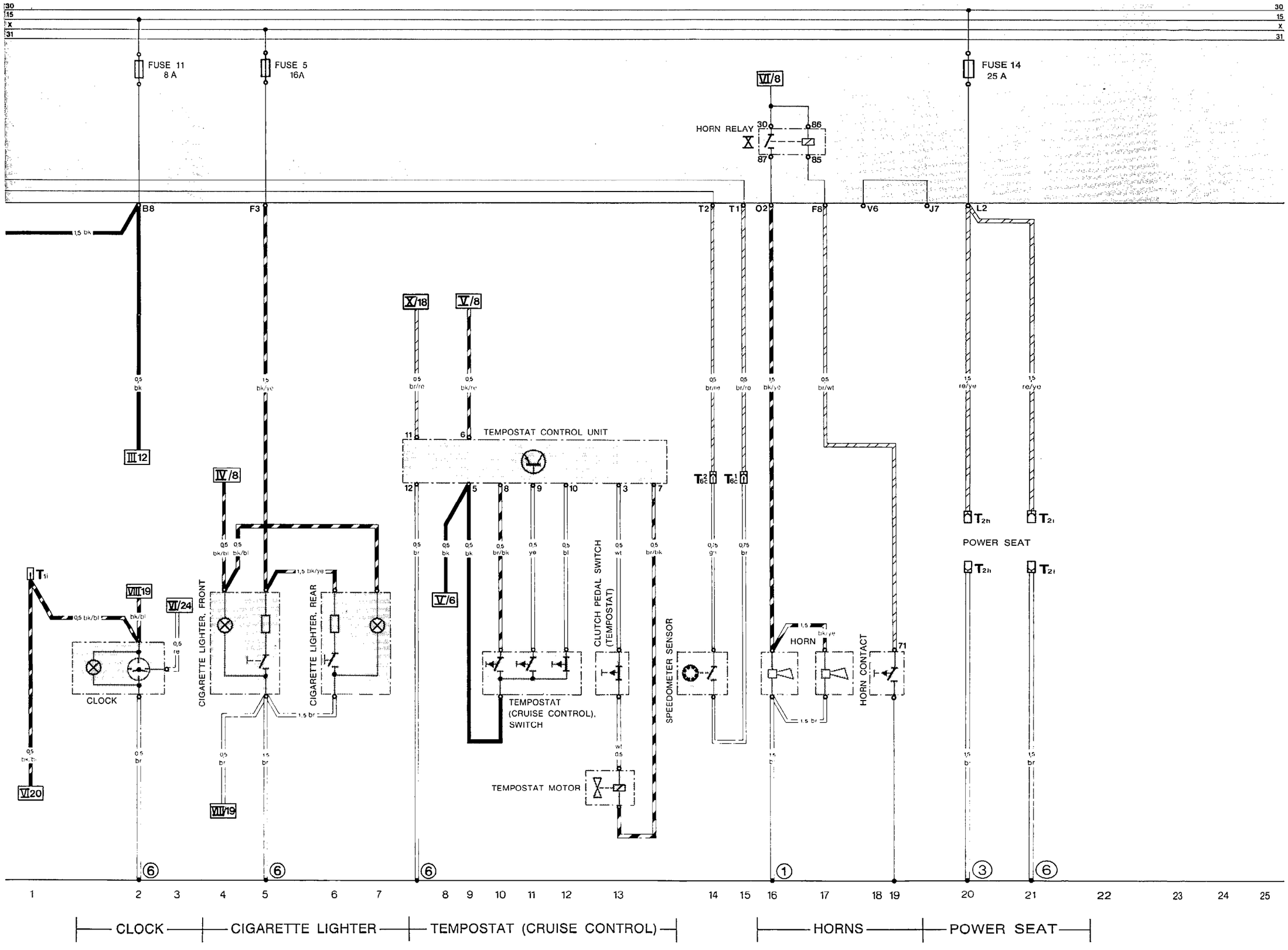
CIGARETTE LIGHTER

TEMPOSTAT (CRUISE CONTROL)

HORNS

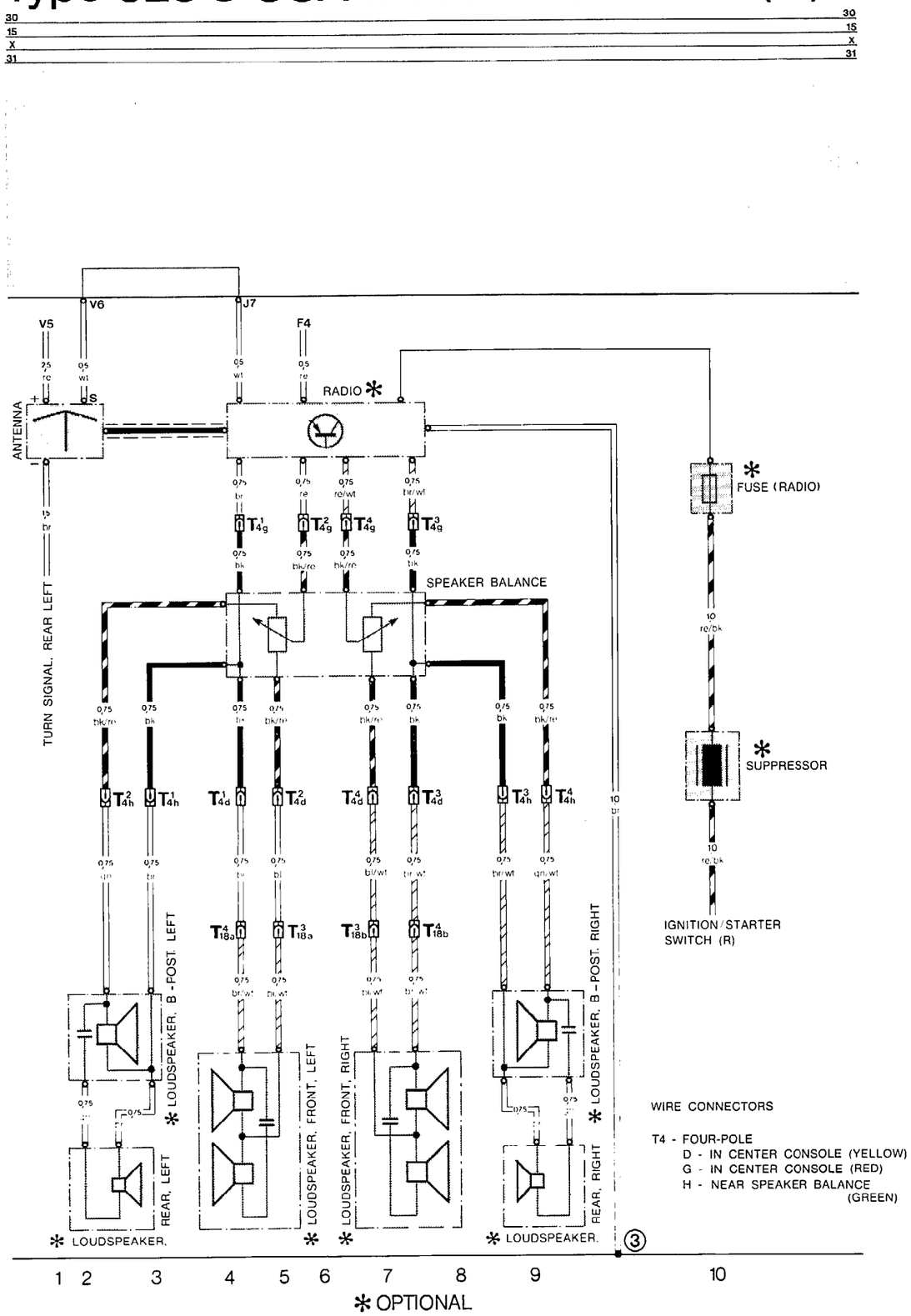
POWER SEAT

Current Flow Diagram Type 928 S USA Model 83 Part XI



Additional Current Flow Diagram

Type 928 S USA Model 83 RADIO WITH 8 LOUDSPEAKERS (HIFI)



Additional Current Flow Diagram
Type 928 S USA Model 83

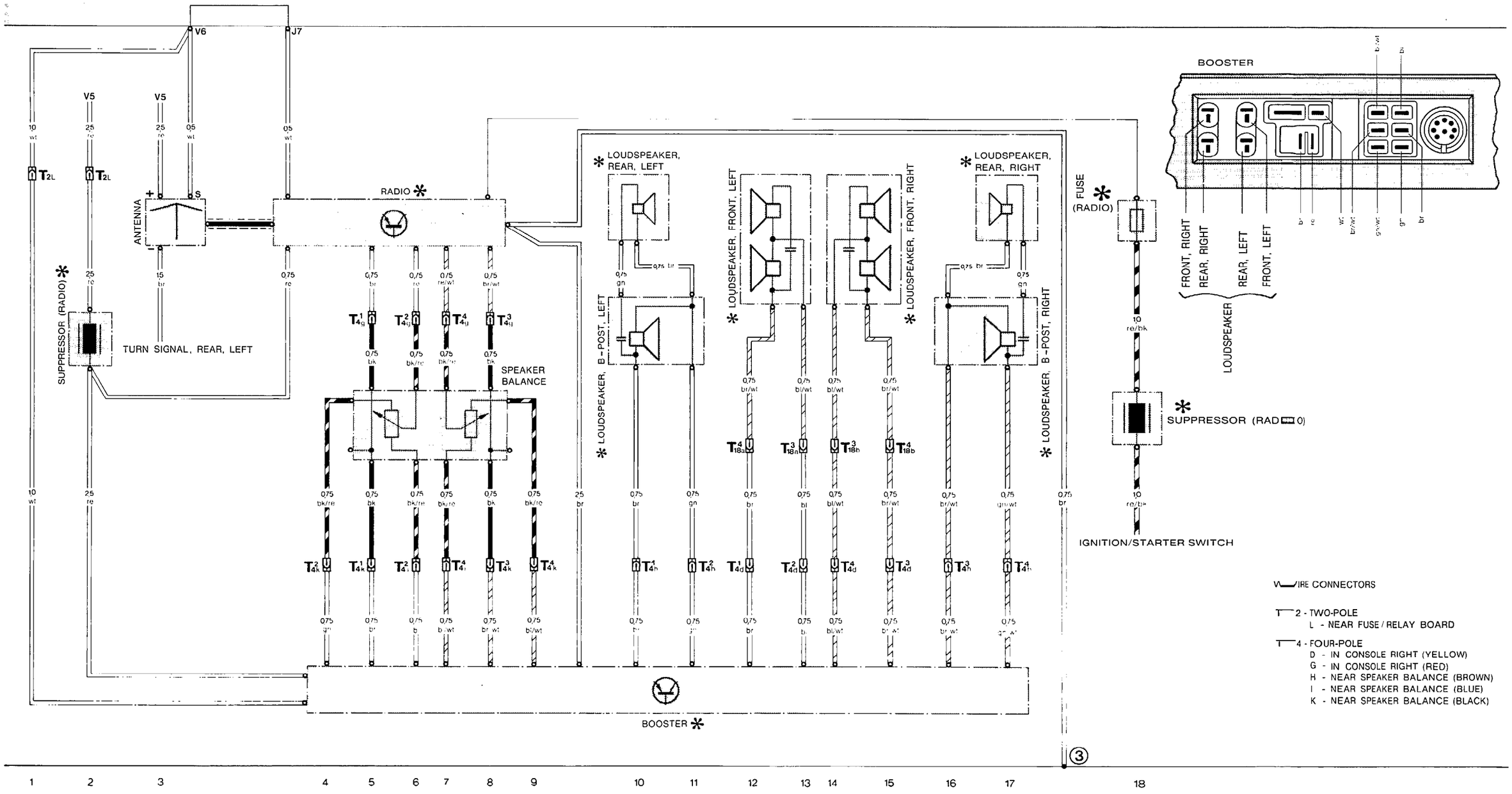
RADIO WITH 8 LOUDSPEAKERS AND BOOSTER (HIFI)

1

Additional Current Flow Diagram Type 928 S USA Model 83

RADIO WITH 8 LOUDSPEAKERS AND BOOSTER (HIFI)

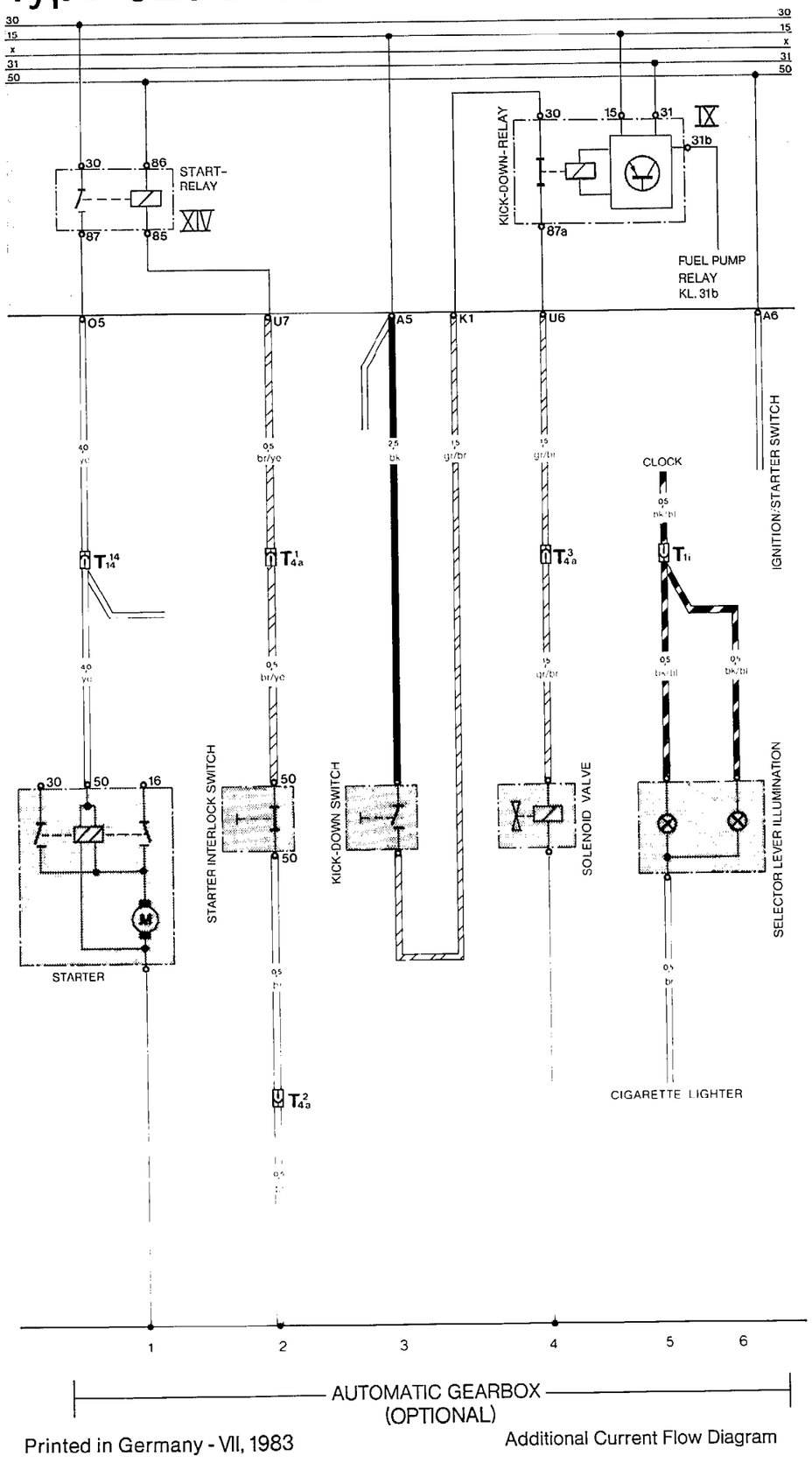
30
15
X
31



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

* OPTIONAL

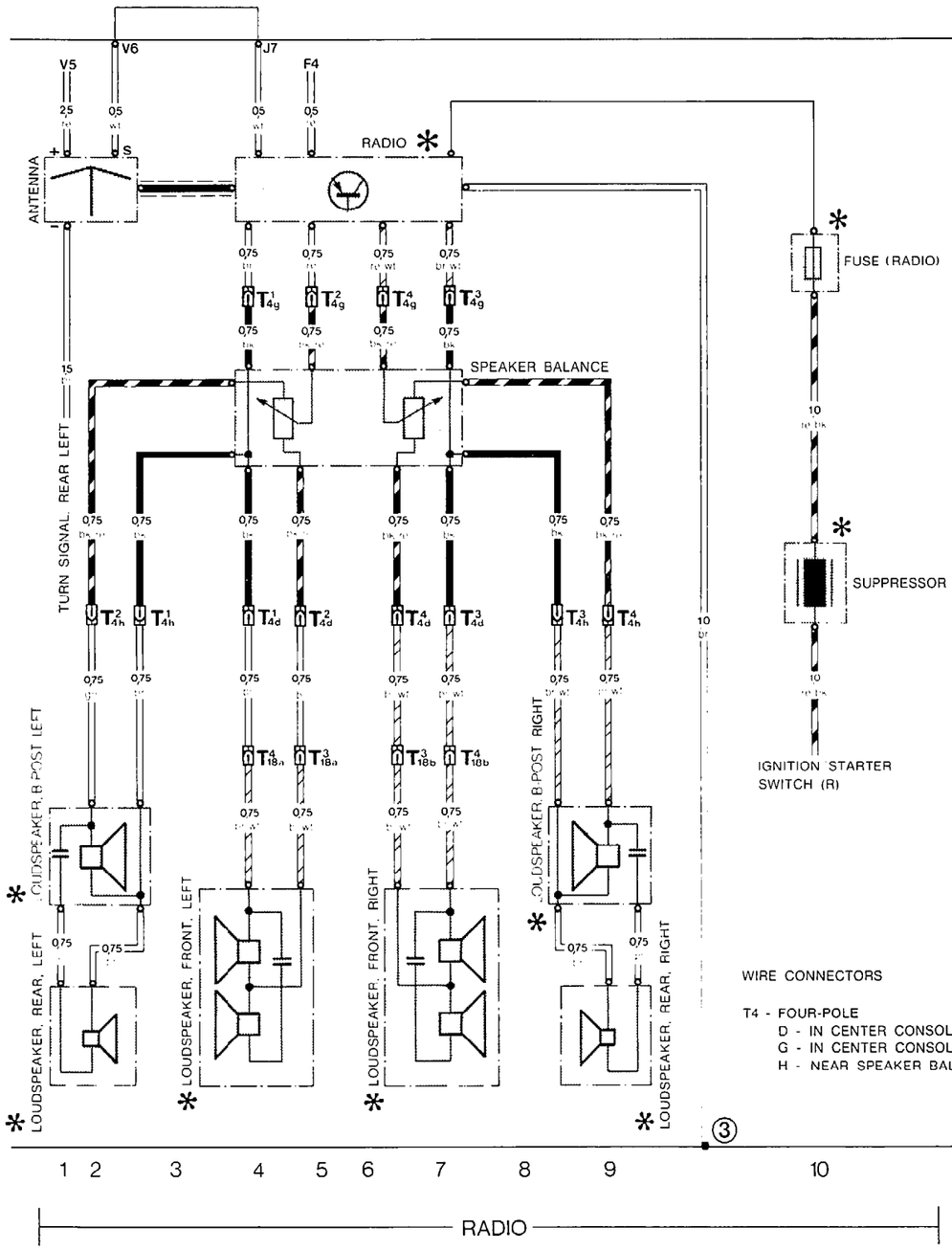
Additional Current Flow Diagram
Type 928S USA Model 83 **Automatic gearbox**



Additional Current Flow Diagram

Type 928 S Model 83 (HIFI) RADIO WITH 8 LOUDSPEAKERS

30
15
X
31



Additional Current Flow Diagram

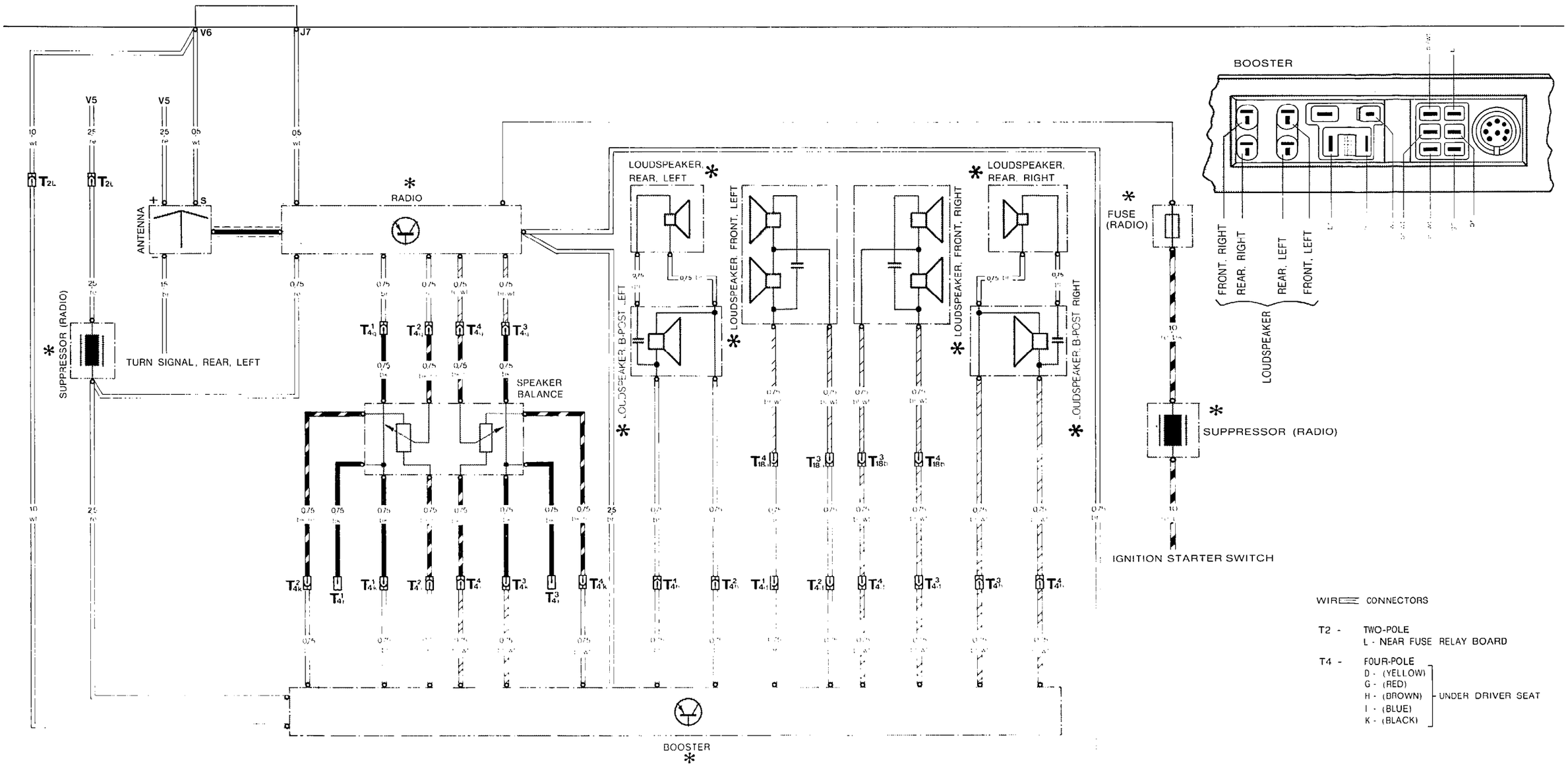
Type 928 S Model 83

RADIO WITH 8 LOUDSPEAKERS
AND BOOSTER (HIFI)

Additional Current Flow Diagram Type 928 S Model 83

RADIO WITH 8 LOUDSPEAKERS AND BOOSTER (HIFI)

30
15
X
31



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 ③ 18

RADIO

Wiring Diagram Type 928 S
Model 84

PAGE 01 CENTRAL ELECTRIC

PAGE 02 CENTRAL ELECTRIC (USA, JAPAN)

PAGE 1 FRONT END AND ENGINE, ELECTRONIC INGNITION/LH INJECTION

PAGE 1A FRONT END AND ENGINE (USA, JAPAN)

PAGE 2 PASSENGER COMPARTMENT AND INSTRUMENTS

PAGE 3 PASSENGER COMPARTMENT

PAGE 4 PASSENGER COMPARTMENT AND REAR END

PAGE 5 HEATING — VENTILATING — AIR CONDITIONING

PAGE 6 RADIO

PAGE 7 ABS

PAGE 8 ADDITIONAL WIRING DIAGRAM FOR BURGLAR ALARM

Wiring Diagram Type 928 S
Model 84

PAGE 01 CENTRAL ELECTRIC

PAGE 02 CENTRAL ELECTRIC (USA, JAPAN)

PAGE 1 FRONT END AND ENGINE, ELECTRONIC INGNITION/LH INJECTION

PAGE 1A FRONT END AND ENGINE (USA, JAPAN)

PAGE 2 PASSENGER COMPARTMENT AND INSTRUMENTS

PAGE 3 PASSENGER COMPARTMENT

PAGE 4 PASSENGER COMPARTMENT AND REAR END

PAGE 5 HEATING – VENTILATING – AIR CONDITIONING

PAGE 6 RADIO

PAGE 7 ABS

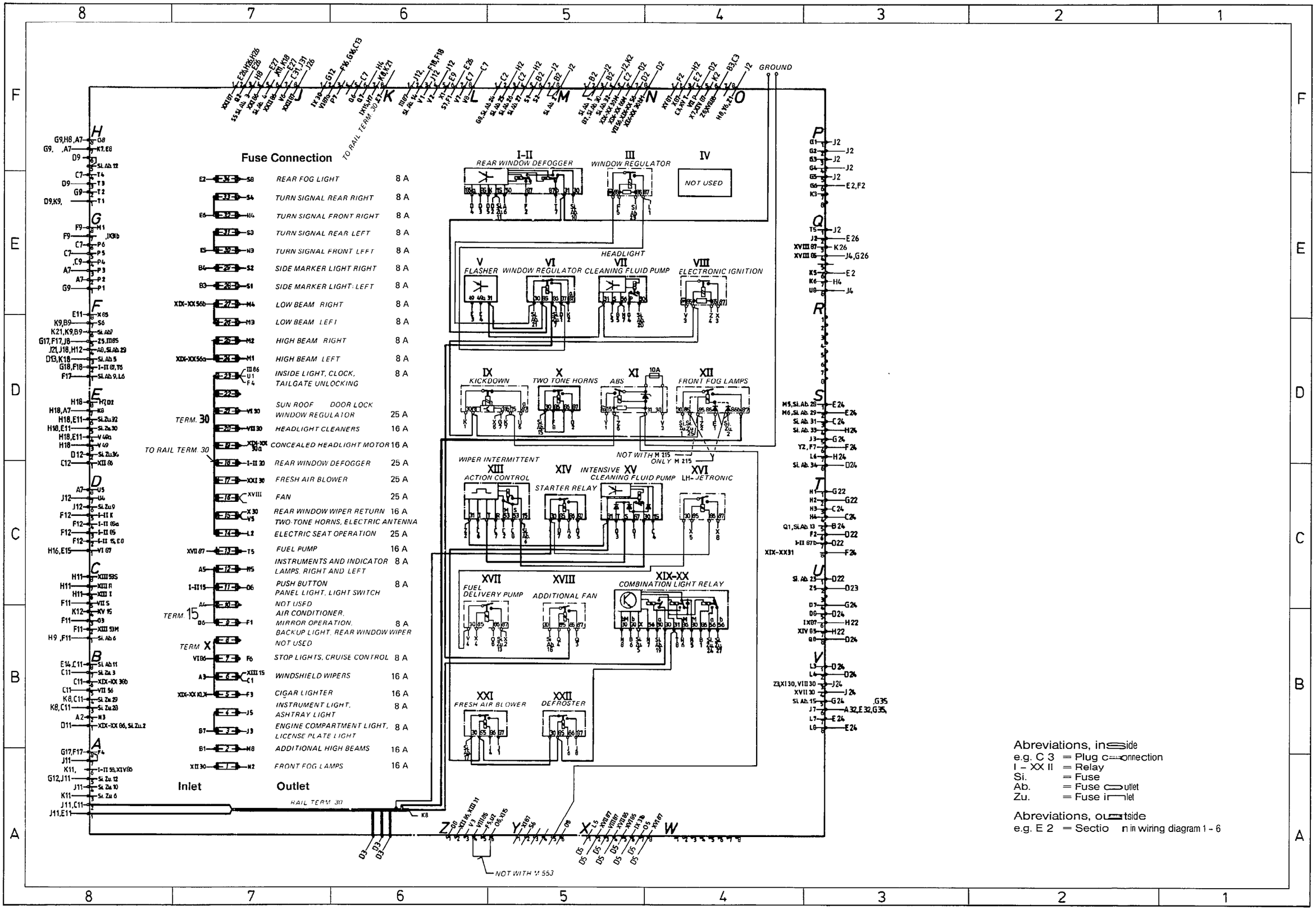
PAGE 8 ADDITIONAL WIRING DIAGRAM FOR BURGLAR ALARM

Wiring Diagram Type 928 S
Model 84 page 01

CENTRAL ELECTRIC

Wiring Diagram Type 928 S Model 84 page 01

CENTRAL ELECTRIC



Wiring Diagram Type 928 S
Model 84 page 02

CENTRAL ELECTRIC (USA, JAPAN)

Wiring Diagram Type 928 S Model 84 page 02

CENTRAL ELECTRIC (USA, JAPAN)

Fuse Connection

E2	S8	REAR FOG LIGHT	8 A
	S4	TURN SIGNAL REAR RIGHT	8 A
E6	N4	TURN SIGNAL FRONT RIGHT	8 A
	S3	TURN SIGNAL REAR LEFT	8 A
E5	N3	TURN SIGNAL FRONT LEFT	8 A
B4	S2	SIDE MARKER LIGHT RIGHT	8 A
B3	S1	SIDE MARKER LIGHT LEFT	8 A
XIX-XX 56b	M4	LOW BEAM RIGHT	8 A
	M3	LOW BEAM LEFT	8 A
nur M553 (USA) XII 85	M2	HIGH BEAM RIGHT	8 A
XIX-XX 56a	M1	HIGH BEAM LEFT	8 A
	U1, F4	INSIDE LIGHT, CLOCK, TAILGATE UNLOCKING	8 A
		NOT USED	
TERM. 30	VI 30	WINDOW REGULATOR, DOOR LOCK	25 A
	VII 30	HEADLIGHT CLEANERS	16 A
TO RAIL TERM. 30	XIX-XX 30a	CONCEALED HEADLIGHT MOTOR	16 A
	I-II 30	REAR WINDOW DEFOGGER	25 A
	XXI 30	FRESH AIR BLOWER	25 A
	XVIII 30	FAN	25 A
	X 30 VS	TWO TONE HORNS, ELECTRIC ANTENNA REAR WINDOW WIPER RETURN	16 A
	L2	ELECTRIC SEAT OPERATION	25 A
XVI 87	T5	FUEL PUMP	16 A
A5	H5	INSTRUMENTS AND INDICATOR LAMPS, RIGHT AND LEFT	8 A
I-II 15	B8	PUSH BUTTON PANEL LIGHT, LIGHT SWITCH	8 A
A4	N2	NOT USED	
TERM. 15 D6	F1	AIR CONDITIONER, MIRROR OPERATION, BACKUP LIGHT, REAR WINDOW WIPER	8 A
TERM. X	L1	SUN ROOF	16 A
VI 86	F6	STOP LIGHTS, CRUISE CONTROL	8 A
A3	XIII 15 C1	WINDSHIELD WIPERS	16 A
XIX-XX K1 X	F3	CIGAR LIGHTER	16 A
	J5	INSTRUMENT LIGHT, ASHTRAY LIGHT ENGINE COMPARTMENT	8 A
B7	J3	LIGHT, LICENSE PLATE LIGHT	
B1	M6	ADDITIONAL HIGH BEAMS (NOT WITH M 553 USA)	8 A 16 A
XII 30	N2	FRONT FOG LAMPS	16 A

Inlet — Outlet — RAIL TERM 30

I-II REAR WINDOW DEFOGGER — III NOT USED — IV BURGLAR ALARM

V FLASHER — VI WINDOW REGULATOR, — VII HEADLIGHT CLEANERS — VIII NOT USED

IX KICKDOWN — X TWO-TONE HORNS — XI ABS — XII FRONT FOG LAMPS (NOT WITH M 193)

XIII WIPER INTERMITTENT ACTION CONTROL — XIV STARTER RELAY — XV INTENSIVE CLEANING FLUID PUMP — XVI M193/551 L-JETRONIC

XVII FUEL DELIVERY PUMP — XVIII ADDITIONAL FAN — XIX-XX COMBINATION LIGHT RELAY

XXI FRESH AIR BLOWER — XXII DEFROSTER

GROUND — RAIL TERM. 30 — NOT WITH M 553

Abreviations, inside
e.g. C 3 = Plug connection
I – XX II = Relay
Si. = Fuse
Ab. = Fuse outlet
Zu. = Fuse inlet

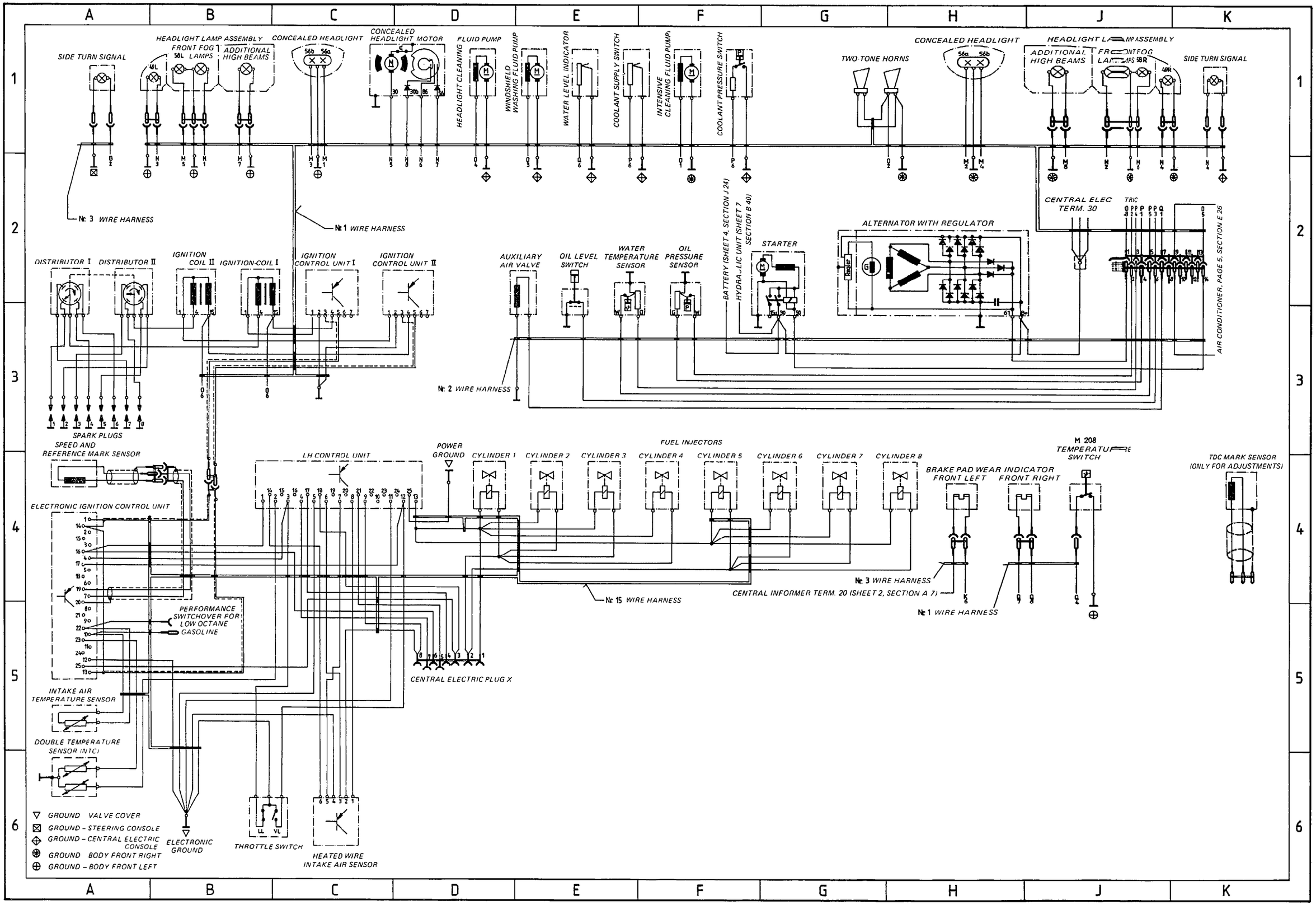
Abreviations, outside
e.g. E 2 = Section in wiring diagram 1 - 6

Wiring Diagram Type 928 S Model 84 page 1

FRONT END AND ENGINE, ELECTRONIC INGNITION/LH INJECTION

Wiring Diagram Type 928 S Model 84 page 1

FRONT END AND ENGINE, ELECTRONIC IGNITION/LH INJECTION

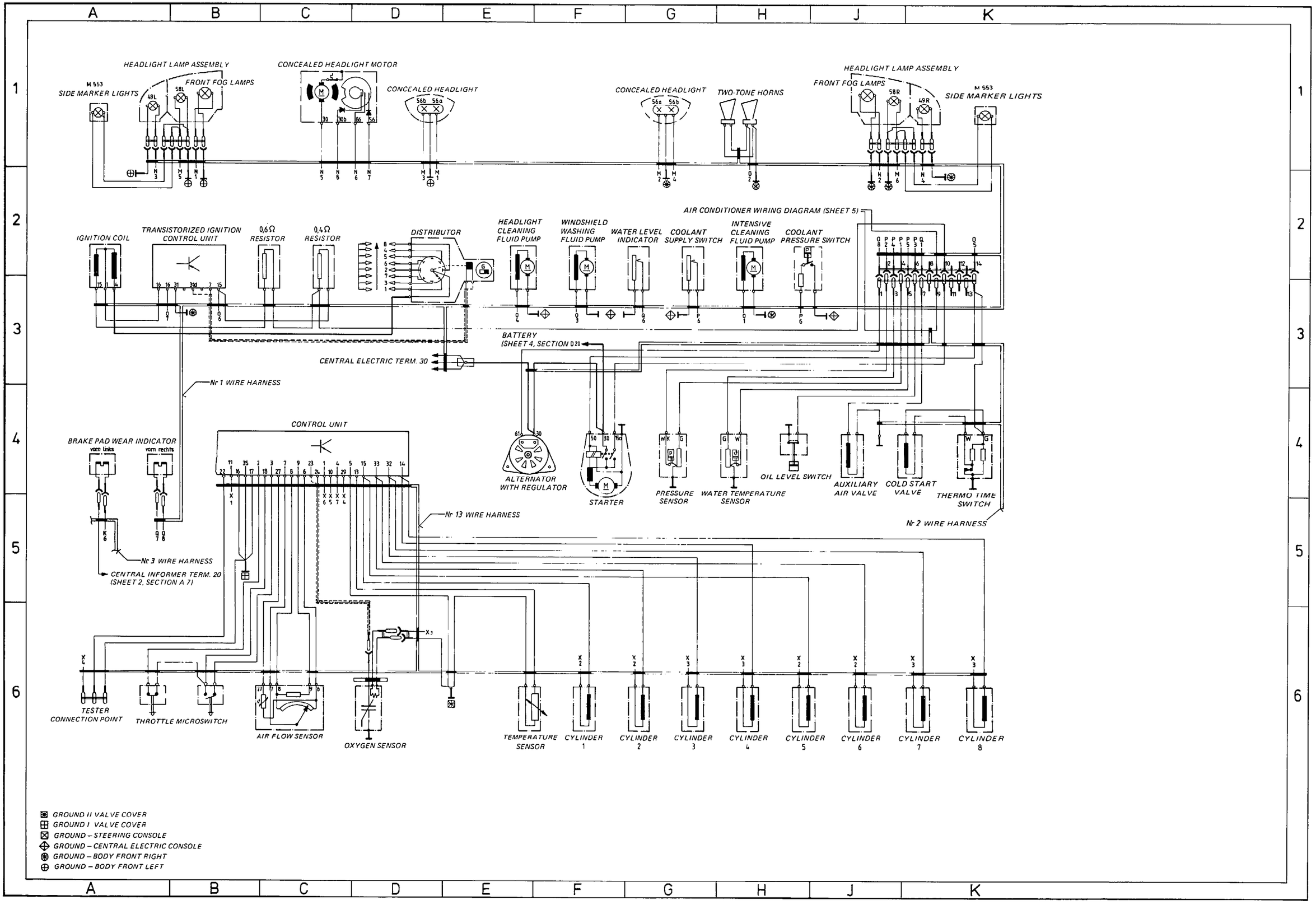


Wiring Diagram Type 928 S
Model 84 page 1A

FRONT END AND ENGINE (USA, JAPAN)

Wiring Diagram Type 928 S Model 84 page 1A

FRONT END AND ENGINE (USA, JAPAN)

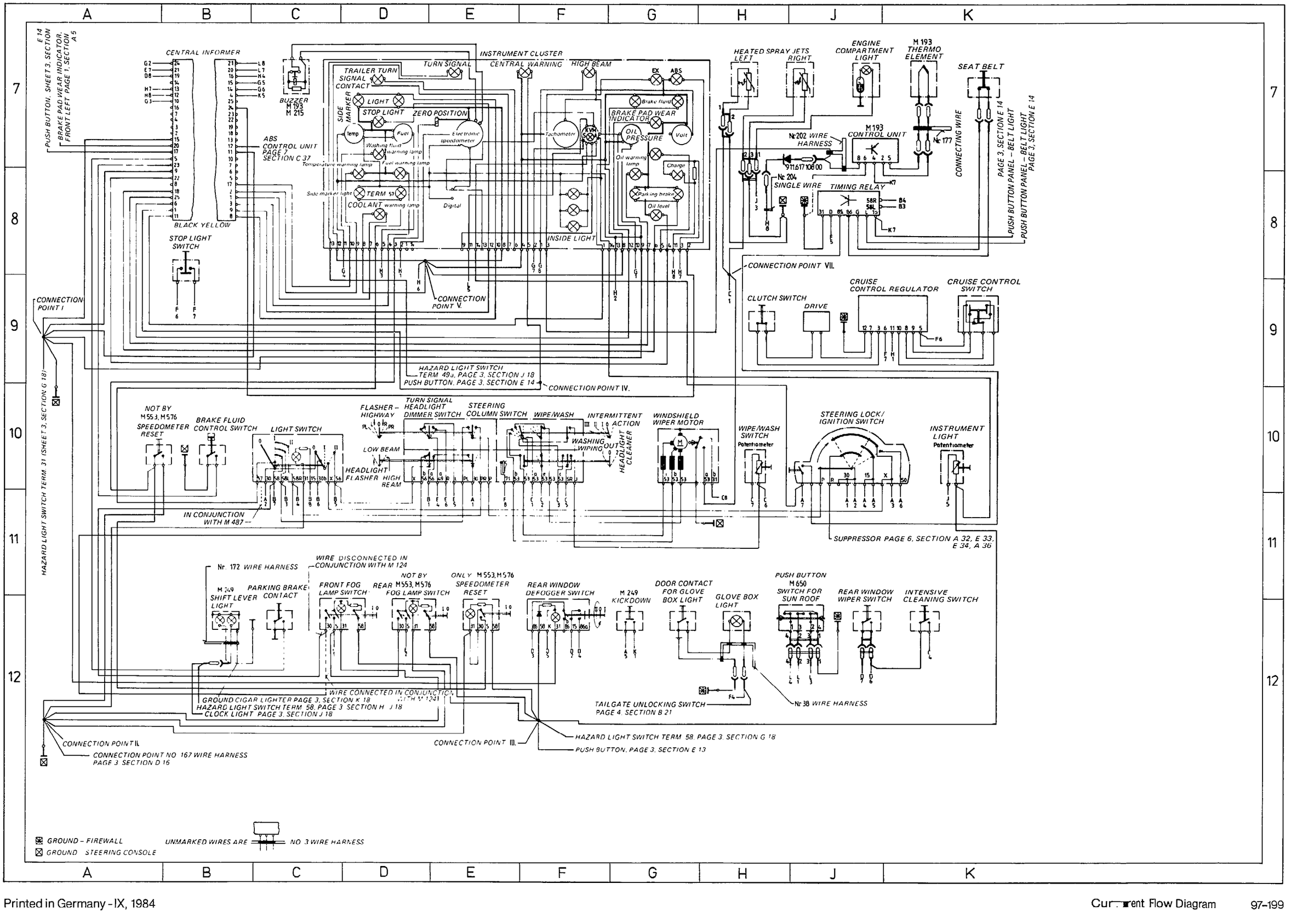


Wiring Diagram Type 928 S
Model 84 page 2

PASSENGER COMPARTMENT AND INSTRUMENTS

Wiring Diagram Type 928 S Model 84 page 2

PASSENGER COMPARTMENT AND INSTRUMENTS

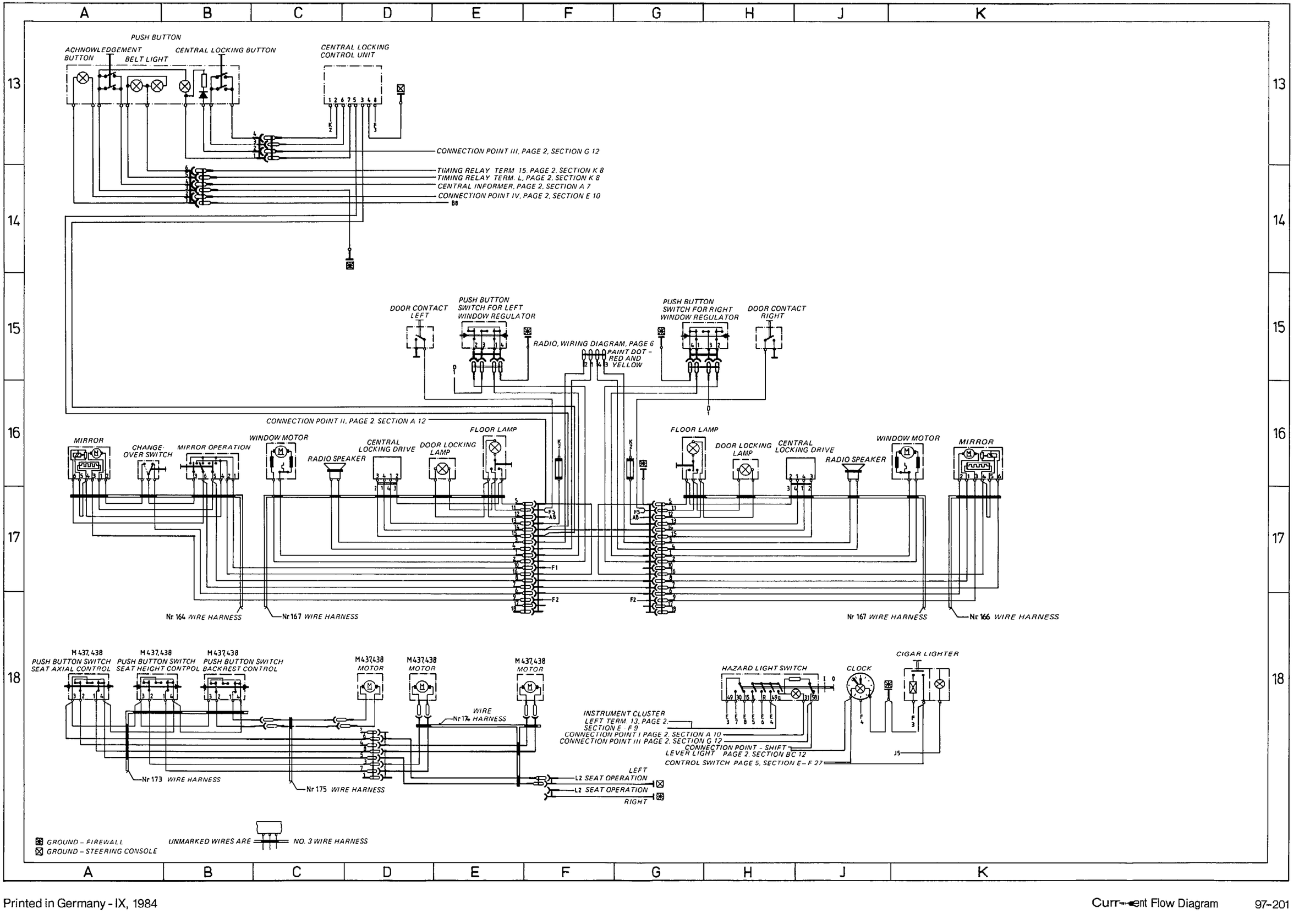


Wiring Diagram Type 928 S
Model 84 page 3

PASSENGER COMPARTMENT

Wiring Diagram Type 928 S Model 84 page 3

PASSENGER COMPARTMENT

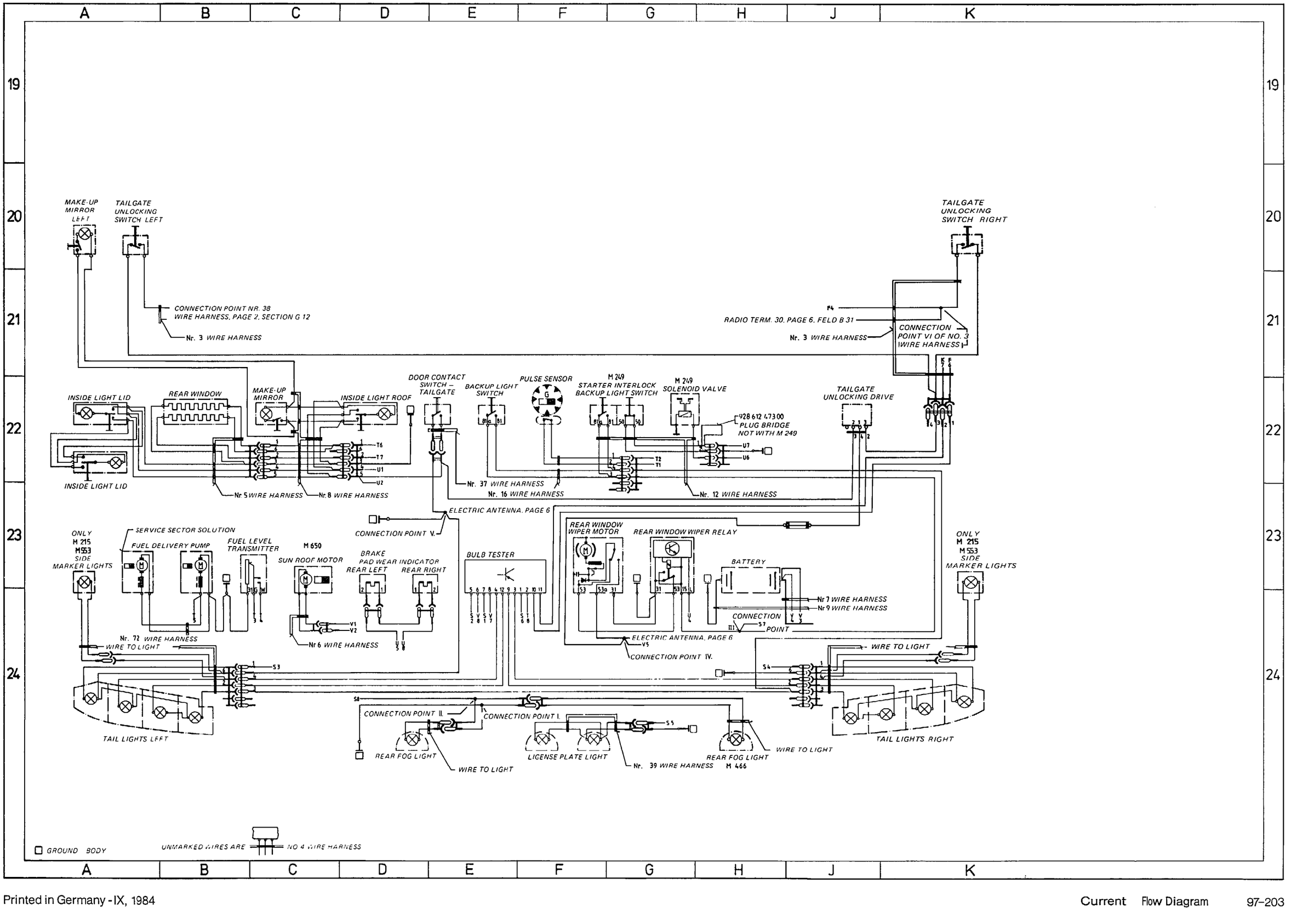


Wiring Diagram Type 928 S
Model 84 page 4

PASSENGER COMPARTMENT AND REAR END

Wiring Diagram Type 928 S Model 84 page 4

PASSENGER COMPARTMENT AND REAR END

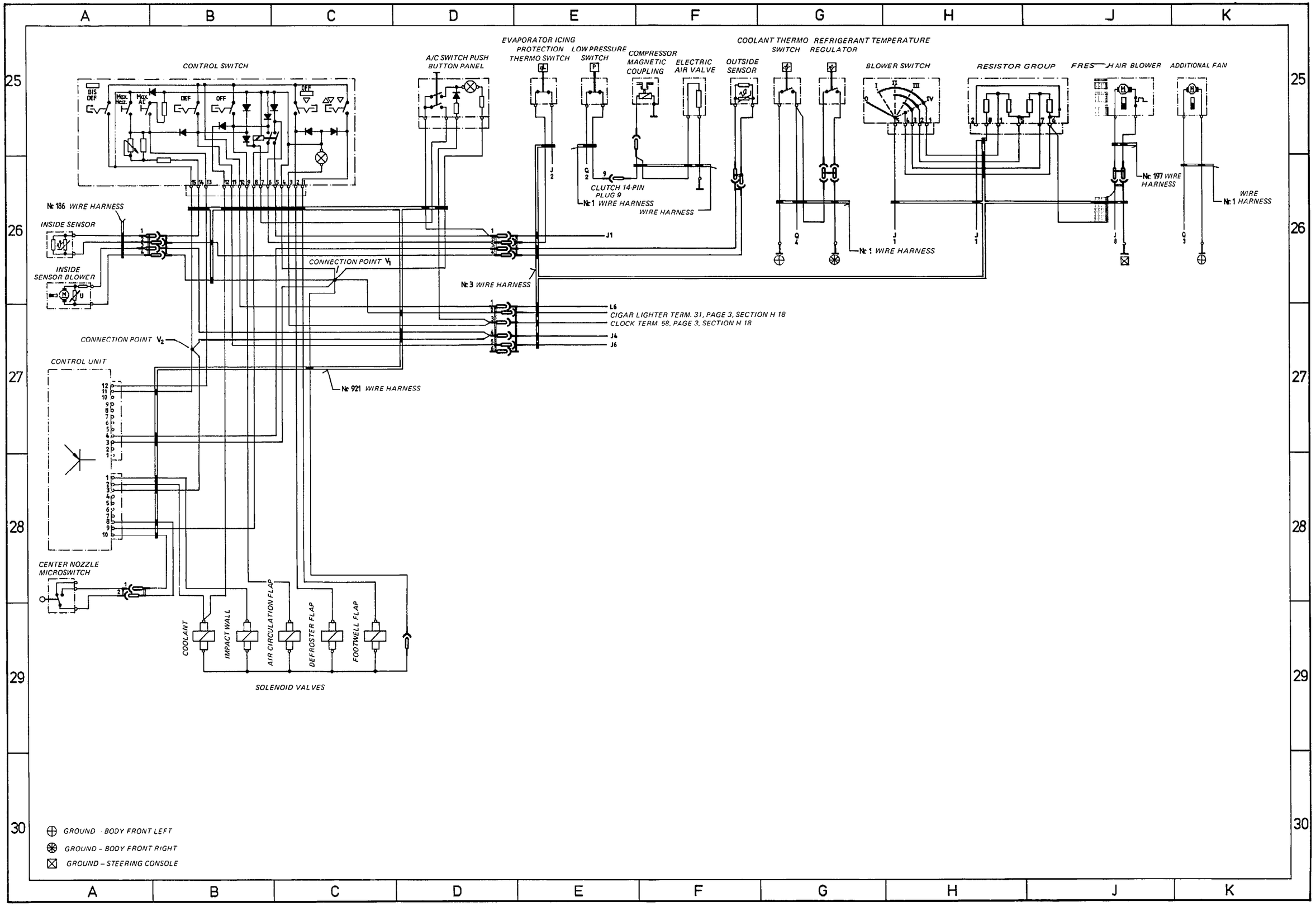


Wiring Diagram Type 928 S
Model 84 page 5

HEATING — VENTILATING — AIR CONDITIONING

Wiring Diagram Type 928 S Model 84 page 5

HEATING — VENTILATING — AIR CONDITIONING



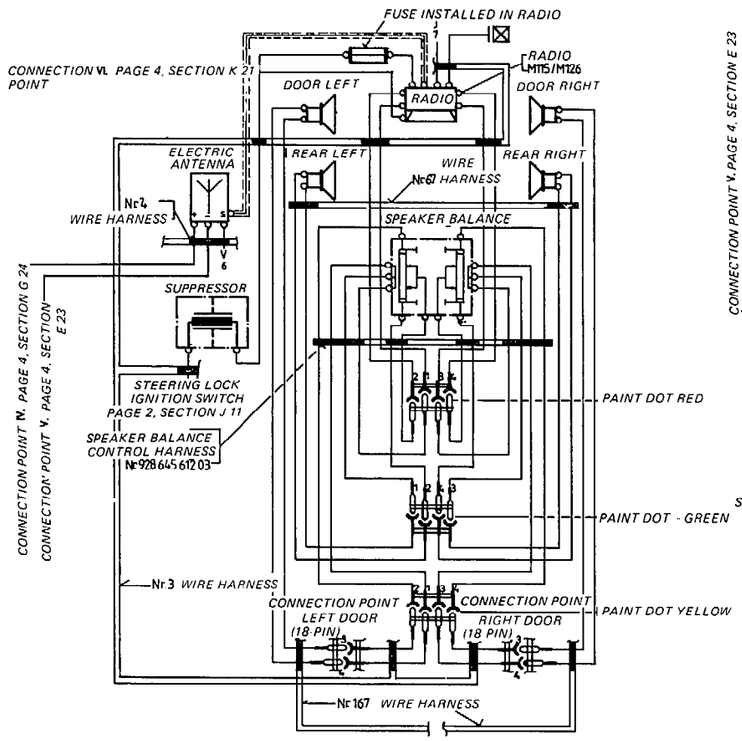
Wiring Diagram Type 928 S
Model 84 page 6

RADIO

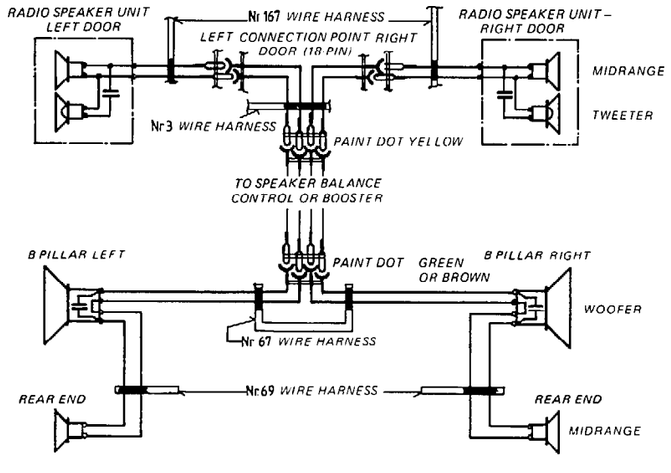
Wiring Diagram Type 928 S Model 84 page 6

RADIO

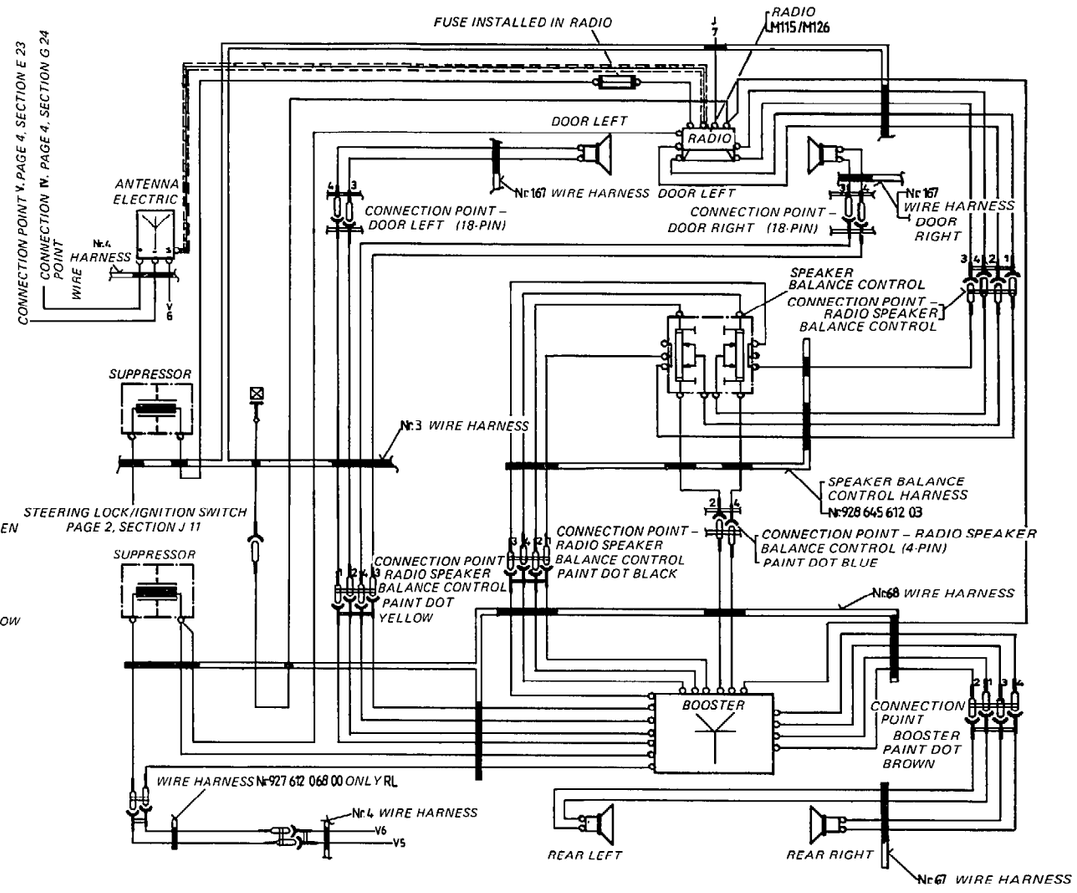
Basic Equipment



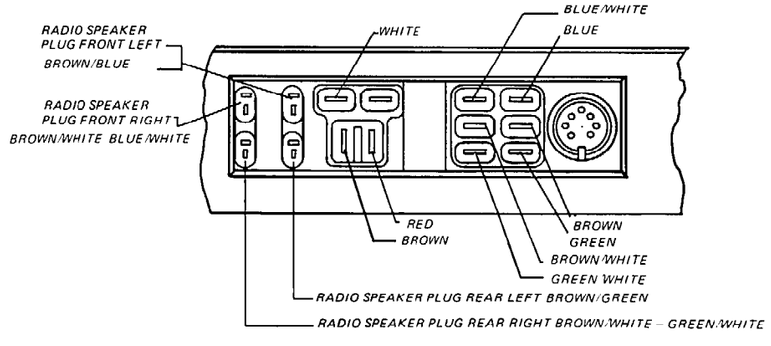
HiFi System M 490



Booster M 494



Booster Connection Plan



GROUND – STEERING CONSOLE

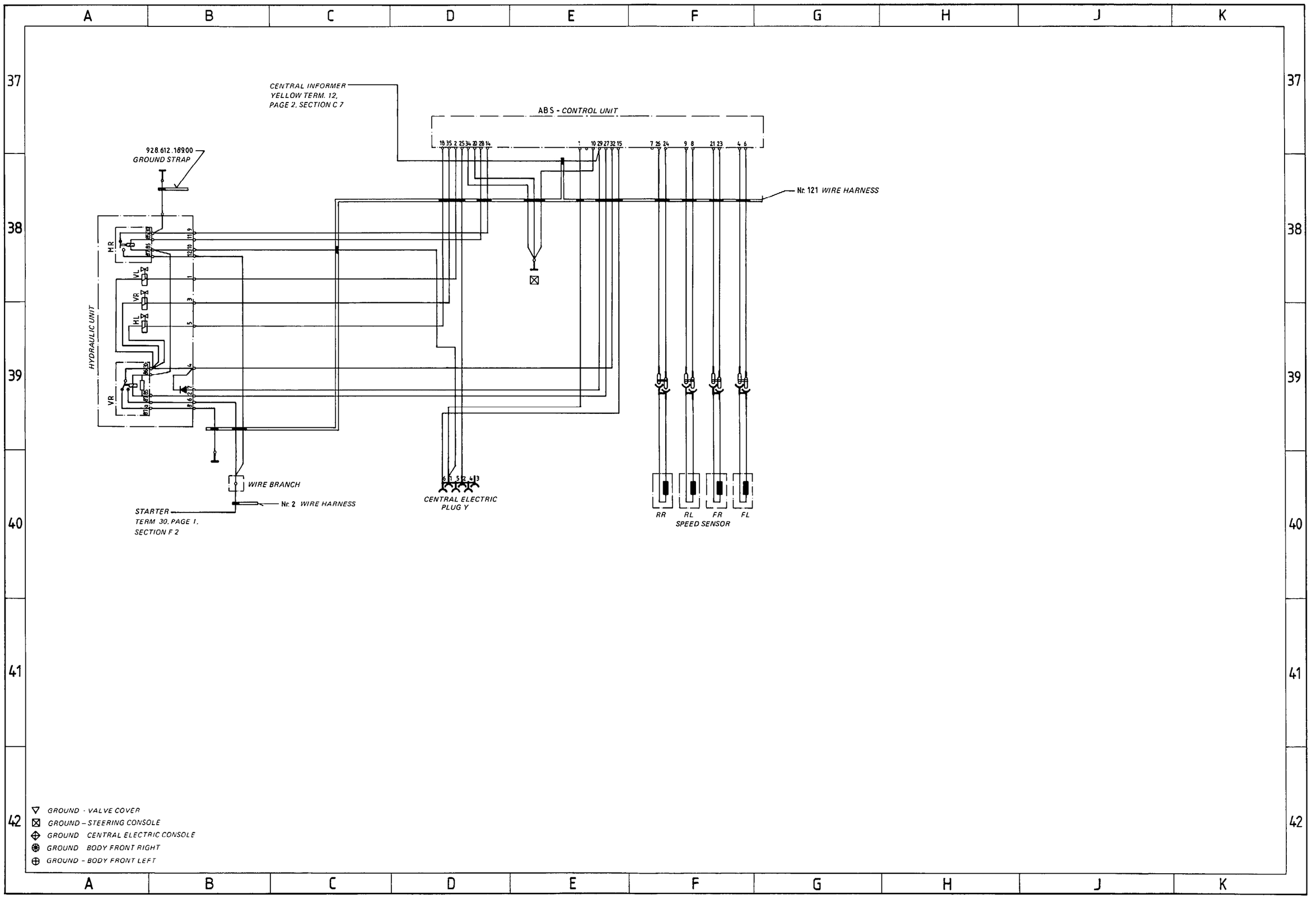
GROUND – BODY TAIL LIGHTS

Wiring Diagram Type 928 S
Model 84 page 7

ABS

Wiring Diagram Type 928 S Model 84 page 7

ABS

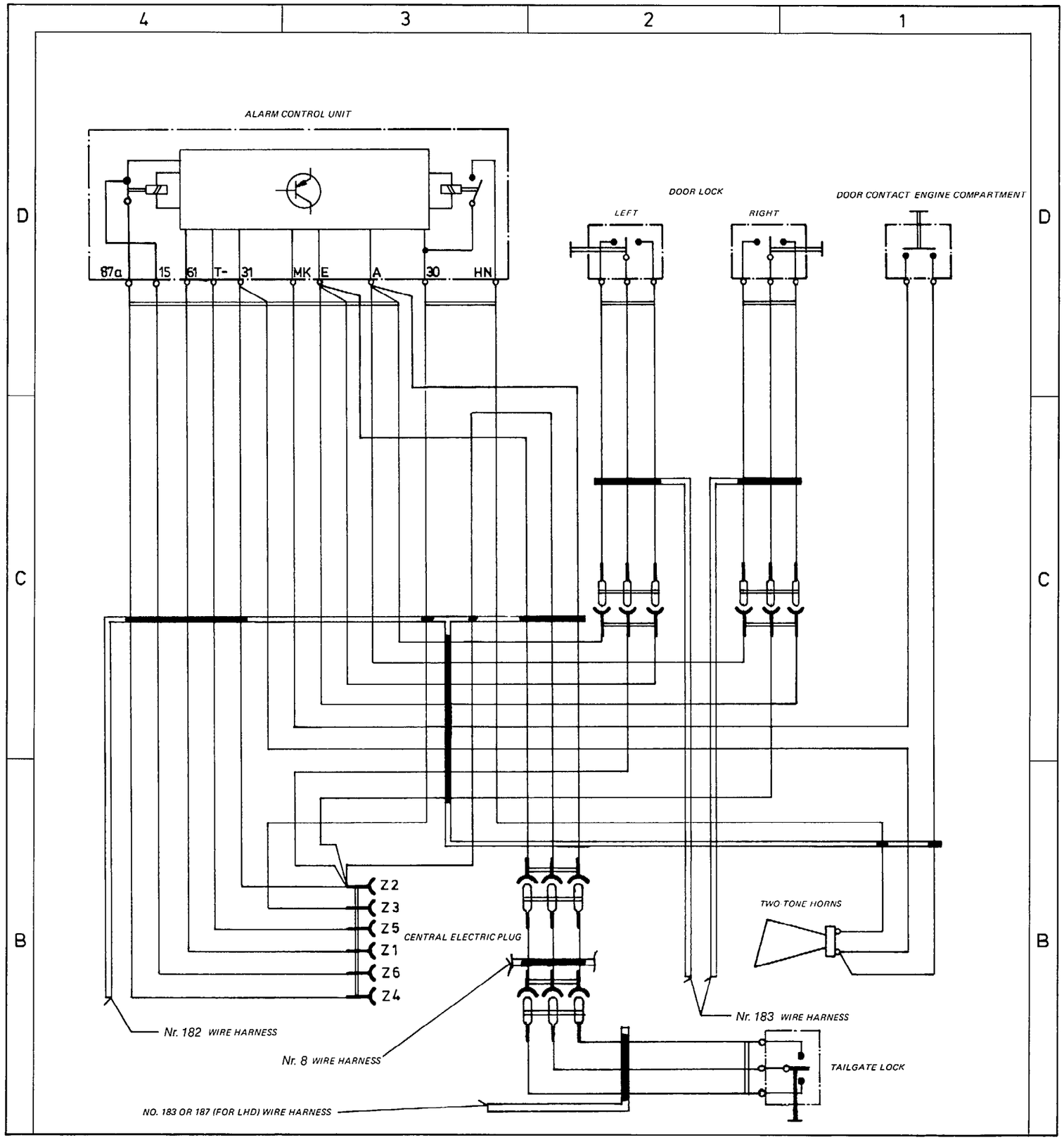


Wiring Diagram Type 928 S
Model 84 page 8

ADDITIONAL WIRING DIAGRAM
FOR BURGLAR ALARM

Wiring Diagram Type 928 S Model 84 page 8

ADDITIONAL WIRING DIAGRAM FOR BURGLAR ALARM



Wiring Diagram Type 928 S
Model 85

PAGE 1 LAMPS

PAGE 2 BODY

PAGE 3 INSTRUMENT CLUSTER + INDICATORS

PAGE 4 VENTILATION AND HEATING

PAGE 5 RADIO

PAGE 6 ABS, ALARM SYSTEM, TRAILER COUPLING

PAGE 7 ENGINE – DIGITAL ENGINE ELECTRONICS

PAGE 8 CENTRAL ELECTRICAL SYSTEM

Wiring Diagram Type 928 S Model 85

The wiring diagram comprises eight individual wiring diagrams and one legend. They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central electrical system within a dash-dot frame.

This part of the central electrical system shows all the lines and relays required for individual wiring diagram.

The ground-connecting points are designated with "MP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are new. They are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Part 2 is the "module element".

Both parts are identified by the digits 1 . . . 5.

Part 3 is a "coding element".

The designations of the plug connections in wiring diagram for central electrical system refer e. g. from A 11 . . . 15 to the "initial element", from A 21 . . . 26 to module element.

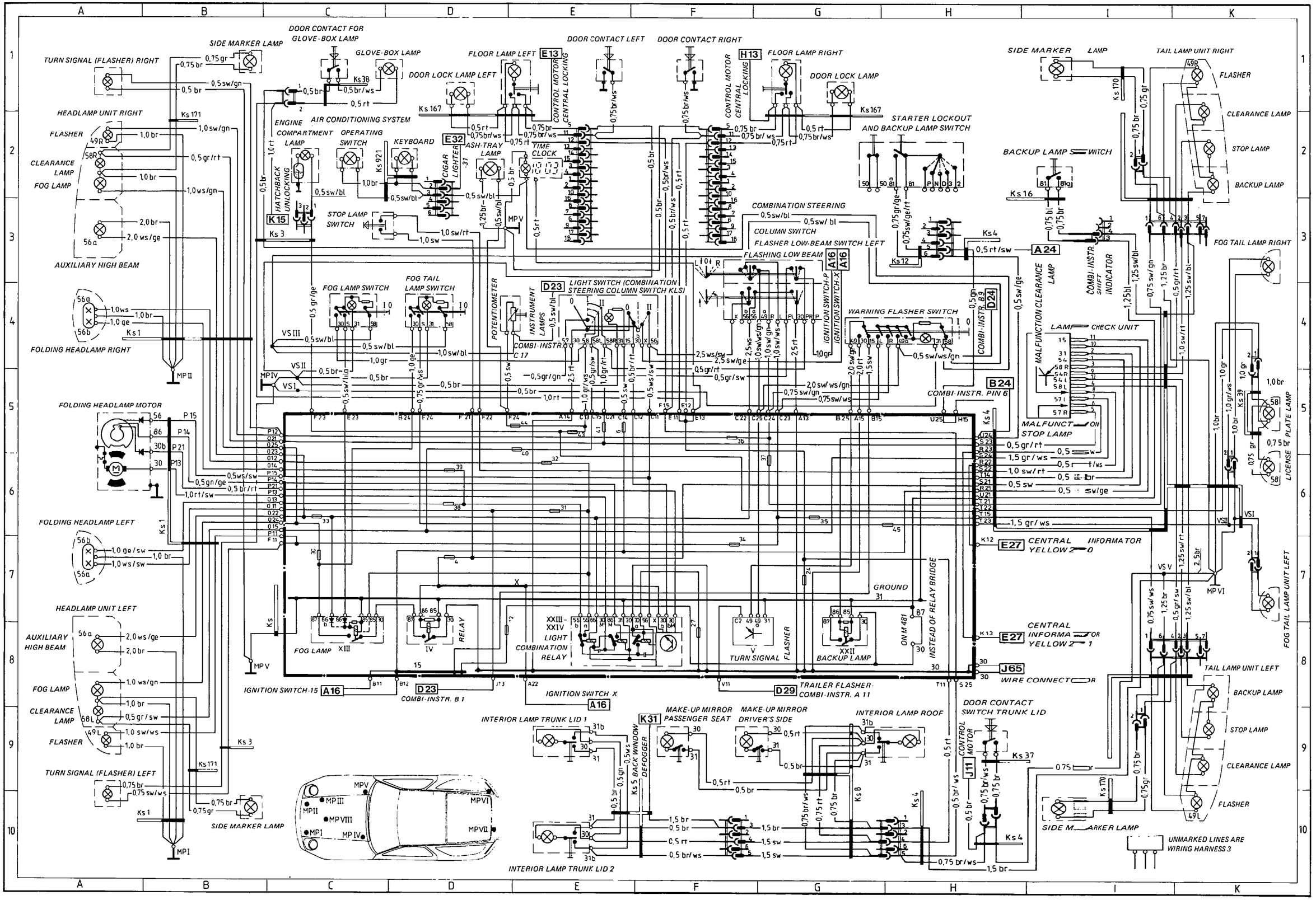
Printed in Germany - X, 1984

Wiring Diagram Type 928 S
Model 85 page 1

LAMPS

Wiring Diagram Type 928 S Model 85 page 1

LAMPS



Printed in Germany - X, 1984

SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

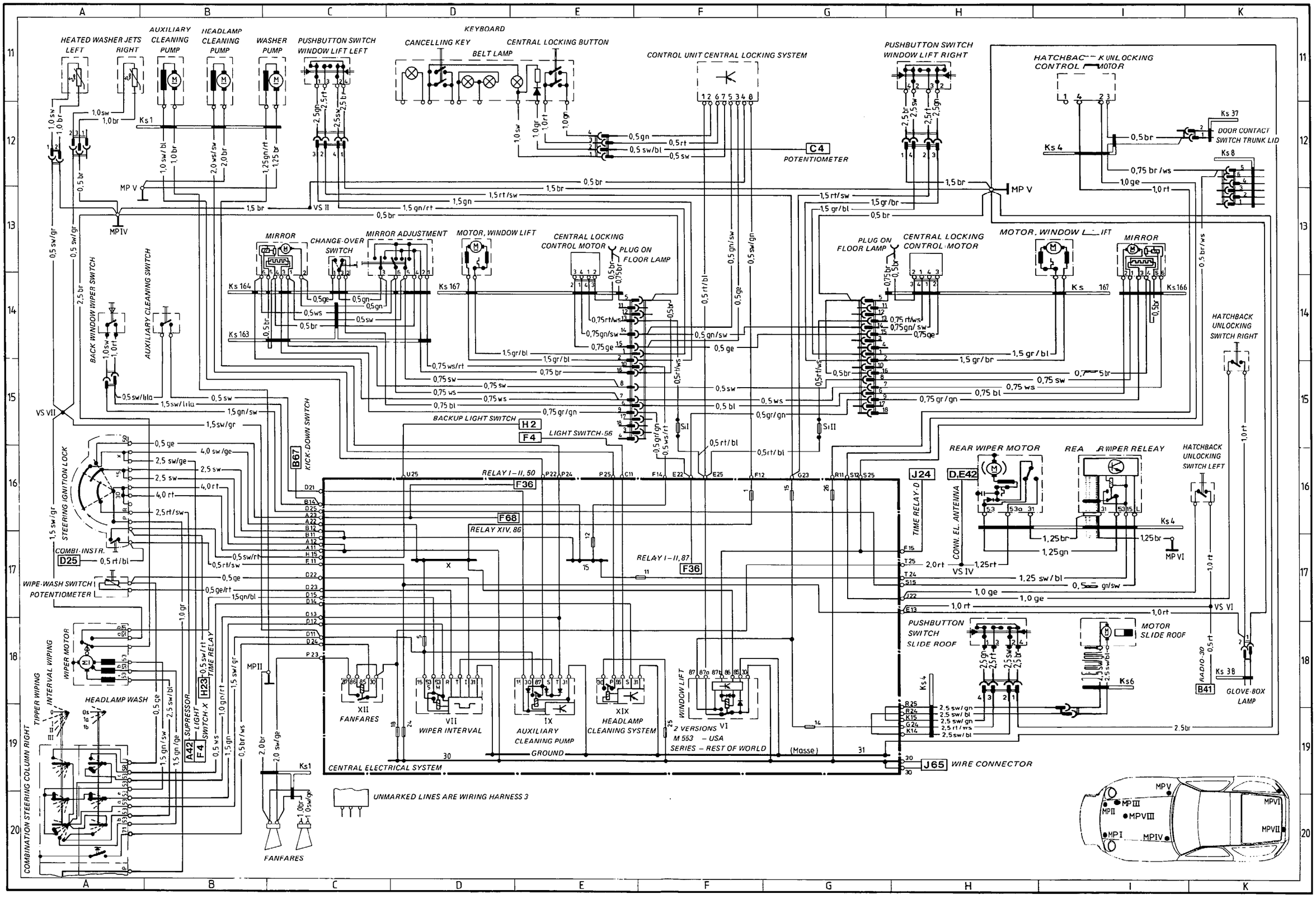
Current Flow Diagram 97-215

Wiring Diagram Type 928 S
Model 85 page 2

BODY

Wiring Diagram Type 928 S Model 85 page 2

BODY



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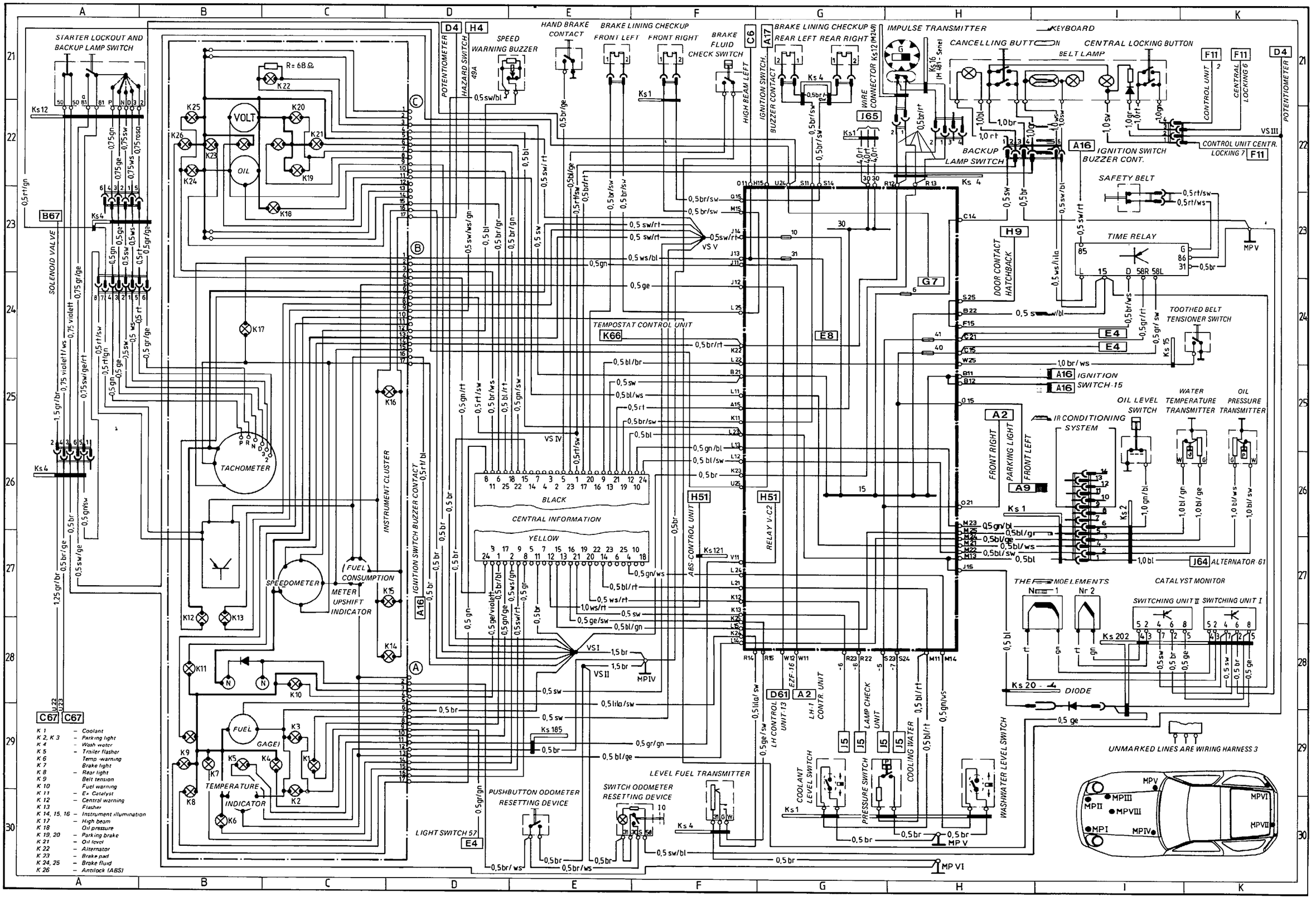
Current Flow Diagram 97-217

Wiring Diagram Type 928 S
Model 85 page 3

INSTRUMENT CLUSTER + INDICATORS

Wiring Diagram Type 928 S Model 85 page 3

INSTRUMENT CLUSTER + INDICATORS

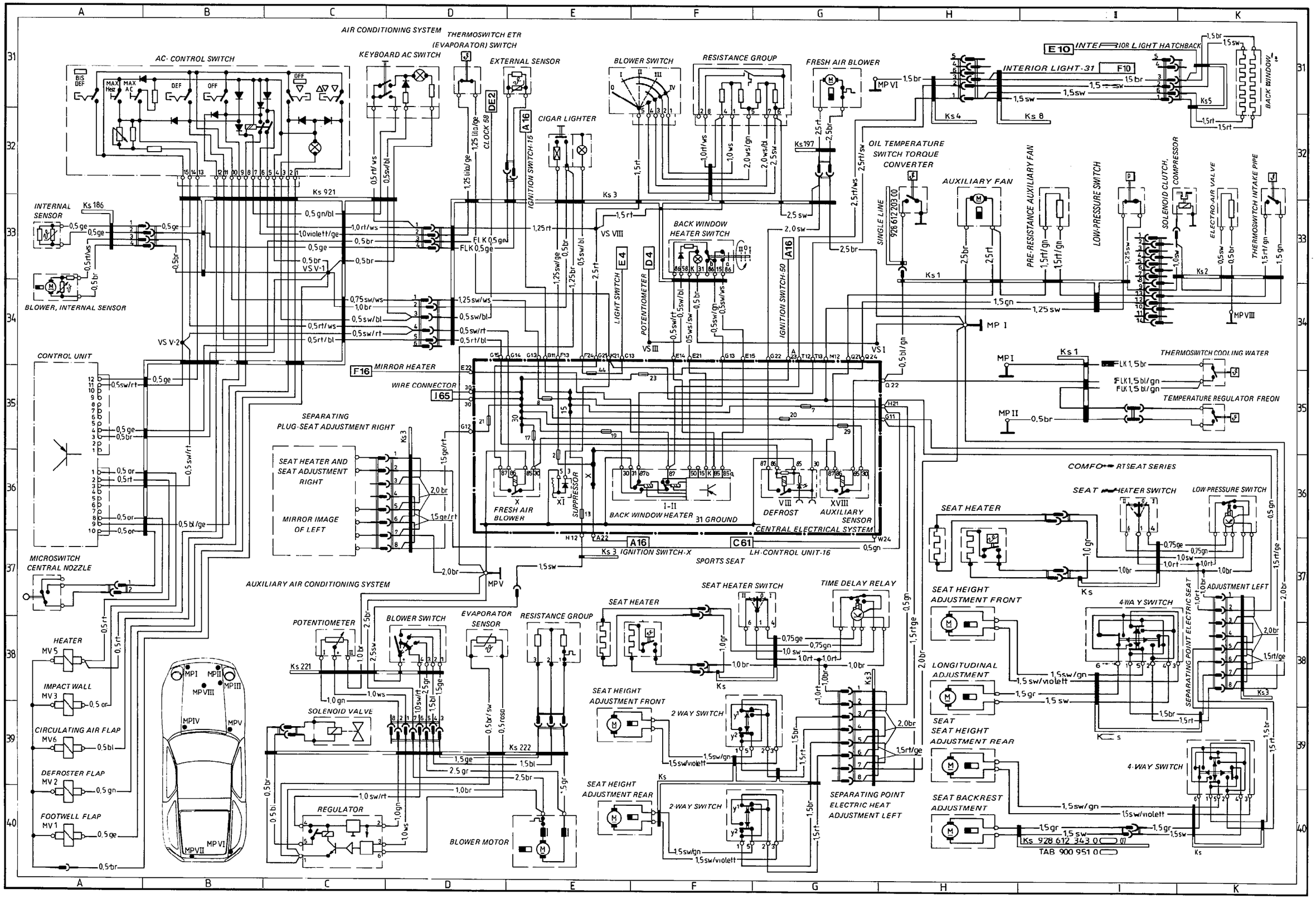


Wiring Diagram Type 928 S
Model 85 page 4

VENTILATION AND HEATING

Wiring Diagram Type 928 S Model 85 page 4

VENTILATION AND HEATING

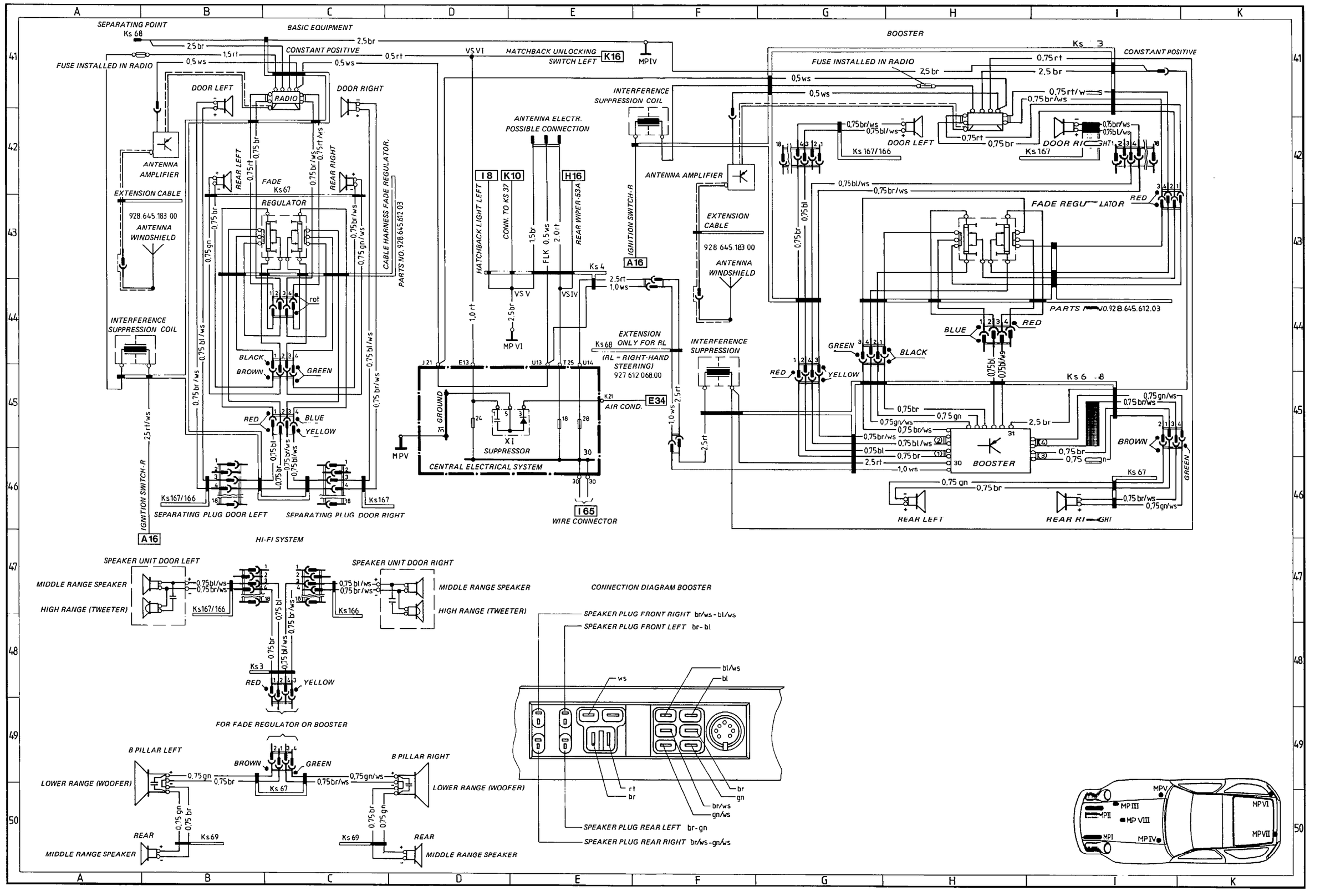


Wiring Diagram Type 928 S
Model 85 page 5

RADIO

Wiring Diagram Type 928 S Model 85 page 5

RADIO

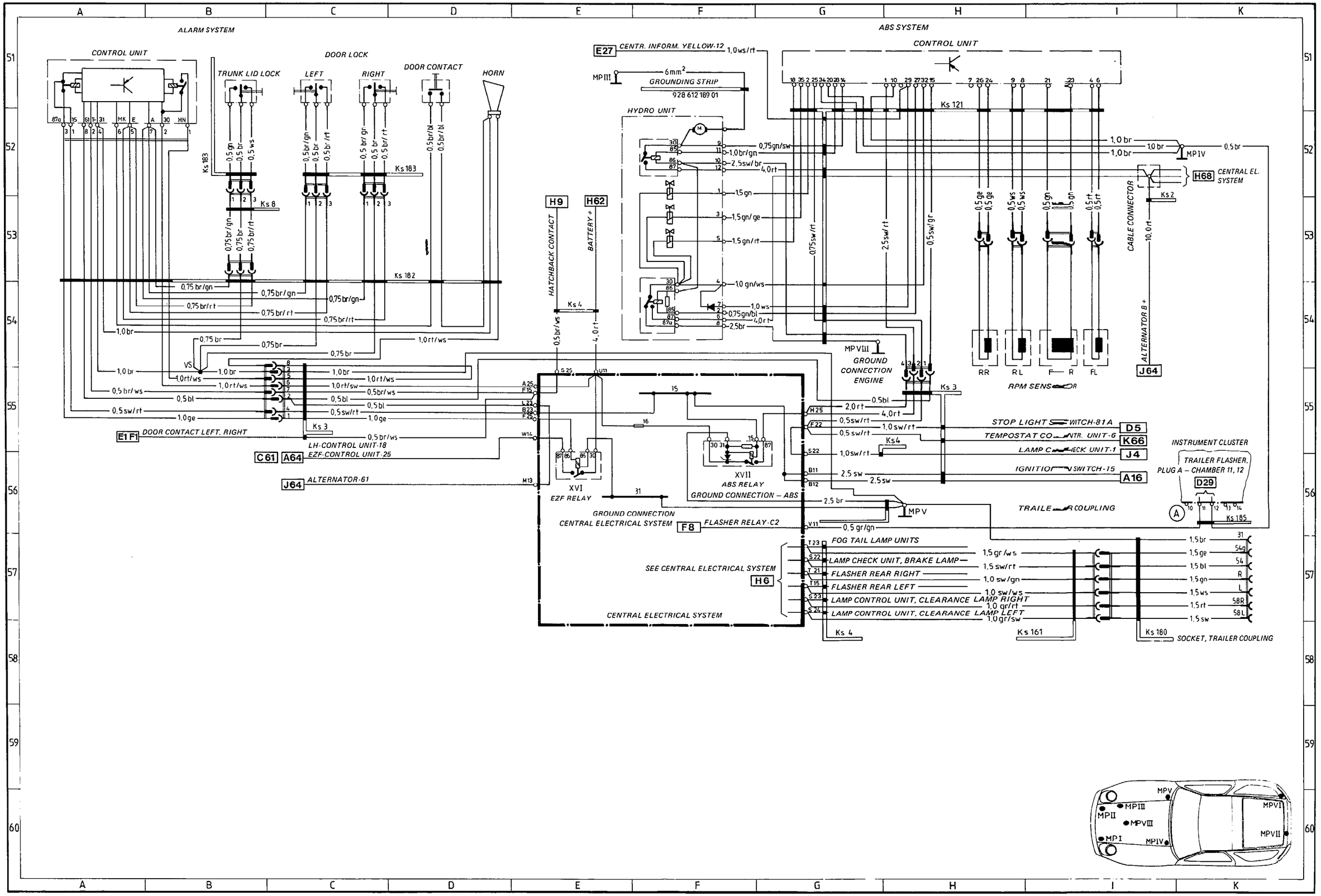


Wiring Diagram Type 928 S
Model 85 page 6

ABS, ALARM SYSTEM, TRAILER COUPLING

Wiring Diagram Type 928 S Model 85 page 6

ABS, ALARM SYSTEM, TRAILER COUPLING



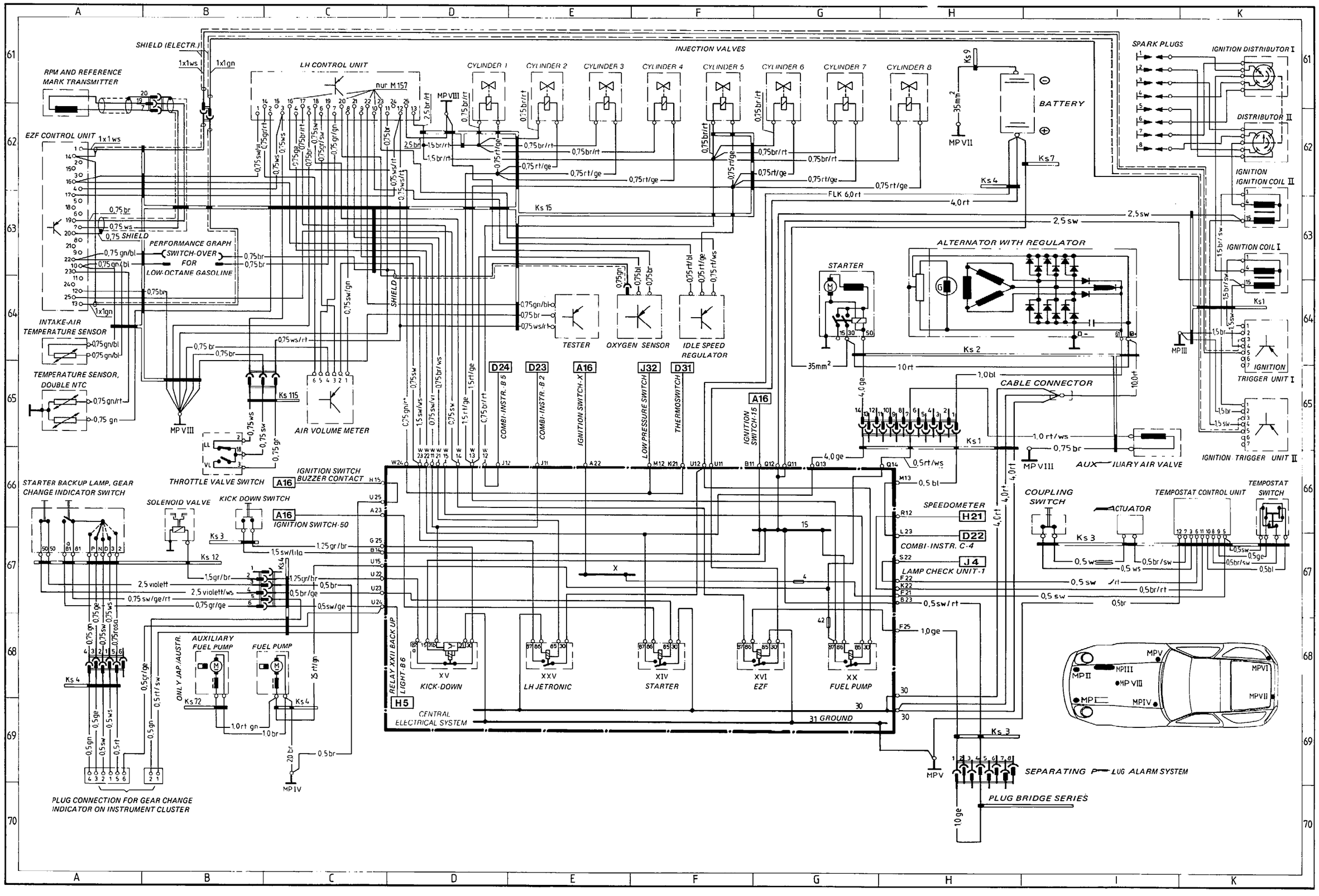
SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 85 page 7

ENGINE – DIGITAL ENGINE ELECTRONICS

Wiring Diagram Type 928 S Model 85 page 7

ENGINE – DIGITAL ENGINE ELECTRONICS



Printed in Germany - X, 1984

SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

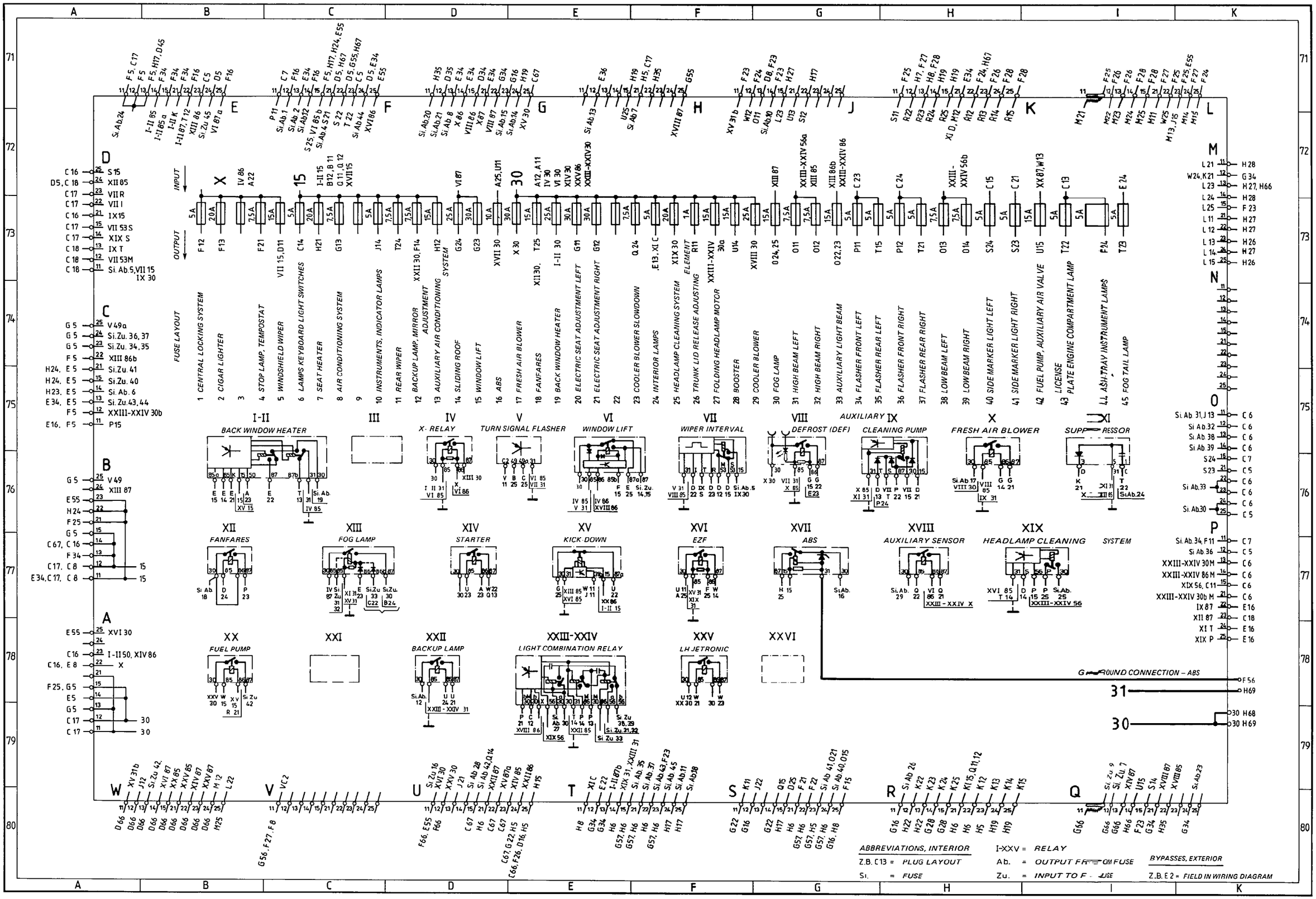
Current Flow Diagram 97-227

Wiring Diagram Type 928 S
Model 85 page 8

CENTRAL ELECTRICAL SYSTEM

Wiring Diagram Type 928 S Model 85 page 8

CENTRAL ELECTRICAL SYSTEM



Wiring Diagram Type 928 S
Model 86

PAGE 1	LAMPS ROW
PAGE 1	LAMPS USA
PAGE 2	BODY
PAGE 3	INSTRUMENT CLUSTER + INDICATORS
PAGE 4	VENTILATION, HEATING, AIR CONDITIONING ELECTRICALLY OPERATED SEATS
PAGE 5	RADIO
PAGE 6	ABS, ALARM SYSTEM, TRAILER COUPLING
PAGE 7	ENGINE – DIGITAL ENGINE ELECTRONICS
PAGE 8	CENTRAL ELECTRICAL SYSTEM

Wiring Diagram Type 928 S Model 86

The wiring diagram comprises nine individual wiring diagrams.
They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central electrical system within a dash-dot frame.

This part of the central electrical system shows all the lines and relays required for individual wiring diagram.

The ground-connecting points are designated with "MP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Part 2 is the "module element".

Both parts are identified by the digits 1 . . . 5.

Part 3 is a "coding element".

The designations of the plug connections in wiring diagram for central electrical system refer e. g. from A 11 . . . 15 to the "initial element", from A 21 . . . 26 to module element.

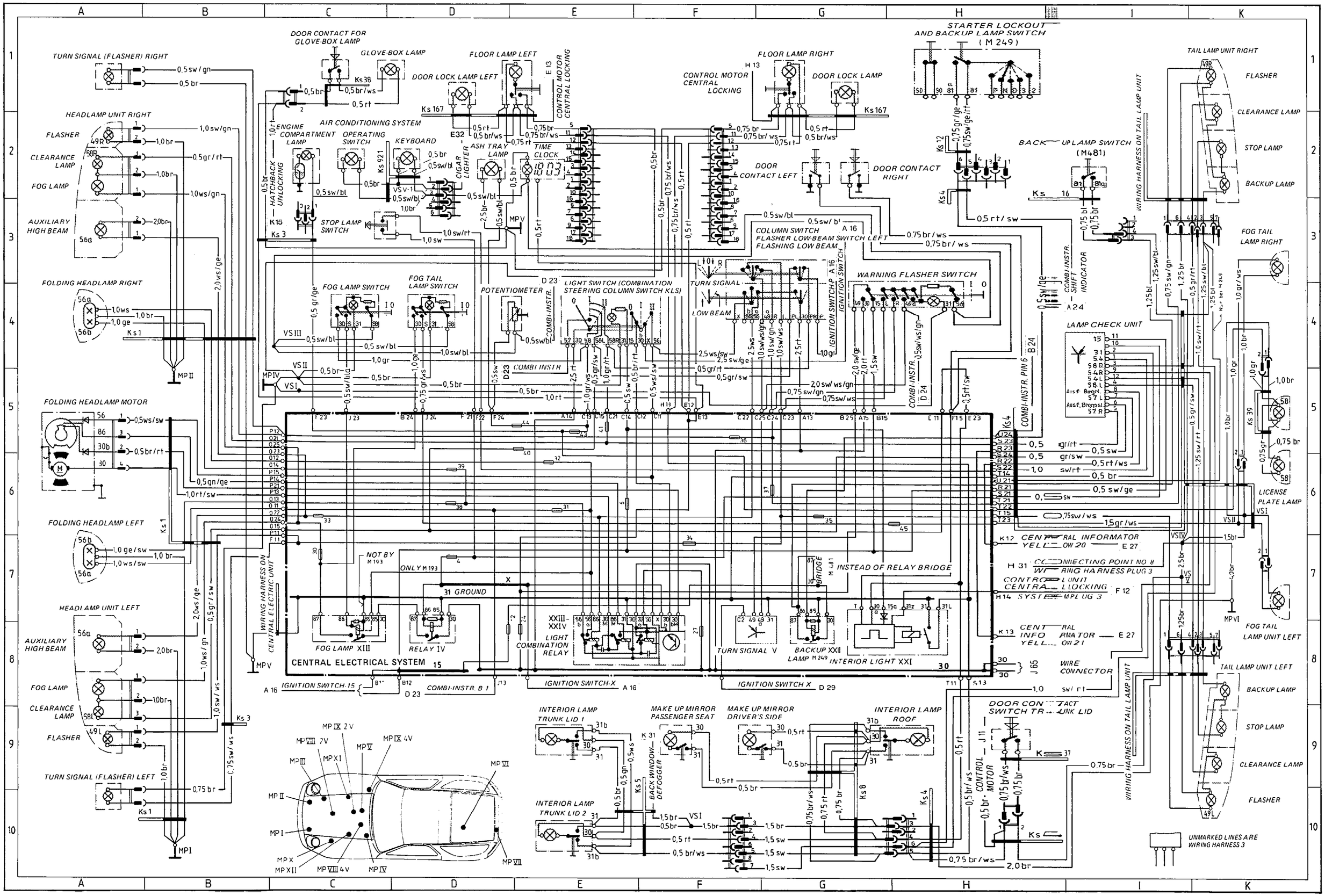
Printed in Germany-XI, 1985

Wiring Diagram Type 928 S
Model 86 page 1

LAMPS ROW

Wiring Diagram Type 928 S Model 86 page 1

LAMPS ROW



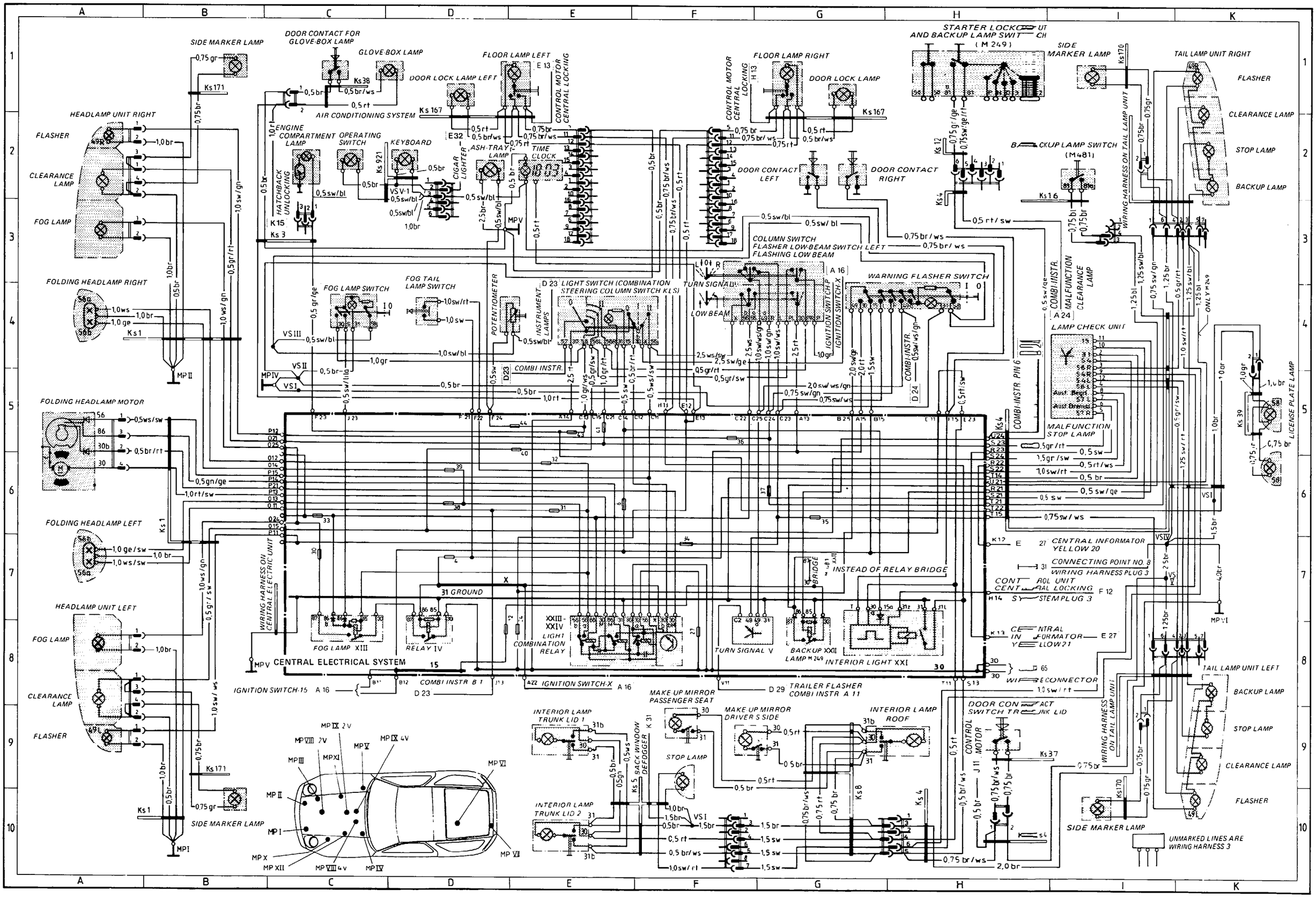
SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET MP = GROUND TERMINALS

Wiring Diagram Type 928 S
Model 86 page 1

LAMPS USA

Wiring Diagram Type 928 S Model 86 page 1

LAMPS USA



Printed in Germany - XV, 1987

SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

MP = GROUND TERMINALS

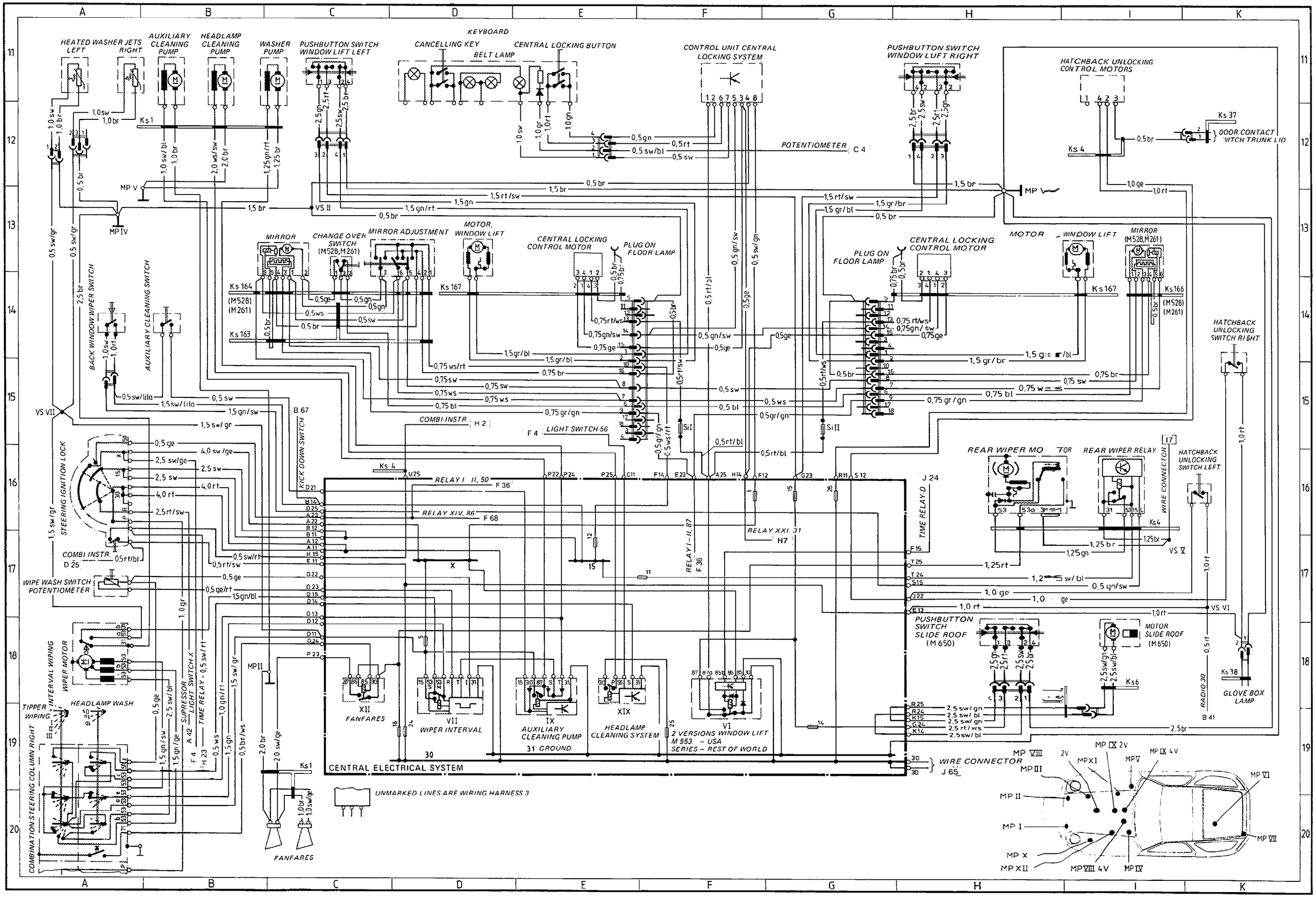
Current Flow Diagram 97-237

Wiring Diagram Type 928 S
Model 86 page 2

BODY

Wiring Diagram Type 928 S Model 86 page 2

BODY

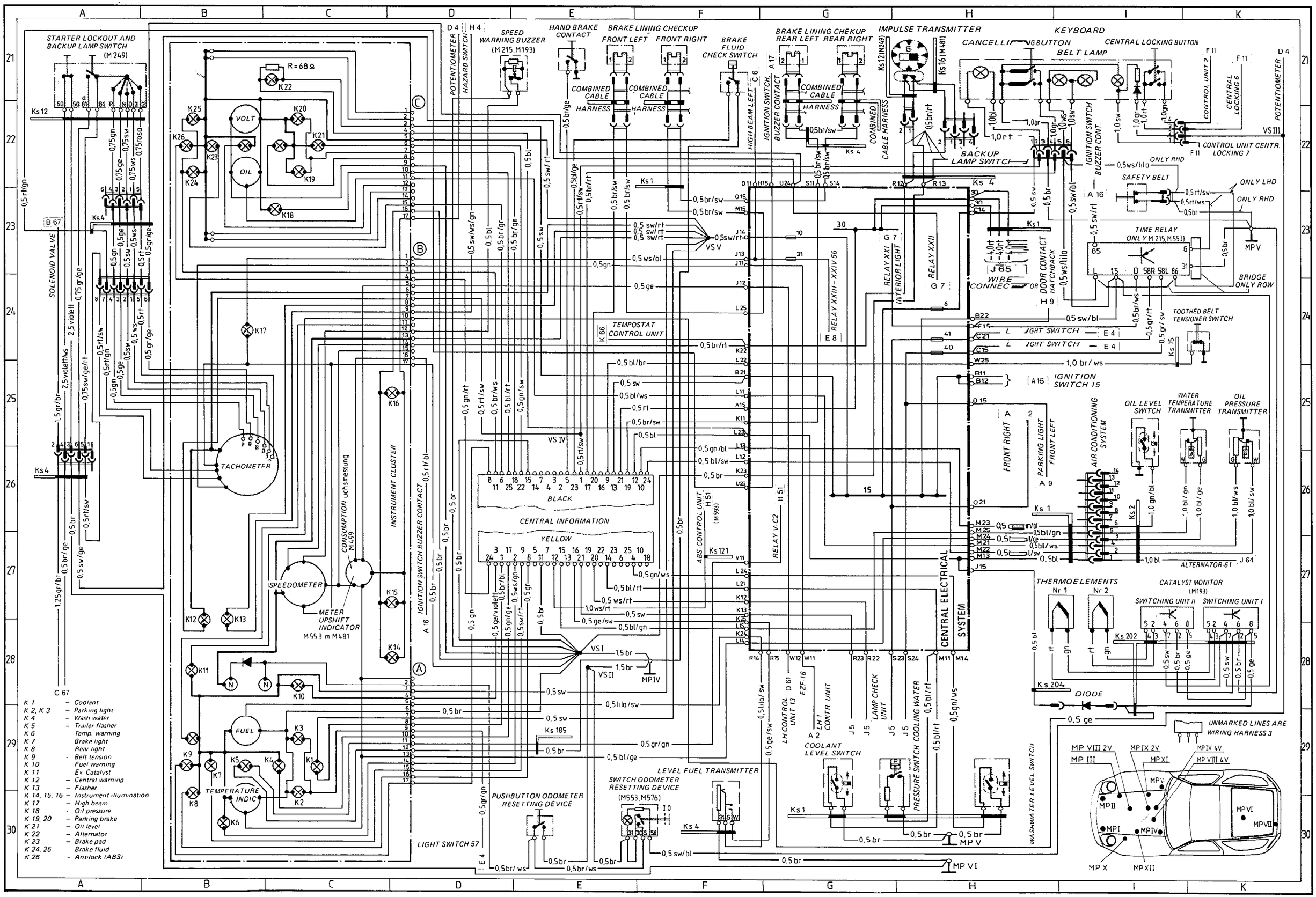


Wiring Diagram Type 928 S
Model 86 page 3

INSTRUMENT CLUSTER + INDICATORS

Wiring Diagram Type 928 S Model 86 page 3

INSTRUMENT CLUSTER + INDICATORS



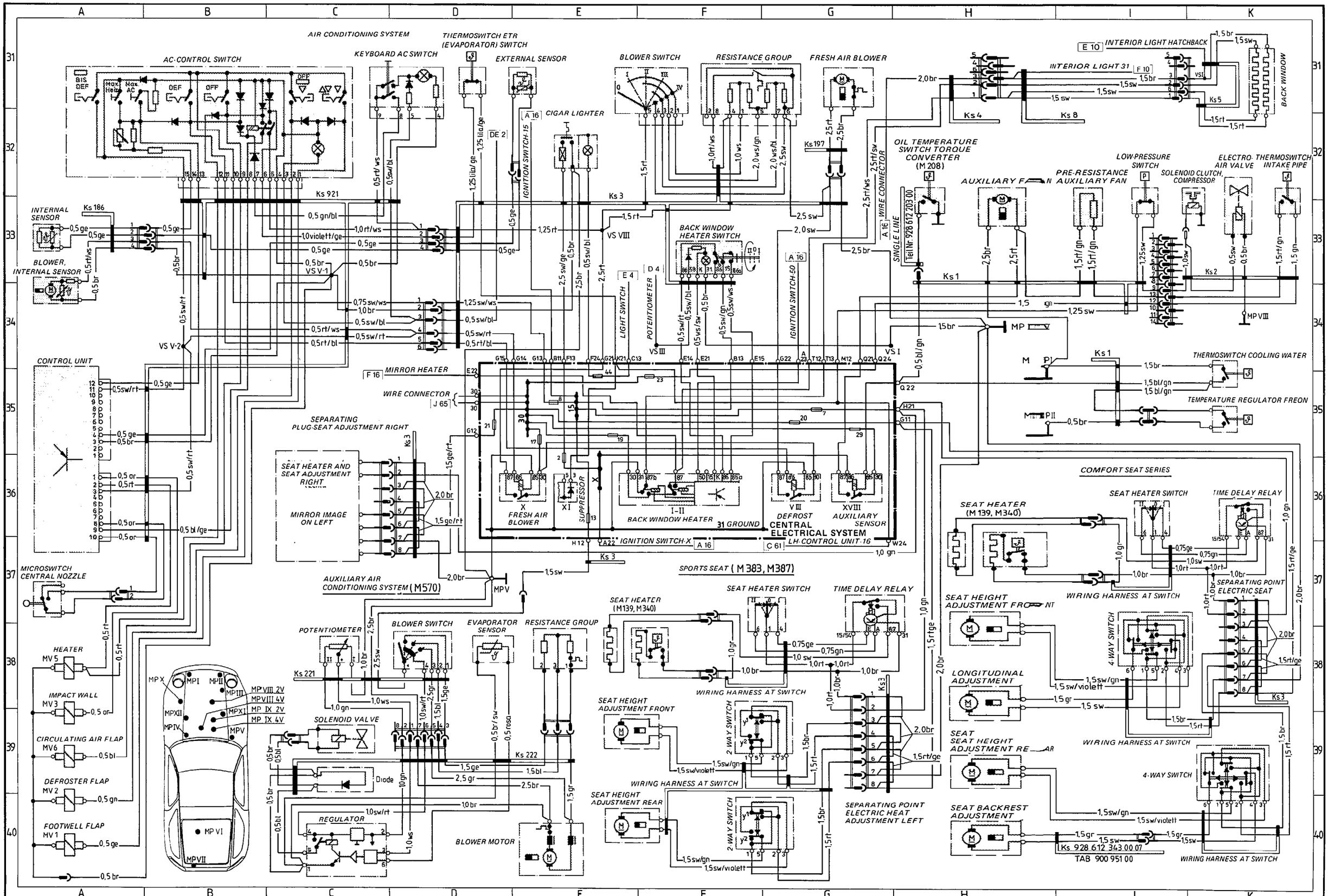
Wiring Diagram Type 928 S
Model 86 page 4

VENTILATION, HEATING, AIR CONDITIONING

ELECTRICALLY OPERATED SEATS

Wiring Diagram Type 928 S Model 86 page 4

VENTILATION, HEATING, AIR CONDITIONING ELECTRICALLY OPERATED SEATS



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SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET MP = GROUND TERMINALS

Wiring Diagram Type 928 S
Model 86 page 5

RADIO

Wiring Diagram Type 928 S Model 86 page 5

RADIO

(M158/M686/M688) STANDARD EQUIPED WITHOUT RADIO

HI-FI SYSTEM (M490)

(M158/M686/M688) BOOSTER (M494)

(M327/M328/M330) BOOSTER (M494)

(M327/M328/M330)

CONNECTION DIAGRAM BOOSTER

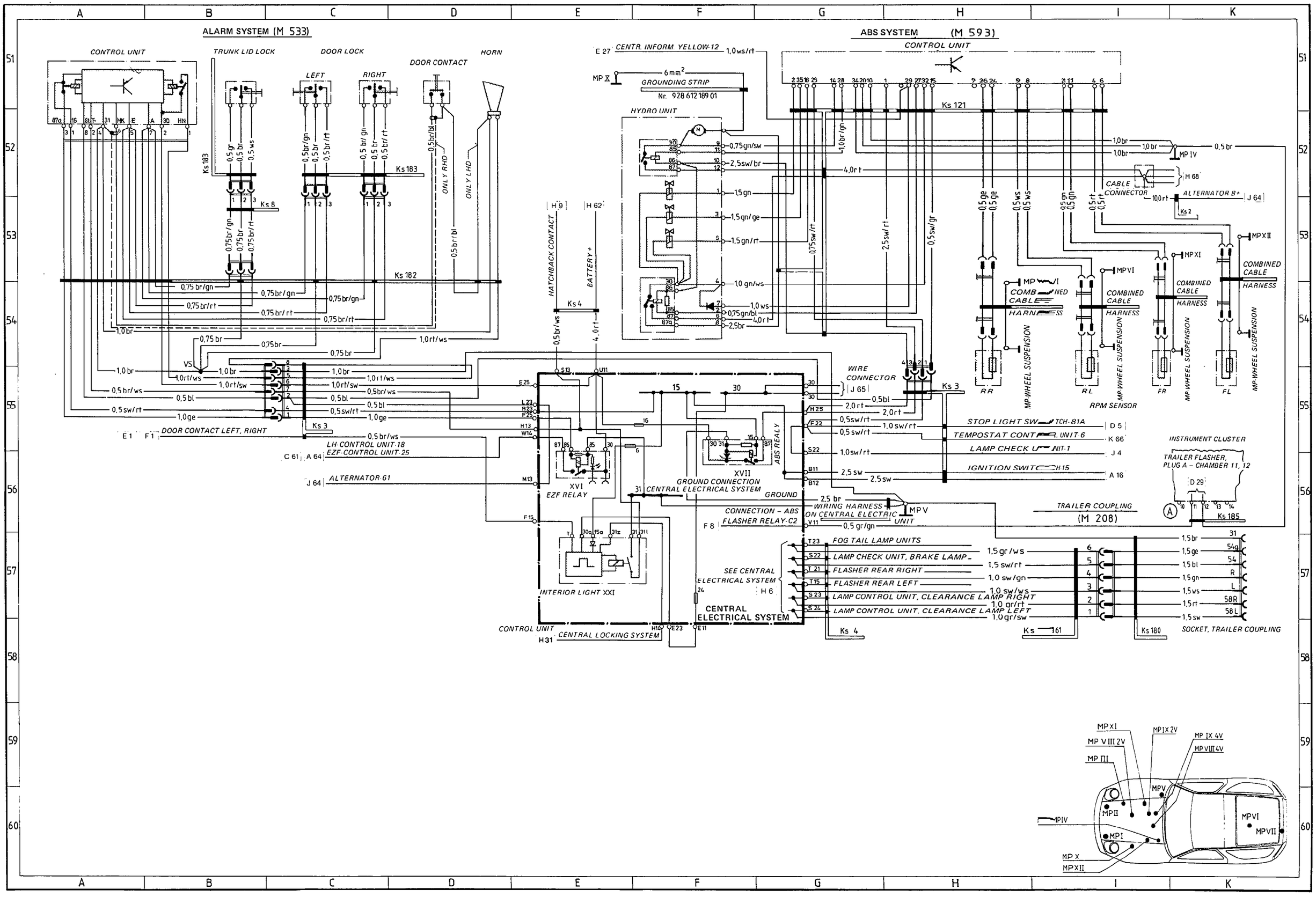
CENTRAL ELECTRICAL SYSTEM

Wiring Diagram Type 928 S
Model 86 page 6

ABS, ALARM SYSTEM, TRAILER COUPLING

Wiring Diagram Type 928 S Model 86 page 6

ABS, ALARM SYSTEM, TRAILER COUPLING



Printed in Germany - XI, 1985

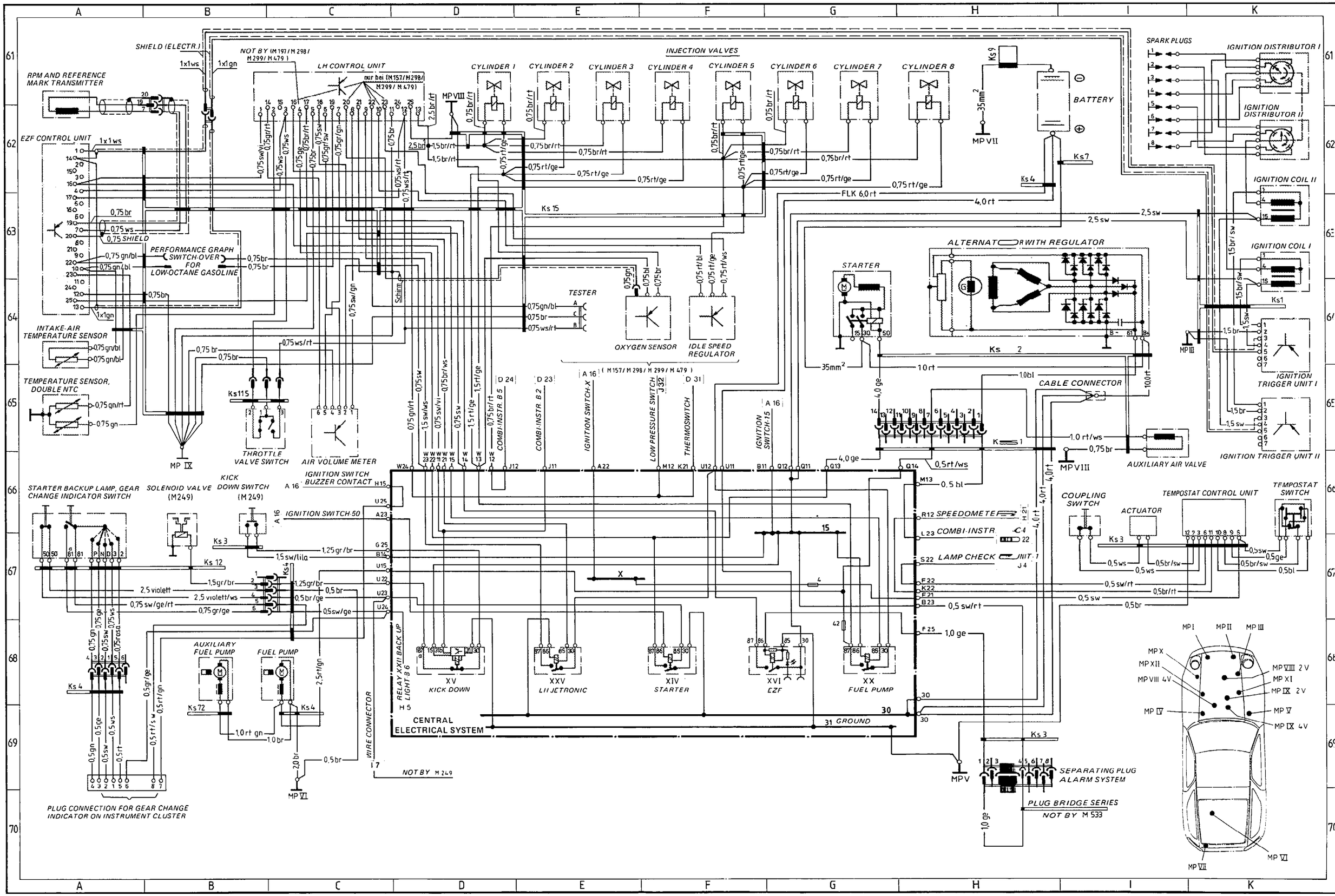
SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET MP = GROUND TERMINALS

Wiring Diagram Type 928 S
Model 86 page 7

ENGINE – DIGITAL ENGINE ELECTRONICS

Wiring Diagram Type 928 S Model 86 page 7

ENGINE – DIGITAL ENGINE ELECTRONICS

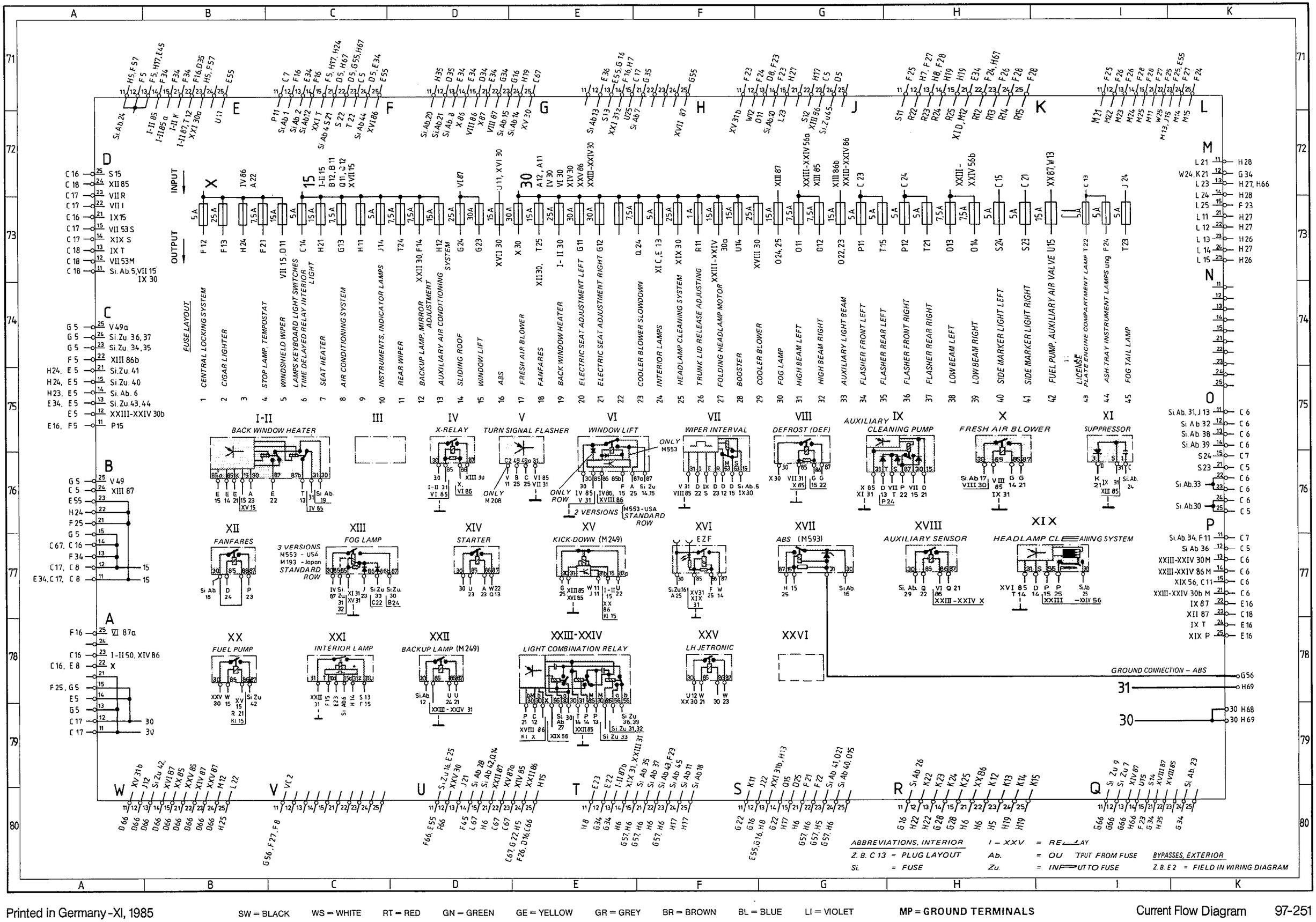


Wiring Diagram Type 928 S
Model 86 page 8

CENTRAL ELECTRICAL SYSTEM

Wiring Diagram Type 928 S Model 86 page 8

CENTRAL ELECTRICAL SYSTEM



Wiring Diagram Type 928 S
Model 87

PAGE 1 LAMPS ROW

PAGE 2 LAMPS USA

PAGE 3 BODY

PAGE 4 INSTRUMENTS AND INDICATORS

PAGE 5 VENTILATION, HEATING, AC

PAGE 6 MIRROR, SEAT ADJUSTMENT

PAGE 7 SEAT- AND MIRROR MEMORY

PAGE 8 RADIO

PAGE 9 ABS, ALARM SYSTEM, TRAILER COUPLING

PAGE 10 ENGINE COMPARTMENT, TEMPOSTAT

PAGE 11 CENTRAL ELECTRICAL SYSTEM

Wiring Diagram Type 928 S Model 87

The wiring diagram comprises **11** individual wiring diagrams.
They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central electrical system within a dash-dot frame.

This part of the central electrical system shows all the lines and relays required for individual wiring diagram.

The ground-connecting points are designated with "MP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Part 2 is the "module element".

Both parts are identified by the digits 1 . . . 5.

Part 3 is a "coding element".

The designations of the plug connections in wiring diagram for central electrical system refer e. g. from A 11 . . . 15 to the "initial element", from A 21 . . . 26 to module element.

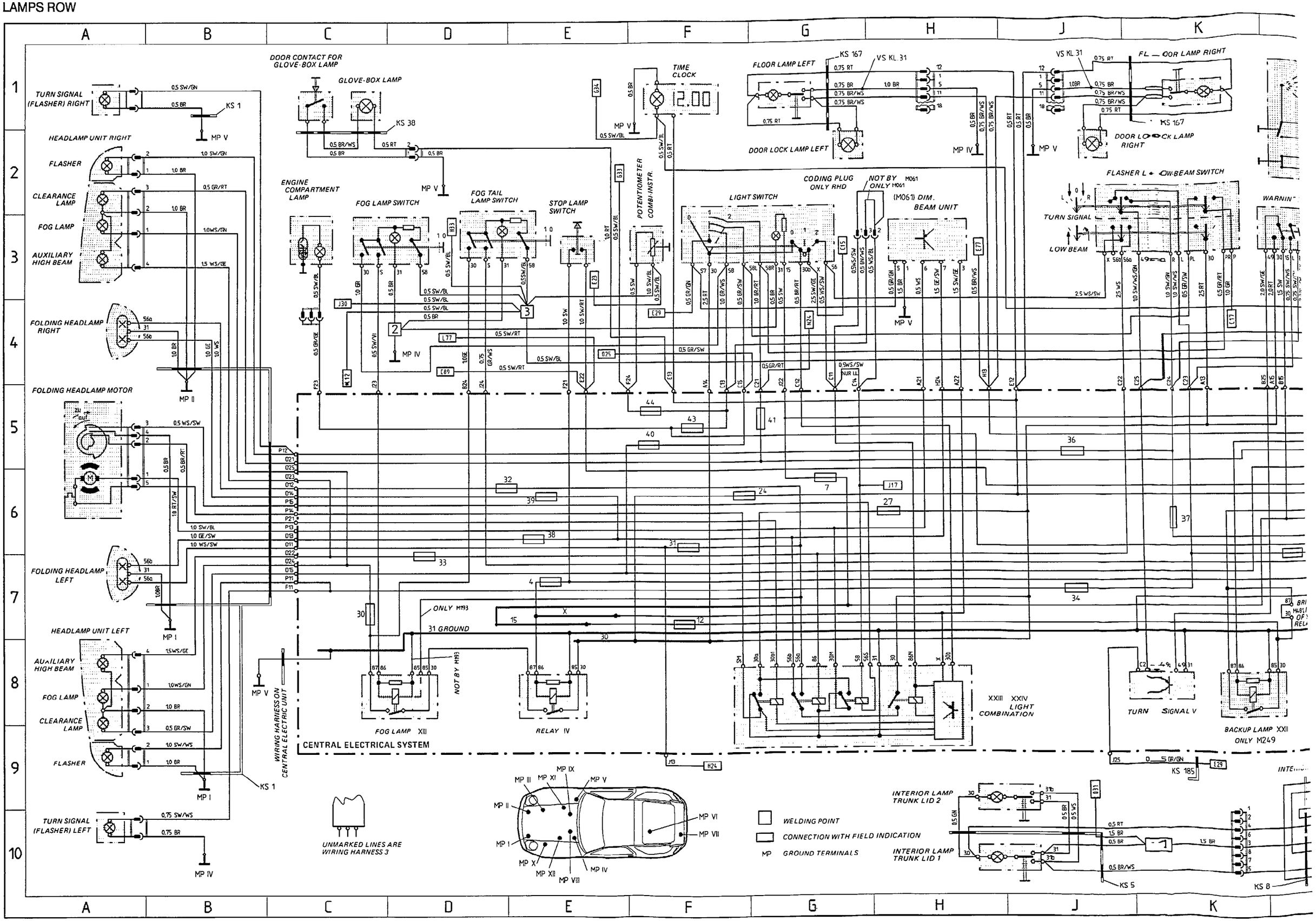
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Wiring Diagram Type 928 S
Model 87 page 1

LAMPS ROW

Wiring Diagram Type 928 S Model 87 page 1

LAMPS ROW



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SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

F G H J K L M N O P

TIME CLOCK

FLOOR LAMP LEFT

DOOR LOCK LAMP LEFT

FLOOR LAMP RIGHT

DOOR LOCK LAMP RIGHT

(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH

LAMP CHECK UNIT

TAIL LAMP UNIT RIGHT

FOG TAIL LAMP RIGHT

CLEARANCE LAMP

FLASHER

STOP LAMP

BACKUP LAMP

CODING PLUG ONLY RHD

NOT BY ONLY M061

(M061) DIM. BEAM UNIT

LIGHT SWITCH

FLASHER LOW-BEAM SWITCH

TURN SIGNAL

LOW BEAM

WARNING FLASHER SWITCH

DOOR CONTACT LEFT

DOOR CONTACT RIGHT

BACKUP LAMP SWITCH (M481)

LICENSE PLATE LAMP

BRIDGE M481 INSTEAD OF X11 RELAY BRIDGE

XXIII XXIV LIGHT COMBINATION

TURN SIGNAL V

BACKUP LAMP XXII ONLY M249

INTERIOR LAMP XXI

DOOR CONTACT SWITCH TRUNK LID

INTERIOR LAMP ROOF

INTERIOR LAMP TRUNK LID 2

INTERIOR LAMP TRUNK LID 1

TAIL LAMP UNIT LEFT

MP VI

MP VII

WELDING POINT

CONNECTION WITH FIELD INDICATION

MP GROUND TERMINALS

1 2 3 4 5 6 7 8 9 10

F G H J K L M N O P

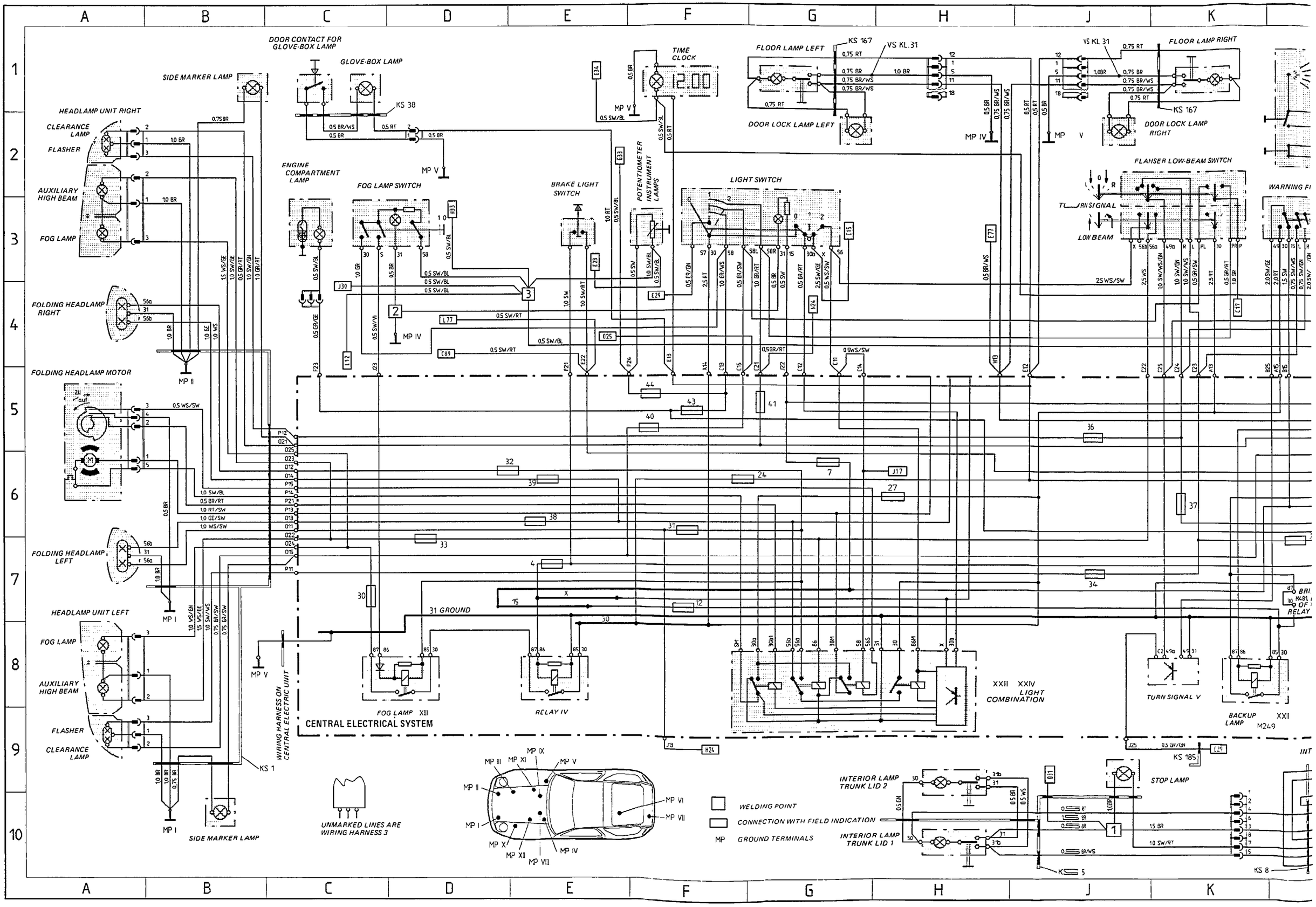
WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 2

LAMPS USA

Wiring Diagram Type 928 S Model 87 page 2

LAMPS USA



Printed in Germany - XIV, 1986

SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

F G H J K L M N O P

TIME CLOCK

FLOOR LAMP LEFT

KS 167

VS KL. 31

0.75 RT

0.75 BR

0.75 BR/WS

1.0 BR

DOOR LOCK LAMP LEFT

MP IV

MP V

FLOOR LAMP RIGHT

DOOR LOCK LAMP RIGHT

(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH

0.75 SW/GE/RT

0.75 GR/GE

0.5 RT/SW

0.5 SW/GE

KS 12

LAMP CHECK UNIT

SIDE MARKER LAMP

KS 170

0.75 GR

0.75 BR

TAIL LAMP UNIT RIGHT

FLASHER

CLEARANCE LAMP

STOP LAMP

BACKUP LAMP

LIGHT SWITCH

FLAHSER LOW-BEAM SWITCH

TURN SIGNAL

LOW BEAM

WARNING FLASHER SWITCH

DOOR CONTACT LEFT

DOOR CONTACT RIGHT

BACKUP LAMP SWITCH (M48 ➝1)

KS 16

KS 39

LICENSE PLATE LAMP

KS 4

MPVI

BRIDGE M48 INSTEAD OF 308 RELAY BRIDGE

XXIII XXIV LIGHT COMBINATION

TURN SIGNAL V

BACKUP LAMP M249 XXII

INTERIOR LIGHT XXI

DOOR CONTACT SWITCH TRUNK LID

KS 185

KS 37

INTERIOR LAMP ROOF

INTERIOR LAMP TRUNK LID 2

INTERIOR LAMP TRUNK LID 1

STOP LAMP

KS 5

KS 8

TAIL LAMP UNIT LEFT

SIDE MARKER LAMP

NUR M249

MP VI

MP VII

WELDING POINT

CONNECTION WITH FIELD INDICATION

MP GROUND TERMINALS

1 2 3 4 5 6 7 8 9 10

F G H J K L M N O P

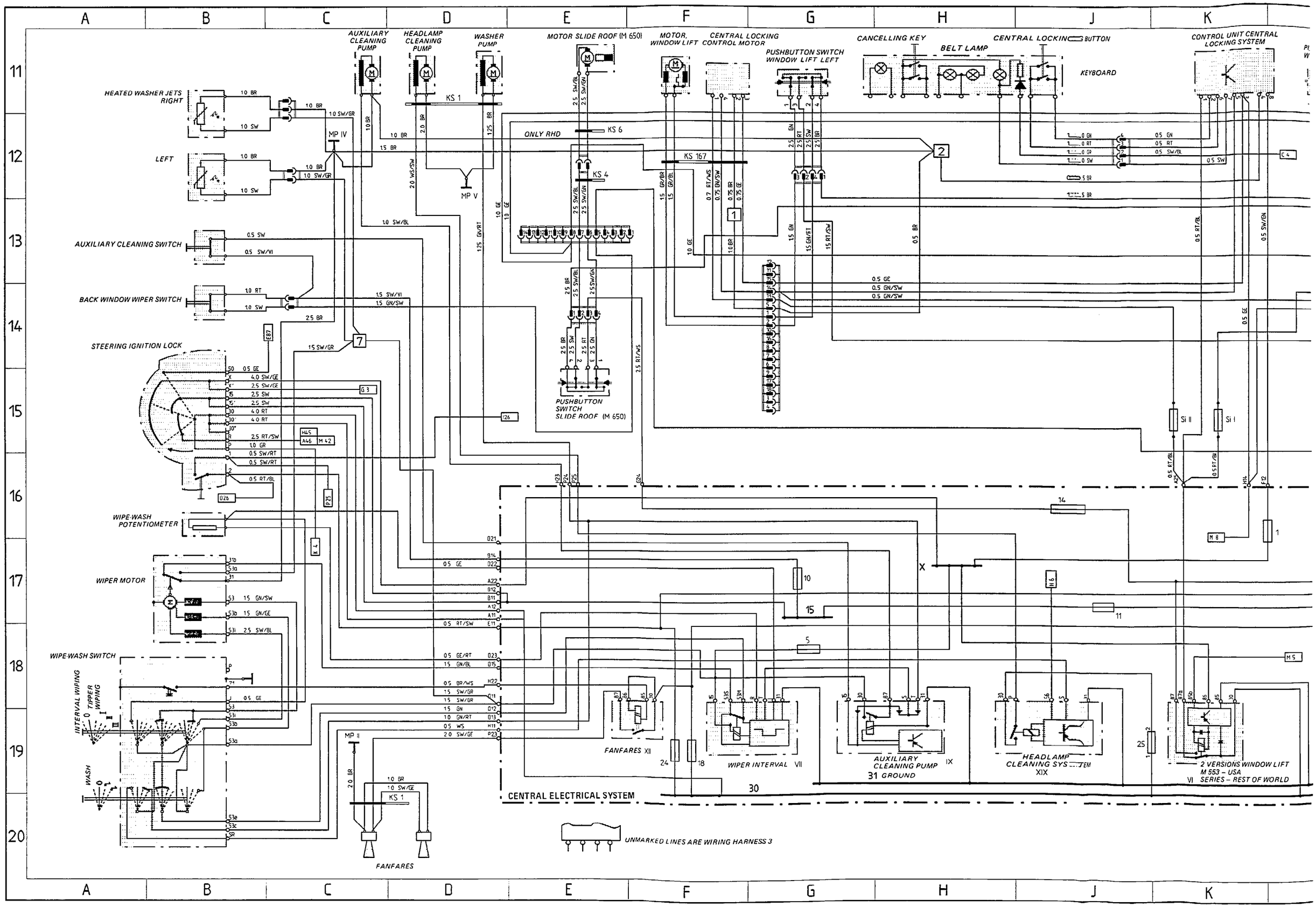
BK = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 3

BODY

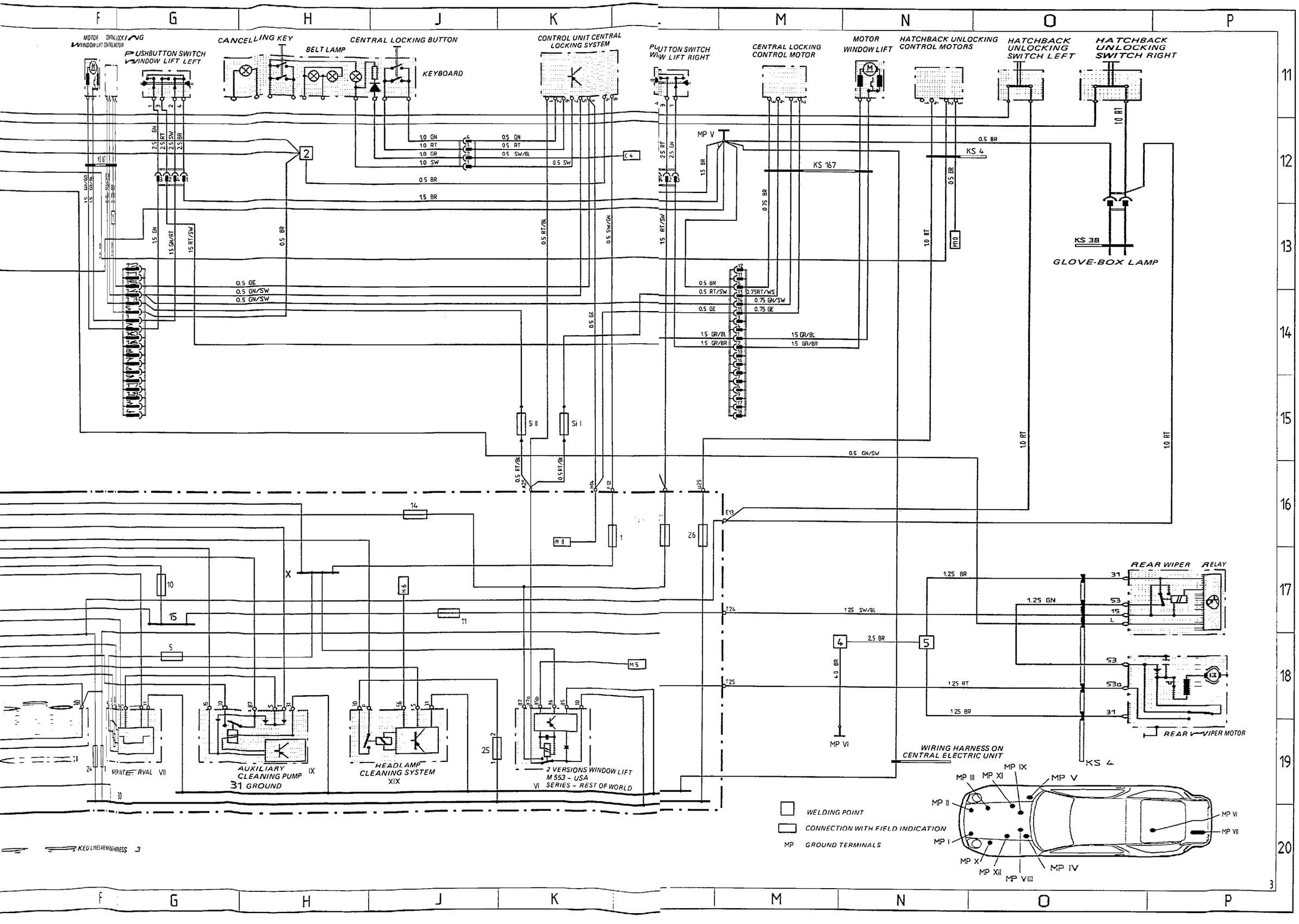
Wiring Diagram Type 928 S Model 87 page 3

BODY



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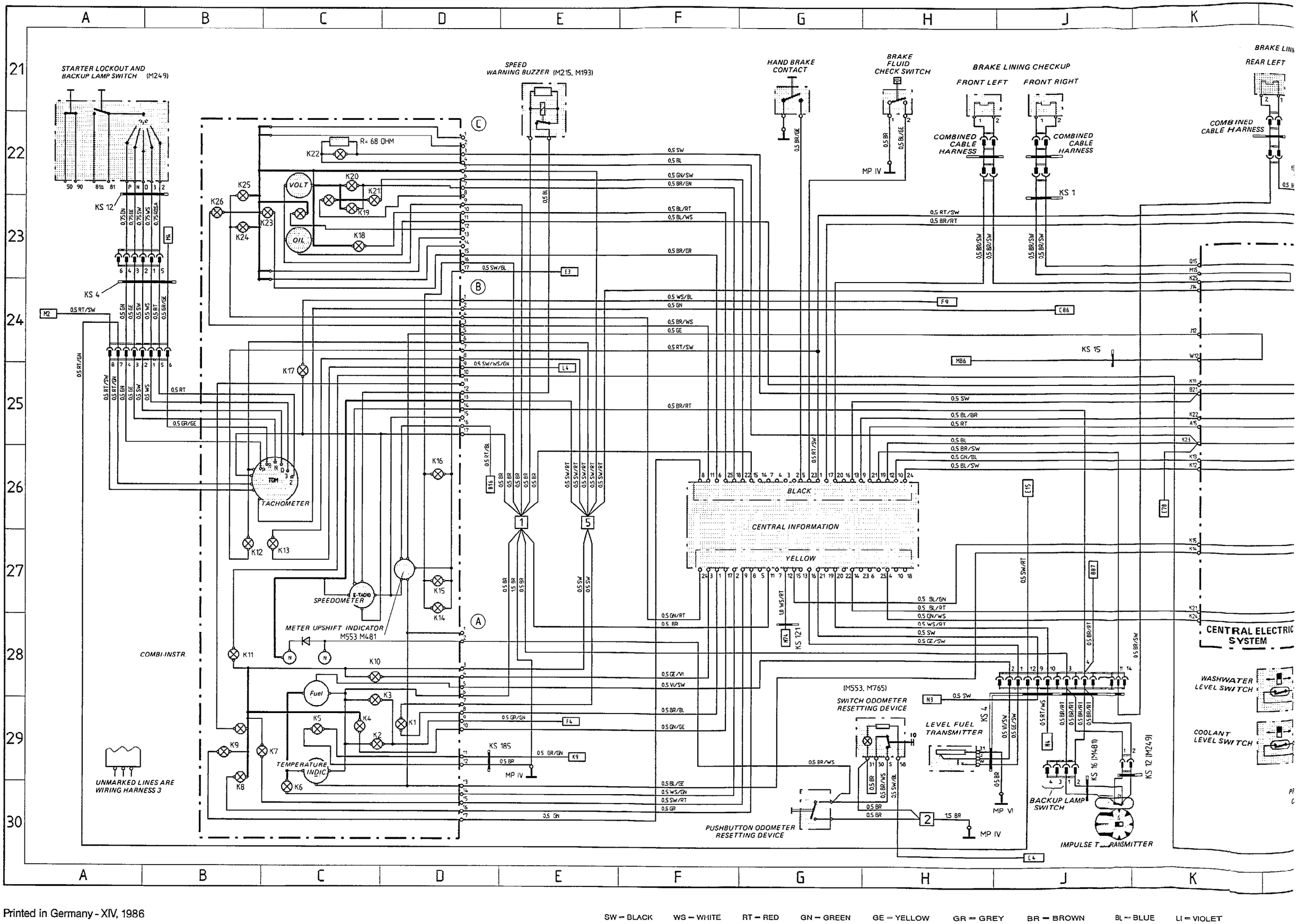
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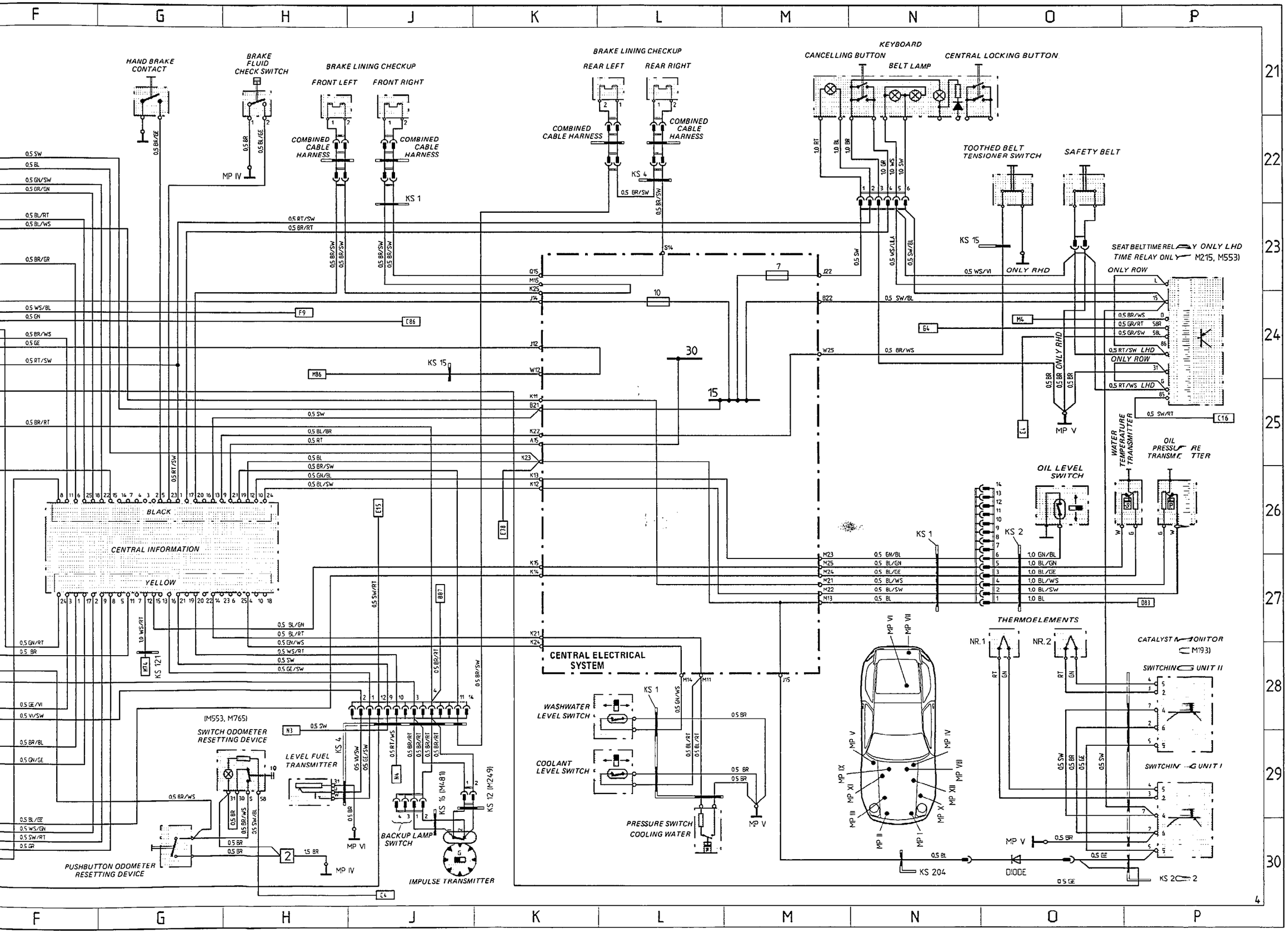
Wiring Diagram Type 928 S
Model 87 page 4

INSTRUMENTS AND INDICATORS

Wiring Diagram Type 928 S Model 87 page 4

INSTRUMENTS AND INDICATORS


STARTER LOCKOUT AND BACKUP LAMP SWITCH (M249)
SPEED WARNING BUZZER (M215, M193)
HAND BRAKE CONTACT
BRAKE FLUID CHECK SWITCH
BRAKE LINING CHECKUP
FRONT LEFT
FRONT RIGHT
REAR LEFT
COMBINED CABLE HARNESS
R= 68 OHM
K22
K20
K21
K19
K18
K25
K26
K23
K24
VOLT
OIL
K17
K16
K12
K13
K15
K14
K11
K10
K3
K5
K4
K2
K1
K9
K7
K8
K6
TACHOMETER
SPEEDOMETER
METER UPSHIFT INDICATOR M553 M481
COMBI-INSTR.
TEMPERATURE INDIC.
Fuel
KS 4
KS 12
KS 1
KS 15
KS 185
KS 121
KS 16 (M481)
KS 12 (M249)
MP IV
MP VI
UNMARKED LINES ARE WIRING HARNESS 3
BLACK
CENTRAL INFORMATION
YELLOW
(M553, M765)
SWITCH ODOMETER RESETTING DEVICE
PUSHBUTTON ODOMETER RESETTING DEVICE
LEVEL FUEL TRANSMITTER
BACKUP LAMP SWITCH
IMPULSE TRANSMITTER
CENTRAL ELECTRIC SYSTEM
WASHWATER LEVEL SWITCH
COOLANT LEVEL SWITCH
0.5 SW
0.5 BL
0.5 GN/SW
0.5 BR/GN
0.5 BL/RT
0.5 BL/WS
0.5 BR/GR
0.5 SW/BL
0.5 WS/BL
0.5 GN
0.5 BR/WS
0.5 GE
0.5 RT/SW
0.5 SW/WS/GN
0.5 RT
0.5 GR/GE
0.5 BR/RT
0.5 RT/BL
0.5 SW/RT
0.5 GN/RT
0.5 BR
1.0 WS/RT
0.5 BL/GN
0.5 GN/WS
0.5 WS/RT
0.5 GE/SW
0.5 GE/VI
0.5 VI/SW
0.5 BR/BL
0.5 GN/GE
0.5 GR/GN
0.5 BL/GE
0.5 WS/GN
0.5 GR
0.5 RT/SW
0.5 BR/SW
0.5 GN/BL
0.5 BL/SW
0.5 BL/BR
1.5 BR
1.5 SW/RT
0.5 BR/SW
0.5 SW/RT
0.5 BR/RT
0.5 RT/WS
0.5 SW/GE
0.5 BR/WS
0.5 SW/BL
0.5 BR
0.5 BR/RT
0.5 BR/SW
0.5 BR/RT
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0.5 BR/SW
0.5 BR/SW
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0.5 BR/SW
0.5 BR/SW
0.5 BR/SW



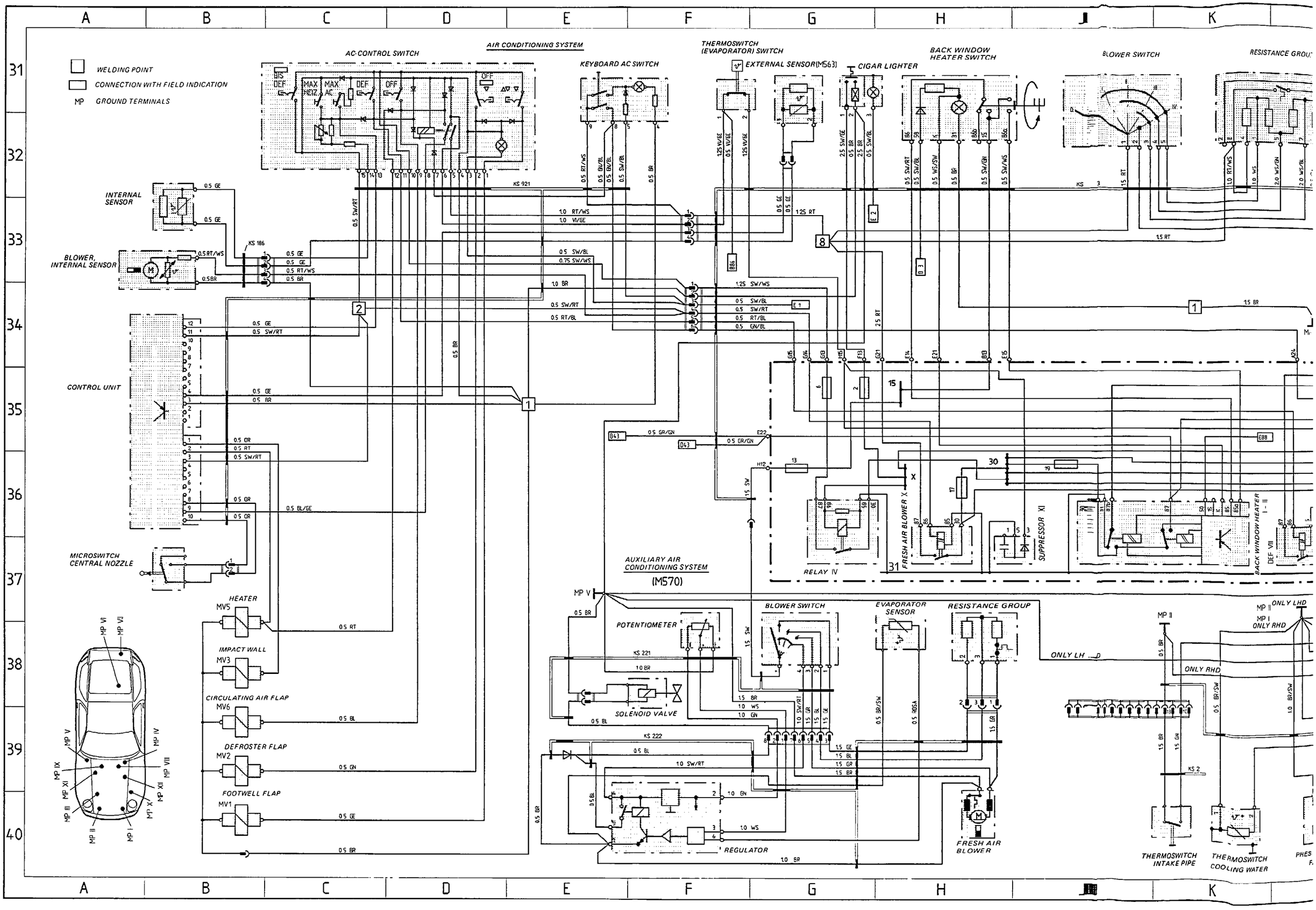
CK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 5

VENTILATION, HEATING, AC

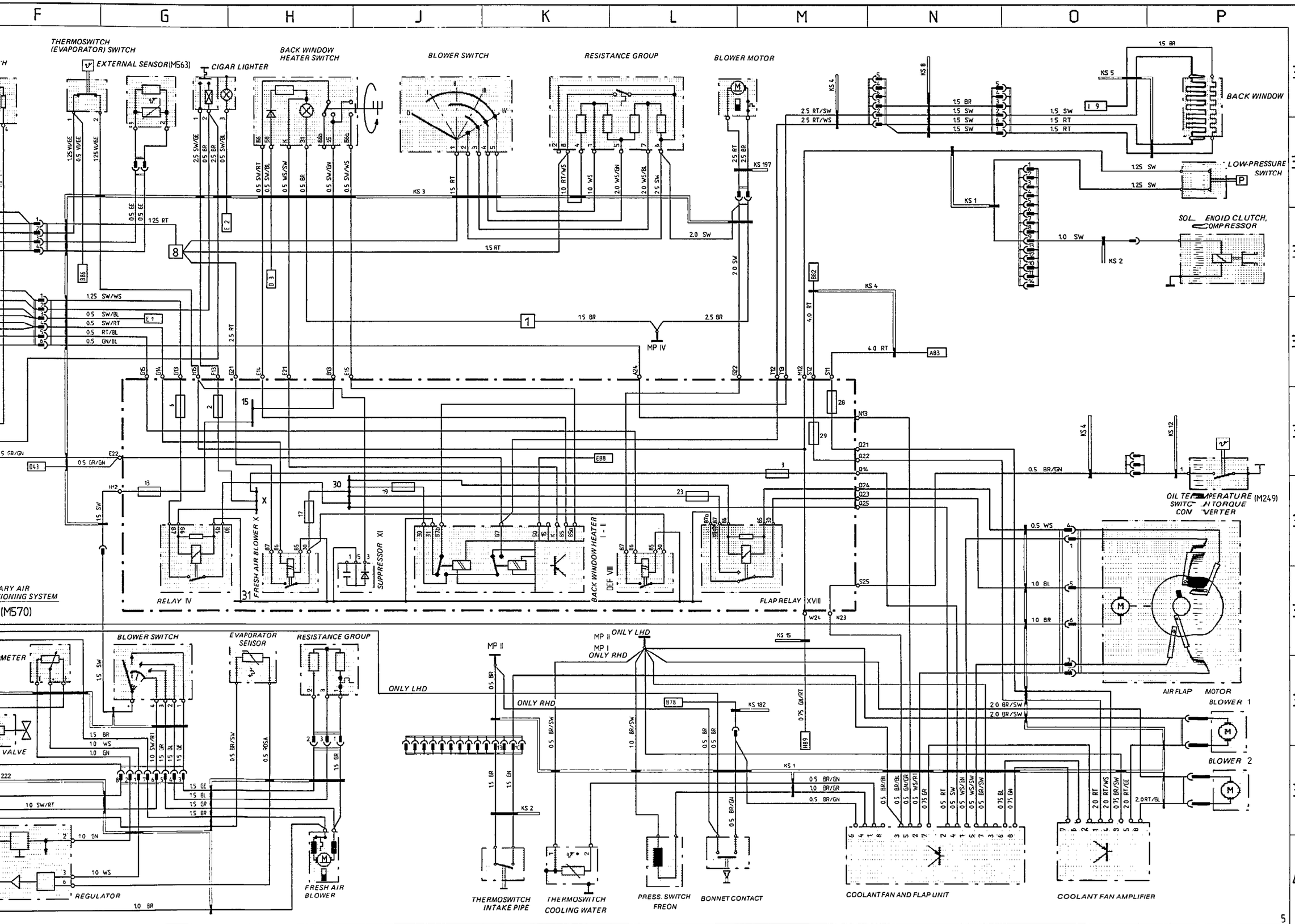
Wiring Diagram Type 928 S Model 87 page 5

VENTILATION, HEATING, AC



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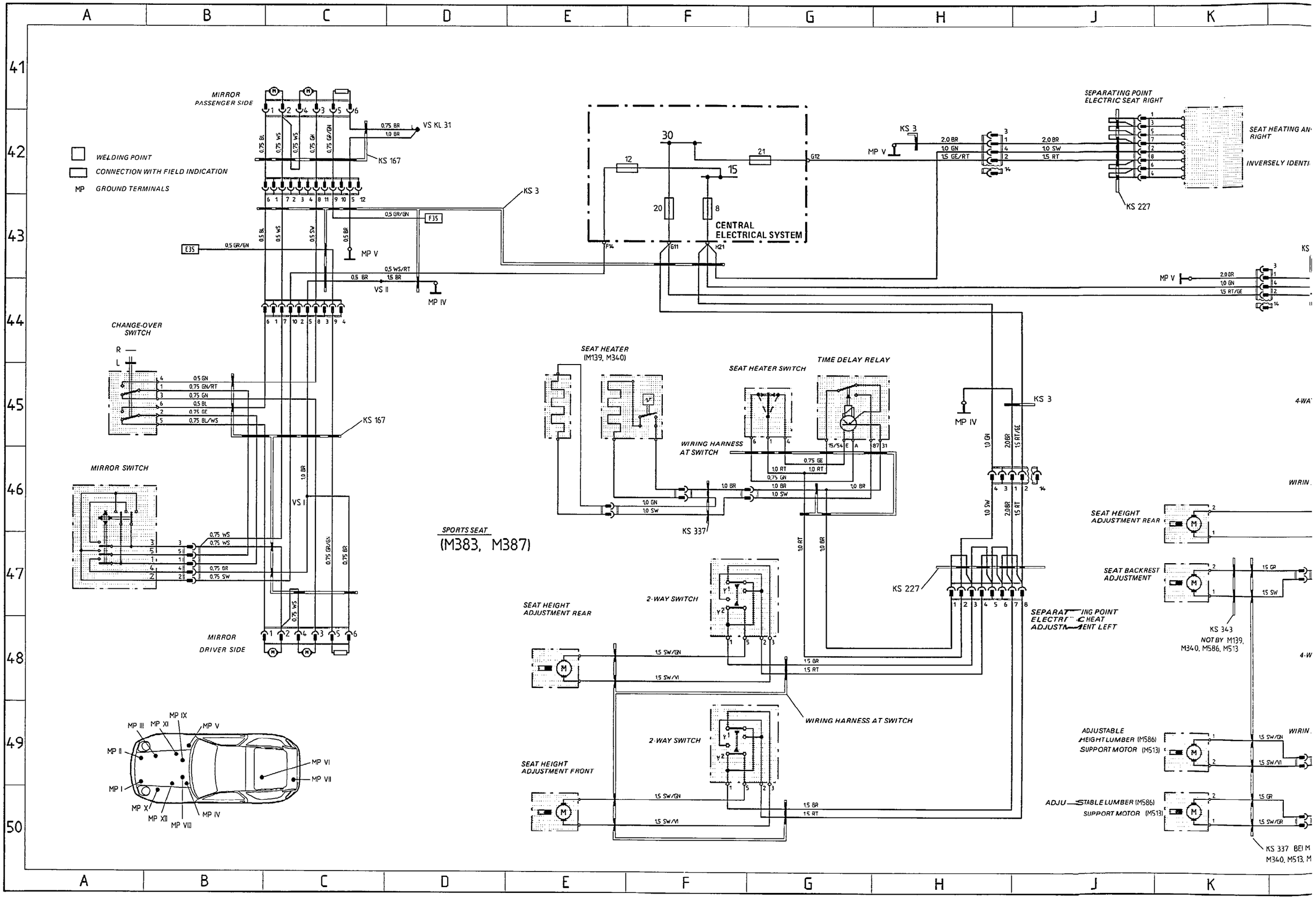
WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 6

MIRROR, SEAT ADJUSTMENT

Wiring Diagram Type 928 S Model 87 page 6

MIRROR, SEAT ADJUSTMENT



SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

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F G H J K L M N O P

41 42 43 44 45 46 47 48 49 50

COMFORT SEAT SERIES

SEPARATING POINT ELECTRIC SEAT RIGHT

SEAT HEATING AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

TIME DELAY RELAY

SEAT HEATER SWITCH

SEAT HEATER

WIRING HARNESS AT SWITCH

SEAT HEATER (M139, M34 =0)

CENTRAL ELECTRICAL SYSTEM

KS 3 KS 227 KS 337

MP V MP IV

2.0 BR 1.0 GN 1.5 GE/RT 1.5 RT/GE 1.0 SW 1.0 BR 1.0 RT 0.75 GN 0.75 GE 1.5 RT 1.5 SW/GN 1.5 SW/VI 1.5 GR 1.5 BR 1.5 SW

4-WAY SWITCH

SEAT HEIGHT ADJUSTMENT REAR

SEAT BACKREST ADJUSTMENT

KS 343 NOT BY M139, M340, M586, M513

ADJUSTABLE HEIGHT LUMBER (M586) SUPPORT MOTOR (M513)

ADJUSTABLE LUMBER (M586) SUPPORT MOTOR (M513)

KS 337 BEI M139, M340, M513, M586

SEPARATING POINT ELECTRIC HEAT ADJUSTMENT LEFT

SEAT HEIGHT ADJUSTMENT FRONT

POWER SEAT FORWARD/BACK CONTROL

6

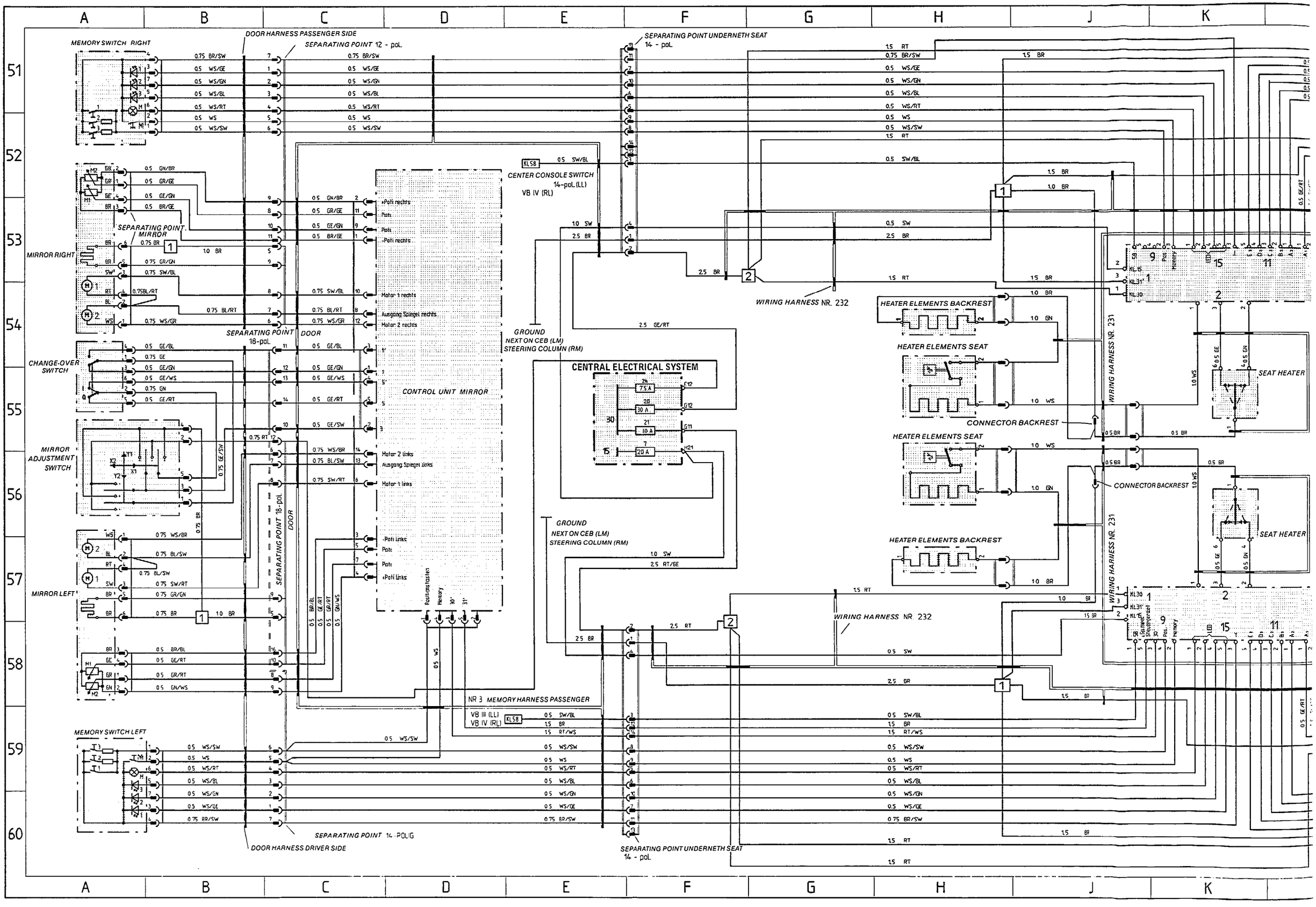
BK = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 7

SEAT- AND MIRROR MEMORY

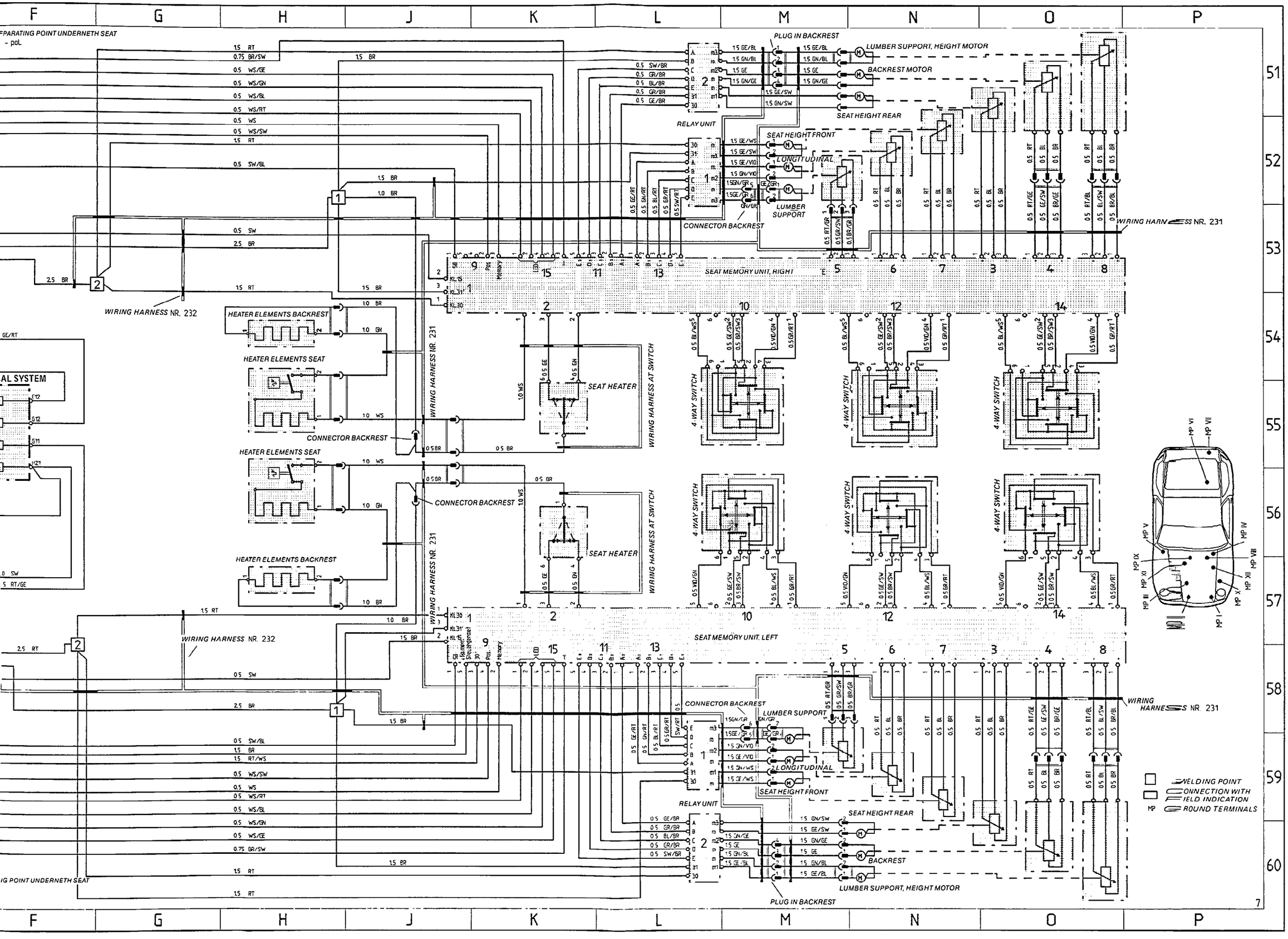
Wiring Diagram Type 928 S Model 87 page 7

SEAT- AND MIRROR MEMORY



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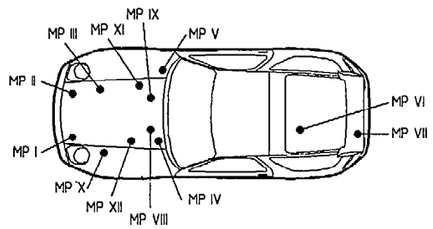
CK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 8

RADIO

Wiring Diagram Type 928 S Model 87 page 8

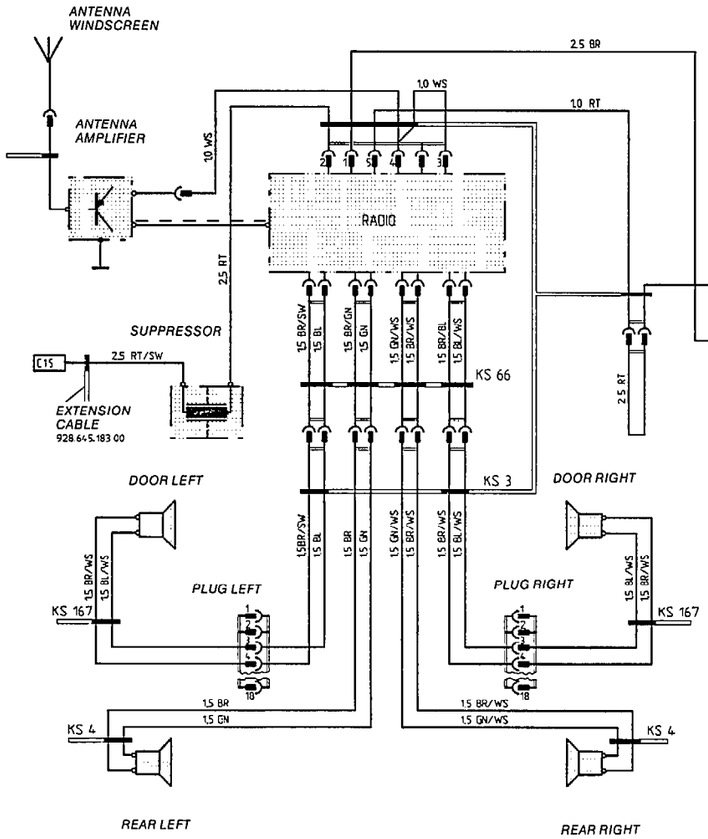
RADIO



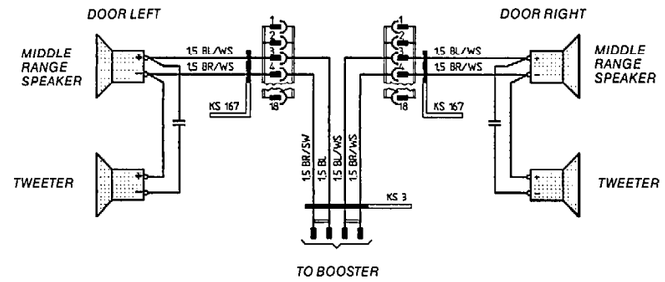
RADIO

(M158, M686, M 368, M328, M330, M329)

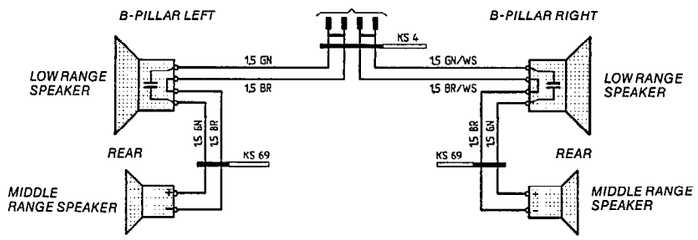
STANDARD WITHOUT RADIO



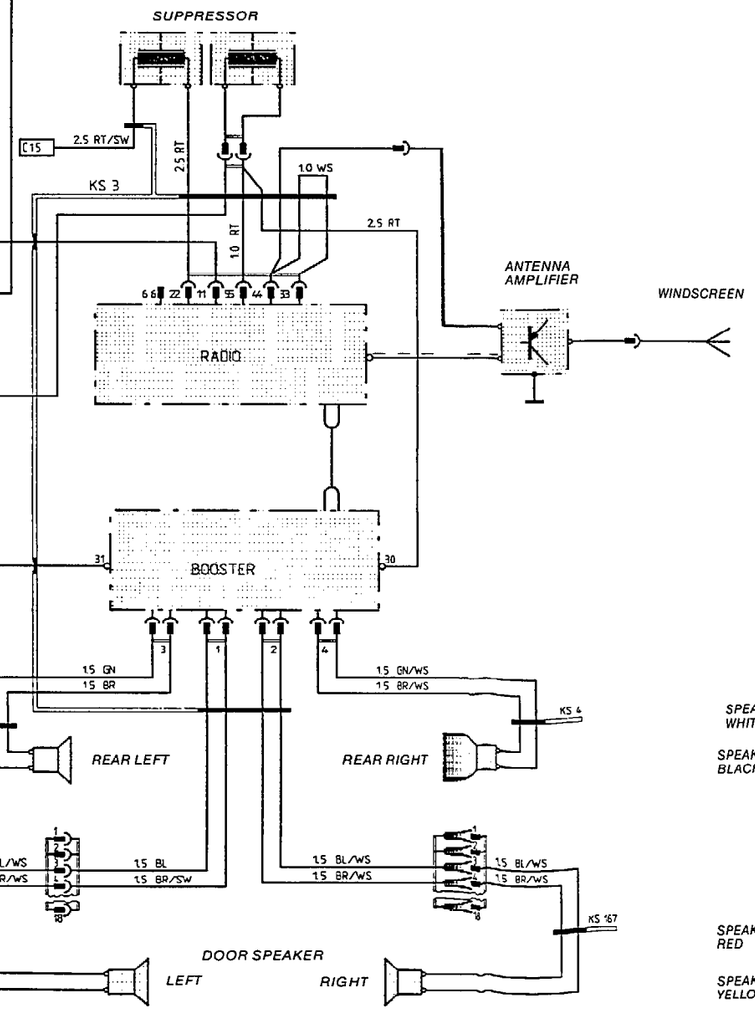
HIFI-ANLAGE (M 490)

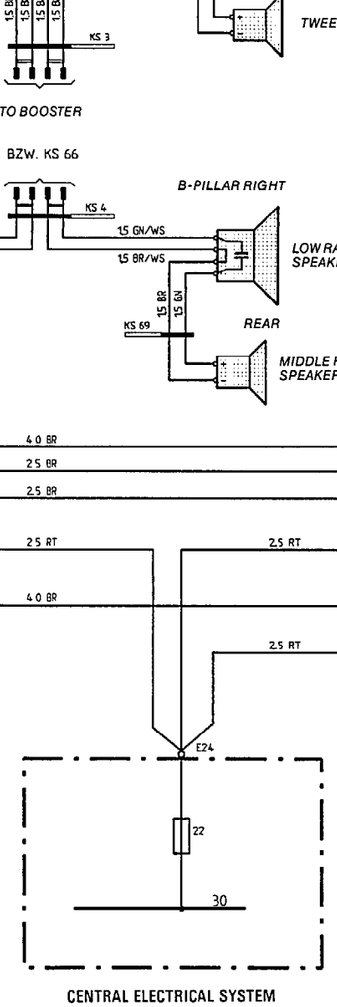


BZW. KS 66



BOOSTER (M 494)





WELDING POINT

CONNECTION WITH FIELD INDICATION

MP GROUND TERMINALS

SPEAKER FRONT WHITE

SPEAKER FRONT R BLACK

SPEAKER REAR RIG RED

SPEAKER REAR LE YELLOW

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SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

F G H J K L M N O P

30)

DOOR RIGHT

1.5 BL/WS
1.5 BR/WS
KS 167
MIDDLE RANGE SPEAKER
TWEETER
KS 3

B-PILLAR RIGHT

KS 4
1.5 GN/WS
1.5 BR/WS
LOW RANGE SPEAKER
1.5 BR
1.5 GN
KS 69
REAR
MIDDLE RANGE SPEAKER

2.5 RT
2.5 RT
E24
22
30

NTRAL ELECTRICAL SYSTEM

BOOSTER (M 494)

SUPPRESSOR
C15
2.5 RT/SW
2.5 RT
KS 3
1.0 WS
1.0 RT
2.5 RT
66 22 11 55 44 33
RADIO
ANTENNA AMPLIFIER
WINDSCREEN
31
BOOSTER
30
3 1 2 4
1.5 GN
1.5 BR
1.5 GN/WS
1.5 BR/WS
KS 4
REAR LEFT
REAR RIGHT
KS 4
1.5 BL/WS
1.5 BR/WS
1.5 BL
1.5 BR/SW
1.5 BL/WS
1.5 BR/WS
1.5 BL/WS
1.5 BR/WS
KS 167
KS 167
DOOR SPEAKER
LEFT
RIGHT

RADIO BERLIN (M 326)

SUPPRESSOR
C15
2.5 RT/SW
KS 3
2.5 RT
1.0 WS
1.0 RT
1 2 6 5 4 3
RADIO
ANTENNA AMPLIFIER
ANTENNA WINDSCREEN
1.0 SW
0.5 WS
911.645.263.00
31
RECAIVER
30
2.5 RT
1.5 GN
1.5 BR
1.5 GN/WS
1.5 BR/WS
KS 4
REAR LEFT
REAR RIGHT
KS 4
1.5 BL/WS
1.5 BR/WS
1.5 BL
1.5 BR/SW
1.5 BL/WS
1.5 BR/WS
KS 167
KS 167
DOOR SPEAKER
LEFT
RIGHT

CONNECTIONPLAN

SPEAKER FRONT LEFT WHITE
SPEAKER FRONT RIGHT BLACK
SPEAKER REAR RIGHT RED
SPEAKER REAR LEFT YELLOW
BOOSTER HARNESS
RT
BR

CONNECTIONPLAN RECEIVER

SPEAKER FRONT RIGHT BLACK
SPEAKER FRONT LEFT WHITE
WS
BR
RT
SPEAKER REAR RIGHT RED
SPEAKER REAR LEFT YELLOW
12V

61 62 63 64 65 66 67 68 69 70

8

F G H J K L M N O P

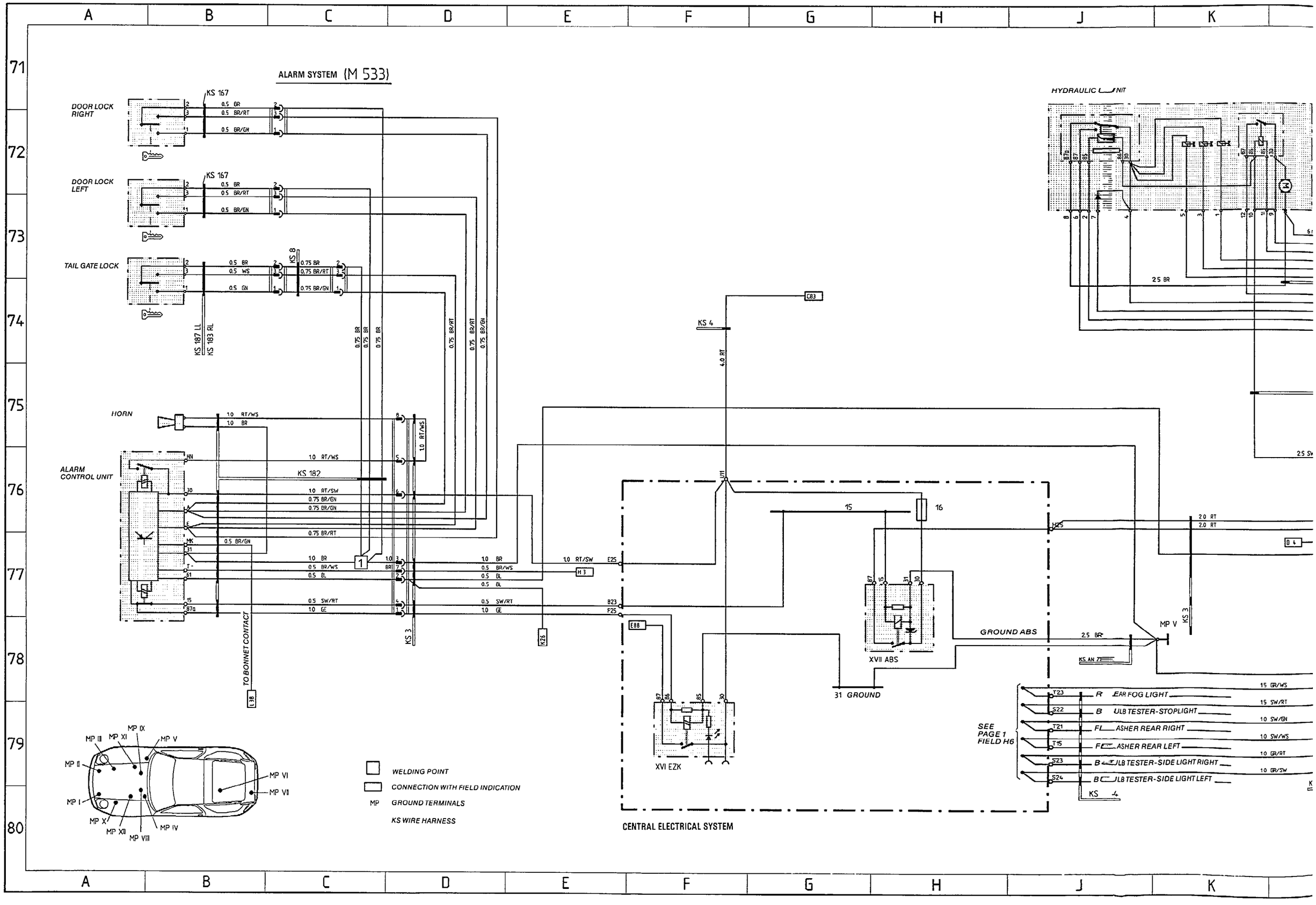
CK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 9

ABS, ALARM SYSTEM, TRAILER COUPLING

Wiring Diagram Type 928 S Model 87 page 9

ABS, ALARM SYSTEM, TRAILER COUPLING



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SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

F G H J K L M N O P

71 72 73 74 75 76 77 78 79 80

ABS SYSTEM (M 593)

HYDRAULIC UNIT

ABS-CONTROL UNIT

MP X

GROUND STRAP
TEIL NR. 928.612.189.01

6 mm²

0.75 GN/SW
1.0 BR/GN
1.5 GN
1.5 GN/GE
1.5 GN/RT
4.0 RT
1.0 GN/WS
1.0 WS
0.75 GN/BL
4.0 RT

2.5 BR

G28

2.5 SW/RT

1.0 BR
1.0 BR
1.0 BR

MP IV

WIRE CONNECTOR

10.0 RT

E82

KS 2

0.5 GE
0.5 GE
0.5 WS
0.5 WS
0.5 GN
0.5 GN
0.5 RT
0.5 RT

MP VI
MP VI
MP XI
MP XII

KOMBI LTG.

MP

REAR RIGHT
REAR LEFT
FRONT REAR
FRONT LEFT
WHEEL SENSOR

KS 121

0.75 SW/RT

2.5 SW/BR

0.5 SW/GR

C83

KS 4

4.0 RT

V11

15

16

H25

2.0 RT
2.0 RT

D 4

0.5 SW/RT

87 85 31 30

XVII ABS

GROUND ABS

2.5 BR

MP V

KS 3

KS AN ZE

31 GROUND

87 86 85 30

XVI EZK

TRAILER COUPLING
(M 208)

SEE PAGE 1 FIELD H6

T23 REAR FOG LIGHT — 1.5 GR/WS
S22 BULB TESTER-STOPLIGHT — 1.5 SW/RT
T21 FLASHER REAR RIGHT — 1.0 SW/GN
T15 FLASHER REAR LEFT — 1.0 SW/WS
S23 BULB TESTER-SIDE LIGHT RIGHT — 1.0 GR/RT
S24 BULB TESTER-SIDE LIGHT LEFT — 1.0 GR/SW

KS 4

KS 161

KS 180

1.5 BR 31
1.5 GR/WS 54g
1.5 SW/RT 54
1.5 SW/GN R
1.5 SW/WS L
1.5 GR/RT 58R
1.5 GR/SW 58L

SOCKET TRAILER COUPLING

. ELECTRICAL SYSTEM

9

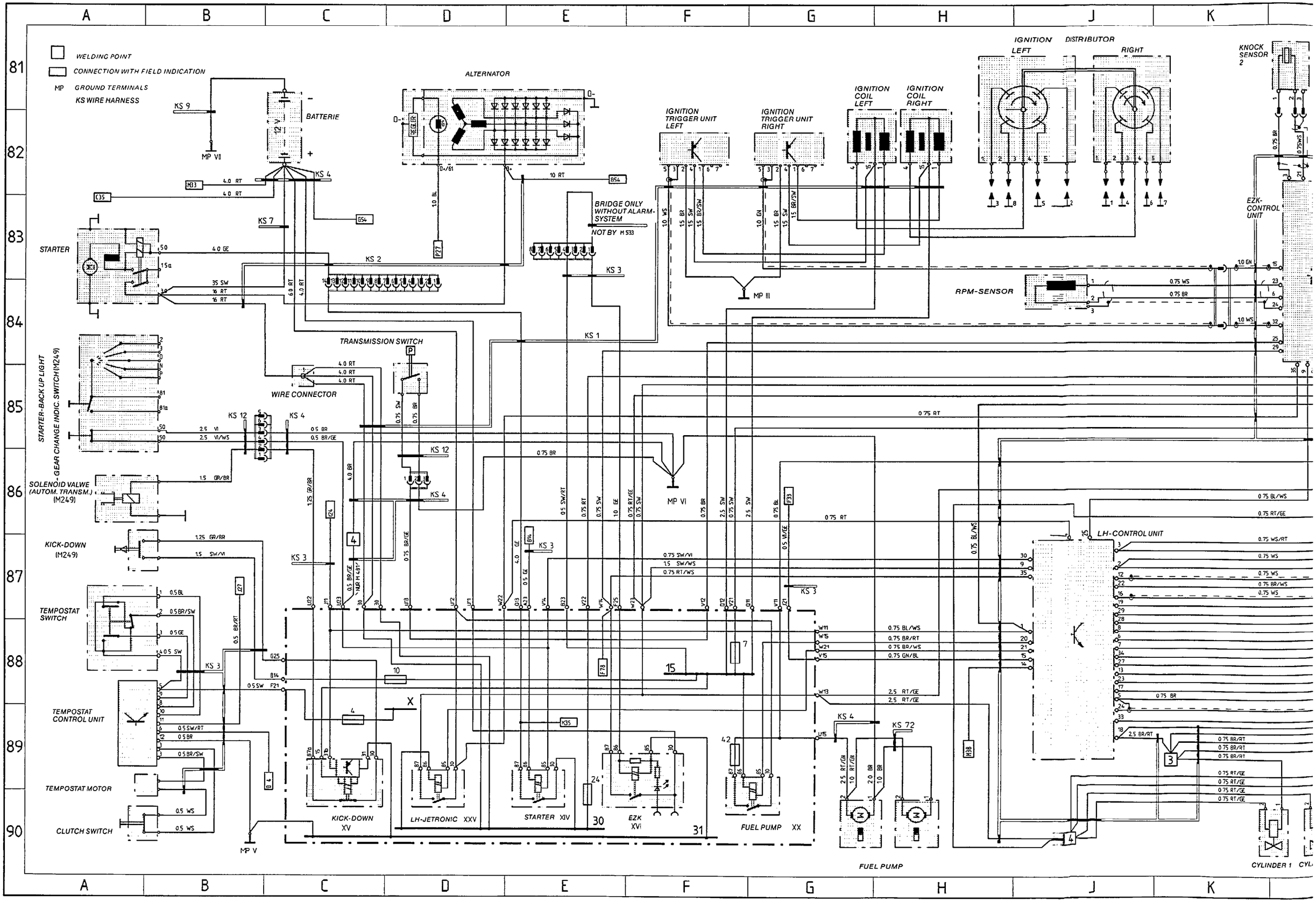
CK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 10

ENGINE COMPARTMENT, TEMPOSTAT

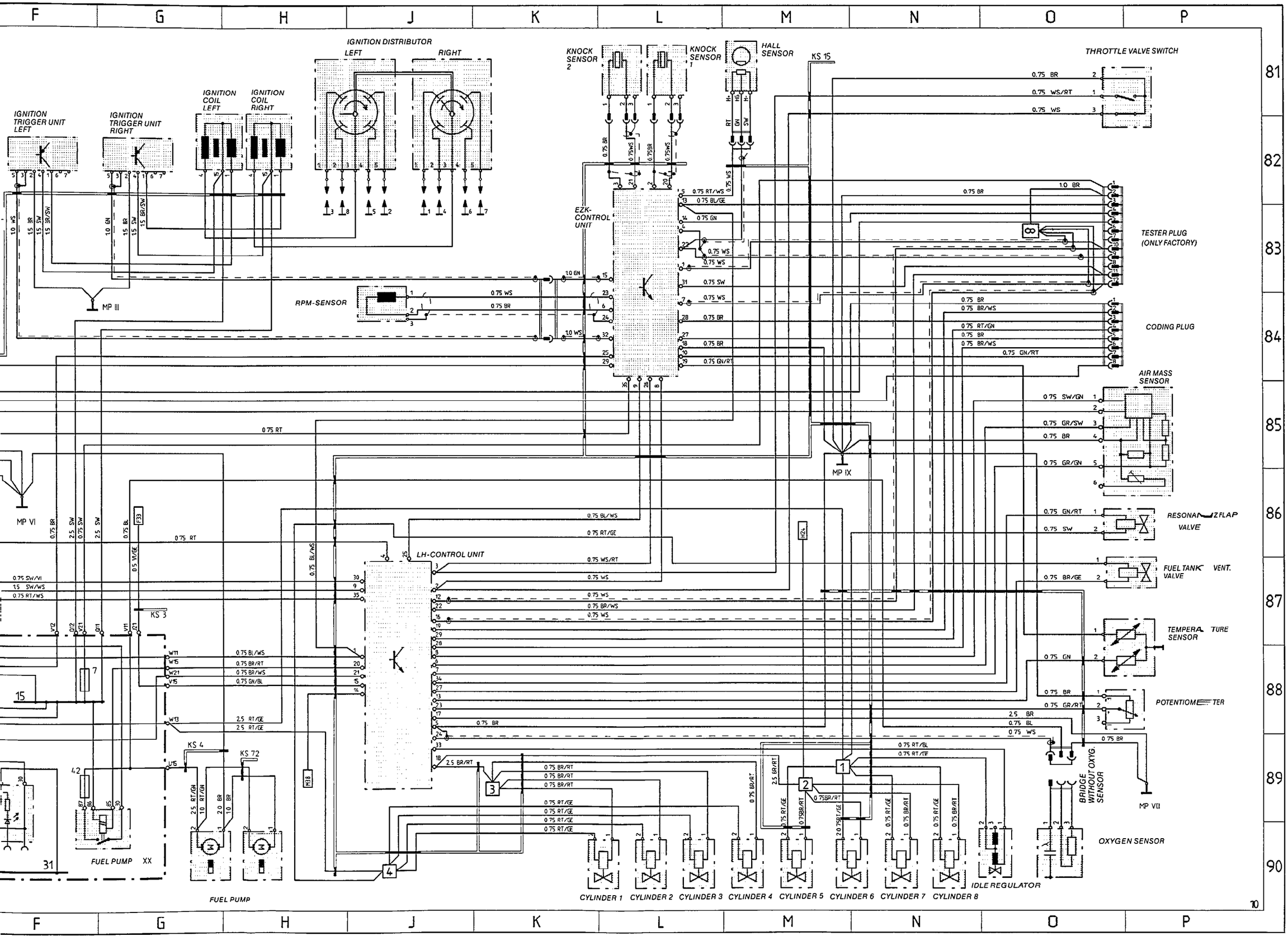
Wiring Diagram Type 928 S Model 87 page 10

ENGINE COMPARTMENT, TEMPOSTAT



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SW – BLACK WS – WHITE RT – RED GN – GREEN GE – YELLOW GR – GREY BR – BROWN BL – BLUE LI – VIOLET



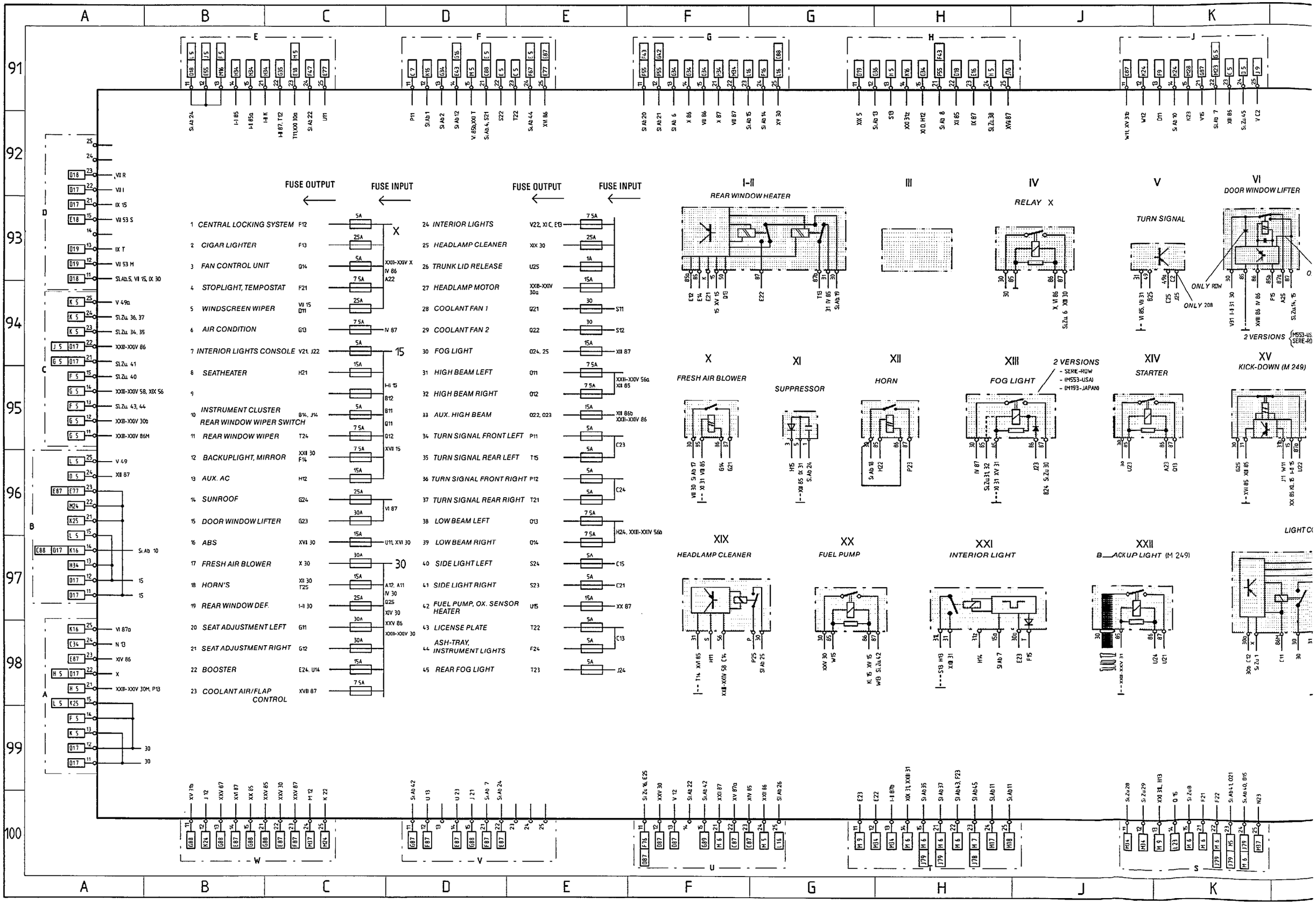
BK = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring Diagram Type 928 S
Model 87 page 11

CENTRAL ELECTRICAL SYSTEM

Wiring Diagram Type 928 S Model 87 page 11

CENTRAL ELECTRICAL SYSTEM



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SW = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

I-II
REAR WINDOW HEATER

III

IV
RELAY X

V
TURN SIGNAL

VI
DOOR WINDOW LIFTER
ONLY RDW
ONLY 208
ONLY M553
2 VERSIONS (M553-USA, SERIE-RDW)

VII
WIPER INTERVAL

VIII
DEF

IX
AUX. CLEANING PUMP

X
FRESH AIR BLOWER

XI
SUPPRESSOR

XII
HORN

XIII
FOG LIGHT
2 VERSIONS
- SERIE-RDW
- (M553-USA)
- (M193-JAPAN)

XIV
STARTER

XV
KICK-DOWN (M 249)

XVI
EZK

XVII
ABS (M 593)

XVIII
ENGINE COOLANT AIR FLAP

XIX
HEADLAMP CLEANER

XX
FUEL PUMP

XXI
INTERIOR LIGHT

XXII
BACK UP LIGHT (M 249)

XXIII-XXIV
LIGHT COMBINATION RELAY

XXV
LH-JETRONIC

XXVI

MASSE ABS

CK = BLACK WS = WHITE RT = RED GN = GREEN GE = YELLOW GR = GREY BR = BROWN BL = BLUE LI = VIOLET

Wiring

Wiring diagram 928 S4 Model 88 . . . . . 97 - 281
Wiring diagram 928 S4/GT Model 89 . . . . . 87 - 309
Wiring diagram 928 S4/GT Model 90 . . . . . 97 - 339
Wiring diagram 928 S4/GT Model 91 . . . . . 97 - 367
Wiring diagram 928 GTS Model 93 . . . . . 97 - 397
Wiring diagram 928 GTS Model 93/2 . . . . . 97 - 427

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Wiring Diagram Type 928 S
Model 88

	COORDINATES	
PAGE 1	1- 10	LIGHTS ROW
PAGE 2	1- 10	LIGHTS USA
PAGE 3	11- 20	BODY
PAGE 4	21- 30	INSTRUMENT CLUSTER AND SENDERS
PAGE 5	31- 40	ENGINE COOLING, HEATER, AIR CONDITIONER
PAGE 6	41- 50	OUTSIDE MIRROR, POWER SEAT
PAGE 7	51- 60	SEAT AND MIRROR MEMORY
PAGE 8	61- 70	RADIO
PAGE 9	71- 80	ABS, ALARM SWITCH, TRAILER HITCH
PAGE 10	81- 90	MOTOR, FUEL AND IGNITION, CRUISE CONTROL
PAGE 11	91-100	CENTRAL ELECTRIC
PAGE 12		CONSTR. COMPONENTS, PLUG CONNECTIONS, GROUND POINTS

Wiring Diagram Type 928 S Model 88

The wiring diagram comprises **12** individual wiring diagrams.
They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central electrical system within a dash-dot frame.

This part of the central electrical system shows all the lines and relays required for individual wiring diagram.

The ground-connecting points are designated with "MP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Part 2 is the "module element".

Both parts are identified by the digits 1 . . . 5.

Part 3 is a "coding element".

The designations of the plug connections in wiring diagram for central electrical system refer e. g. from A 11 . . . 15 to the "initial element", from A 21 . . . 26 to module element.

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Wiring Diagram Type 928 S
Model 88 page 1

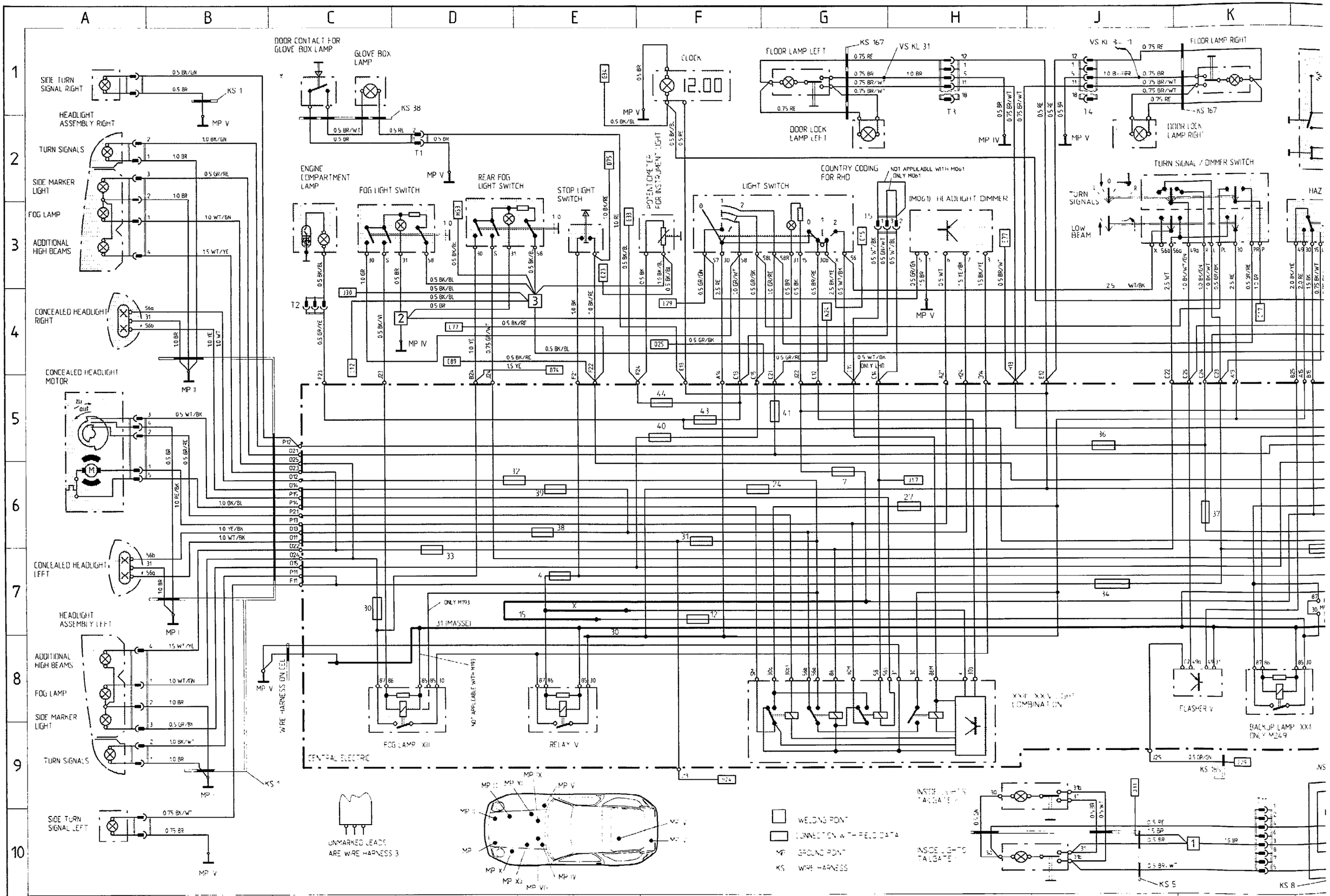
LIGHTS ROW

COORDINATES

1- 10

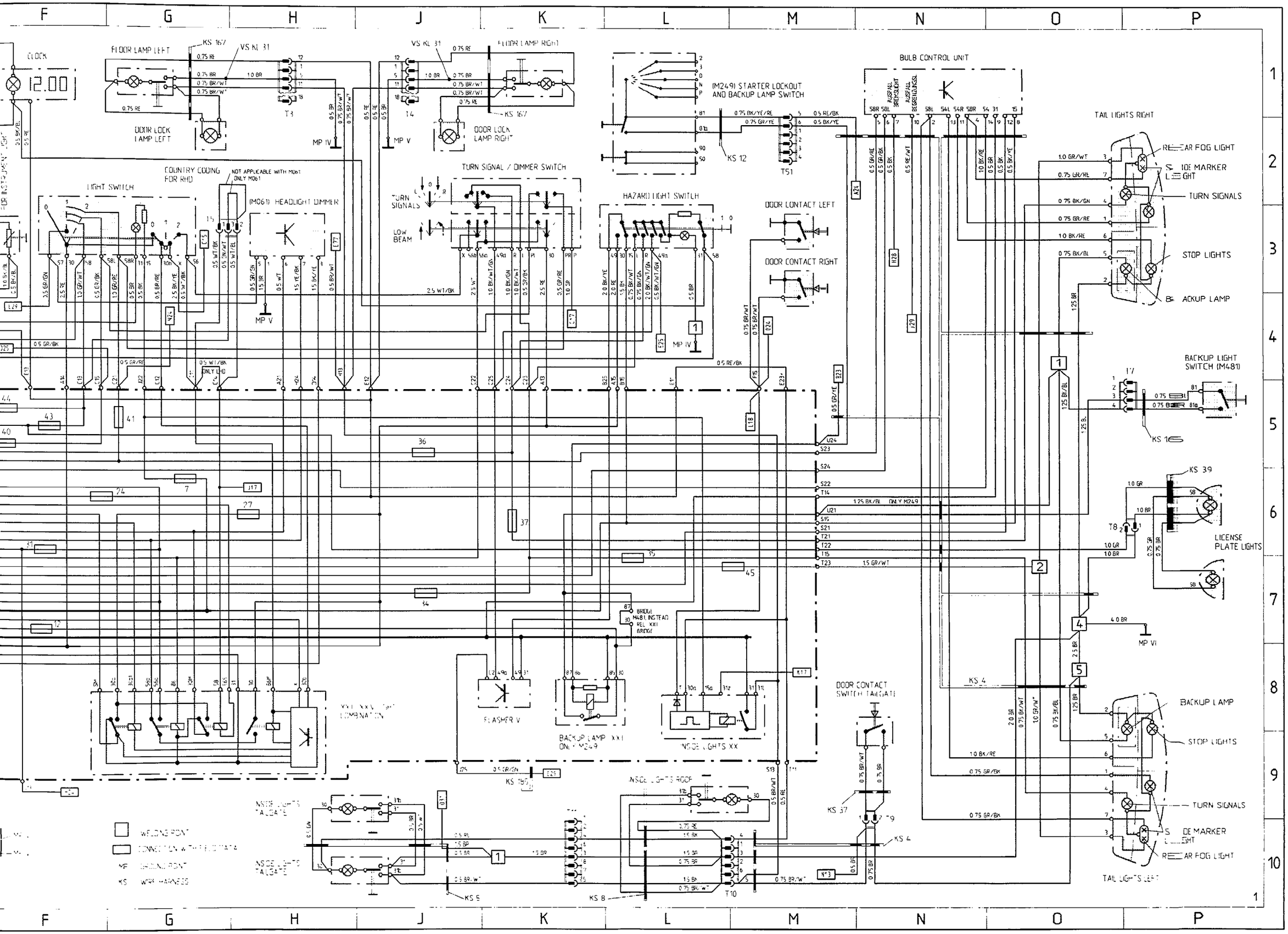
Wiring Diagram Type 928 S Model 88 page 1

LIGHTS ROW



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BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S
Model 88 page 2

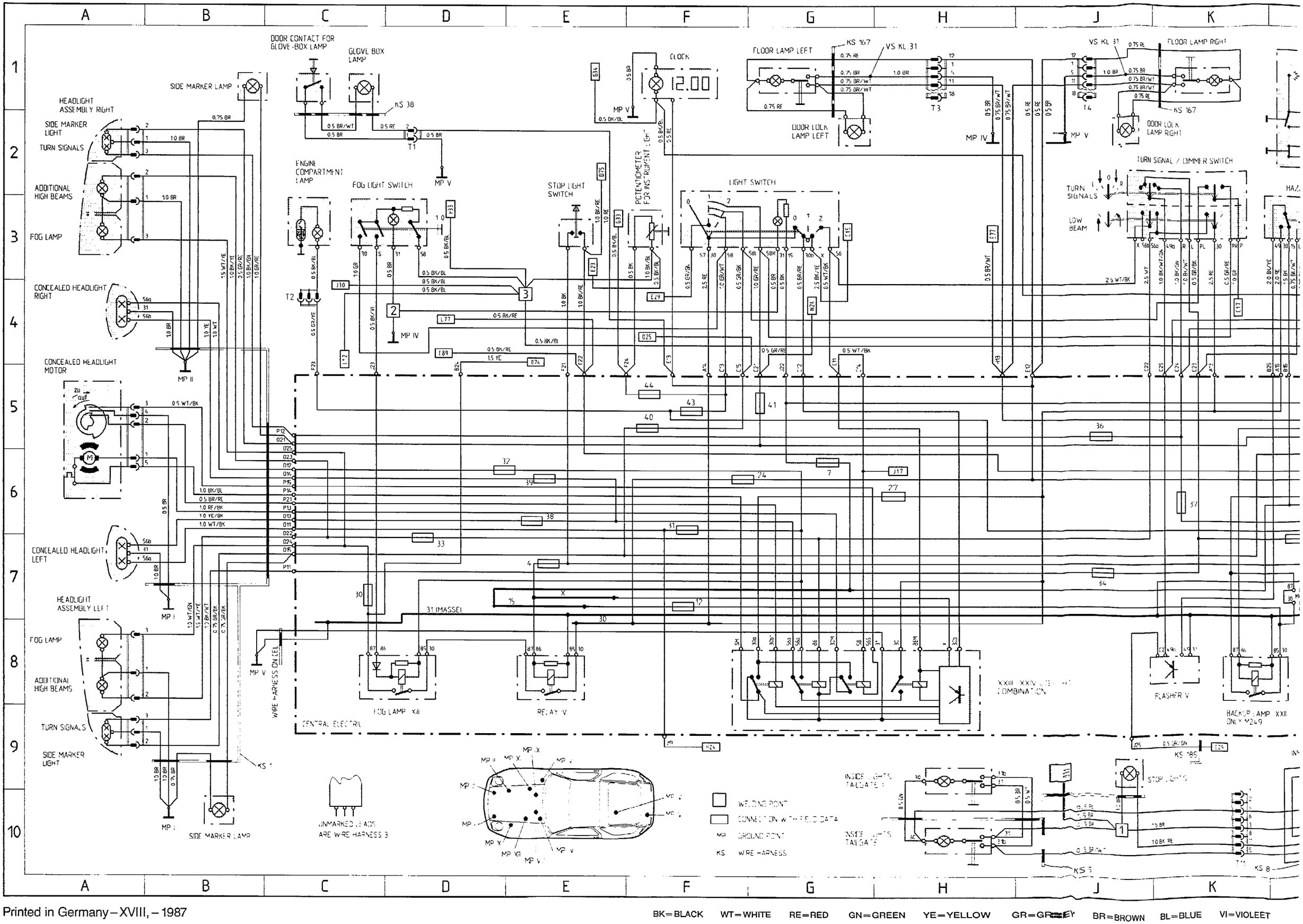
LIGHTS USA

COORDINATES

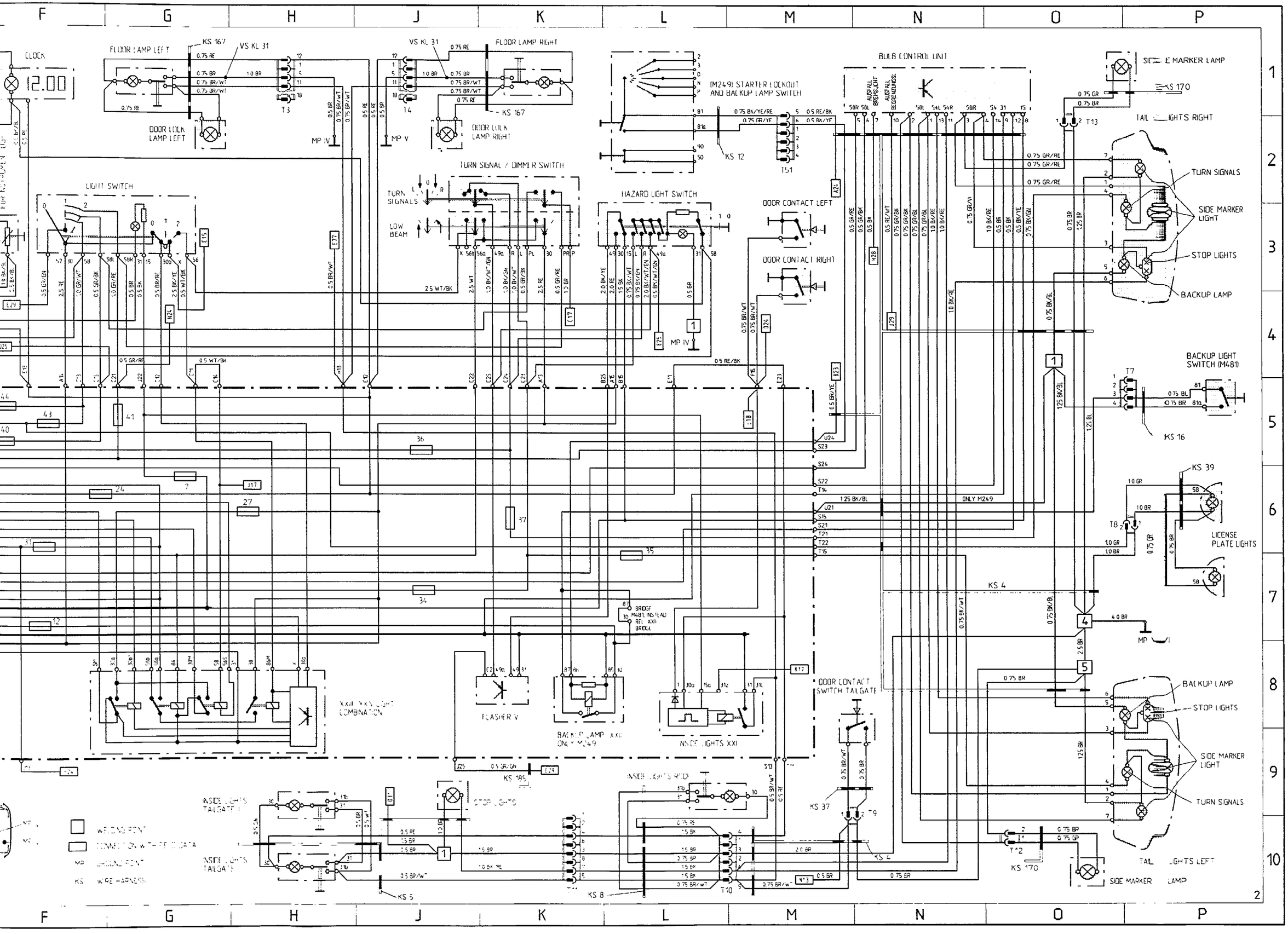
1- 10

Wiring Diagram Type 928 S Model 88 page 2

LIGHTS USA



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Wiring Diagram Type 928 S
Model 88 page 3

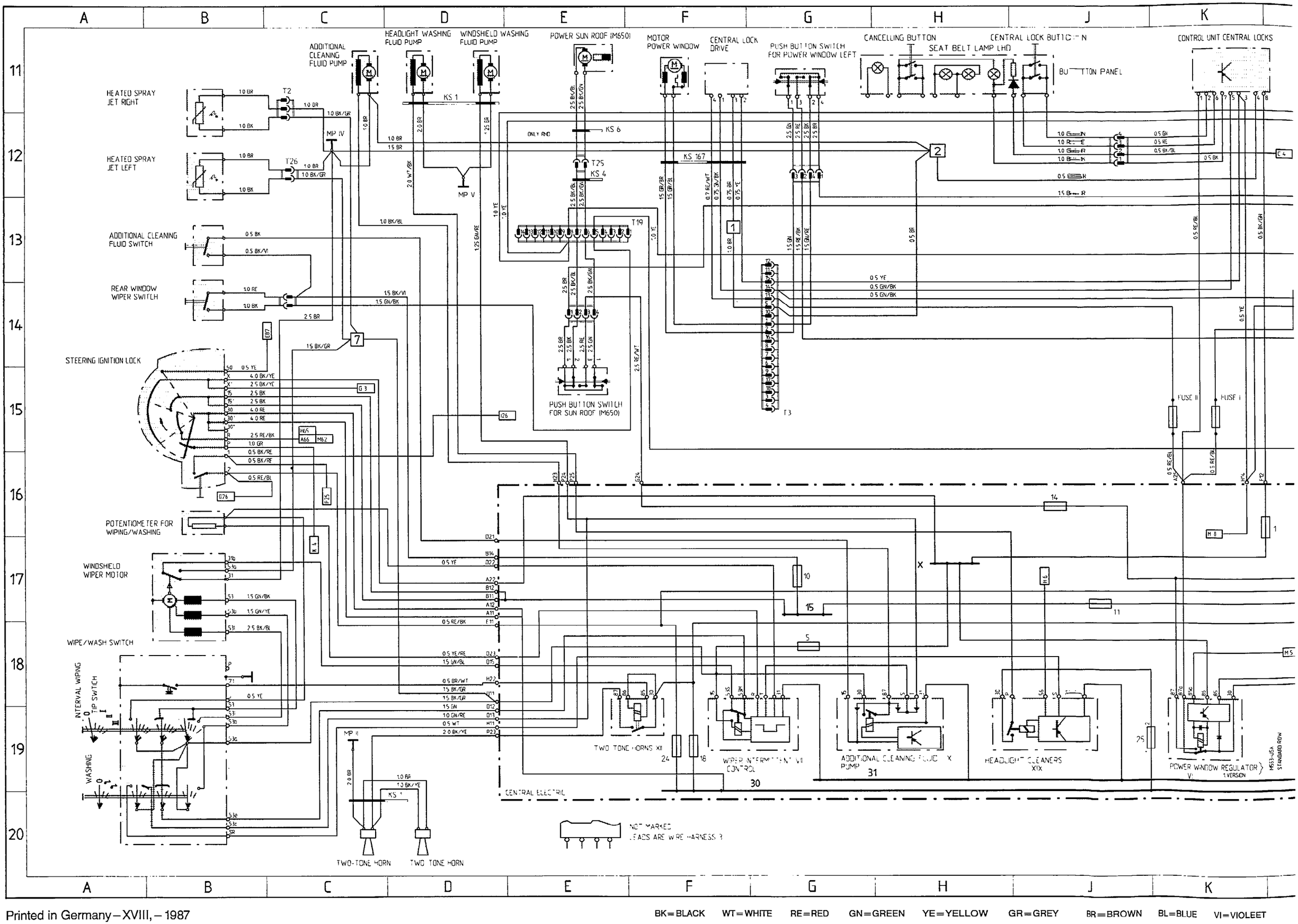
BODY

COORDINATES

11- 20

Wiring Diagram Type 928 S Model 88 page 3

BODY



BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

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F G H J K L M N O P

MOTOR POWER WINDOW
CENTRAL LOCK DRIVE
PUSH BUTTON SWITCH FOR POWER WINDOW LEFT
CANCELLING BUTTON
SEAT BELT LAMP LHD
CENTRAL LOCK BUTTON
BUTTON PANEL
CONTROL UNIT CENTRAL LOCKS
PUSH BUTTON SWITCH FOR POWER WINDOW RIGHT
CENTRAL LOCK DRIVE RIGHT
MOTOR POWER WINDOW
TAILGATE UNLOCKING DRIVE
TAILGATE UNLOCKING SWITCH LEFT
TAILGATE UNLOCKING SWITCH RIGHT

KS 167
KS 4
KS 38
T1
T3
T4
MP V
M10
GLOVE BOX LAMP
FUSE II
FUSE I
M 8
M 5
WIPER INTERMITTENT VII CONTROL
ADDITIONAL CLEANING FLUID X
JMP
HEADLIGHT CLEANERS X*X
POWER WINDOW REGULATOR VI
1 VERSION
W553 USA STANDARD ROW
MP VI
REAR WINDOW WIPER RELAY
REAR WINDOW WIPER MOTOR
WIRE HARNESS ON CEL
KS 4

WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
KS WIRE HARNESS

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI MP XII

MARKED
CS ARE WIRE HARNESS 3

3

F G H J K L M N O P

BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S
Model 88 page 4

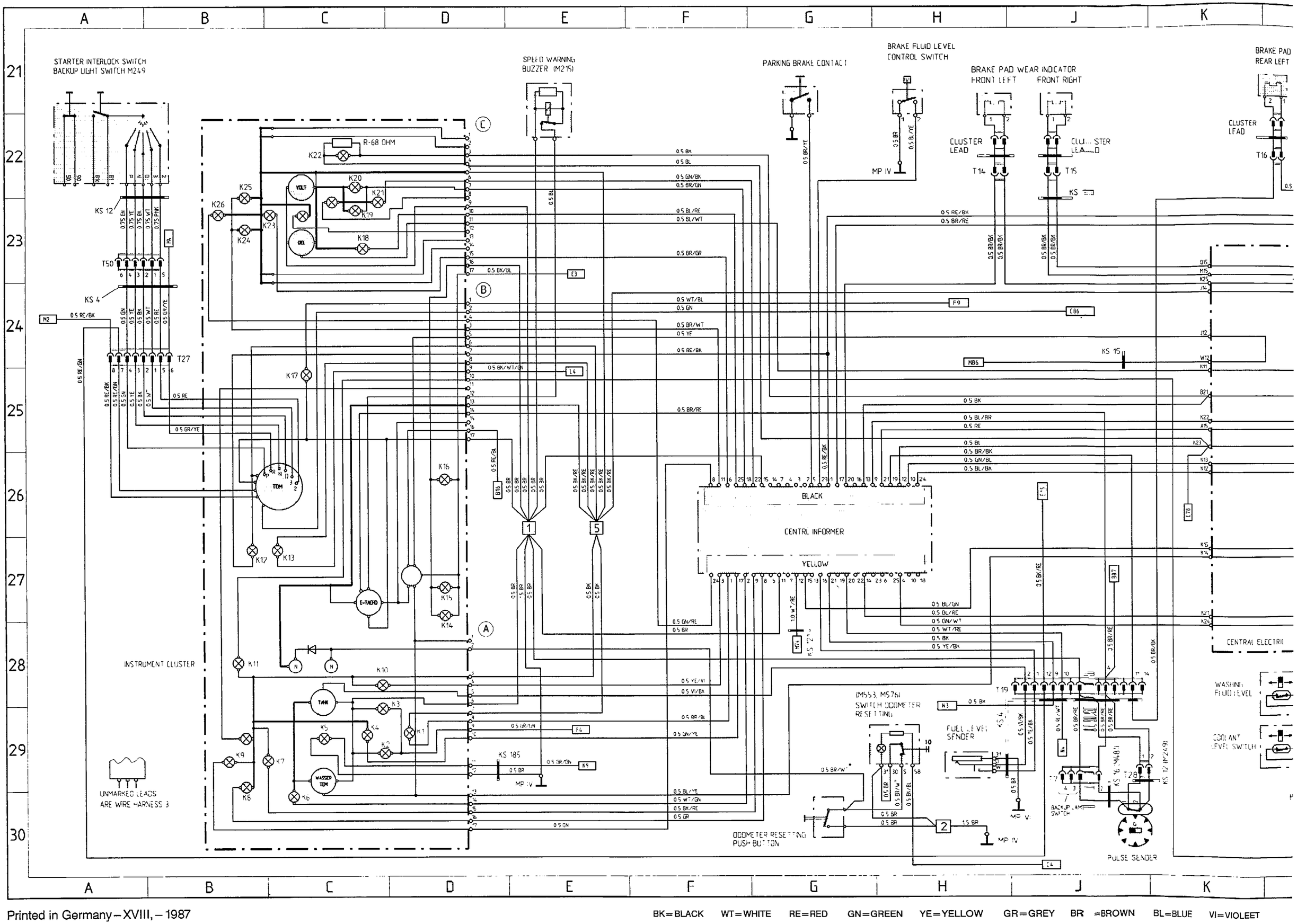
INSTRUMENT CLUSTER AND SENDERS

COORDINATES

21- 30

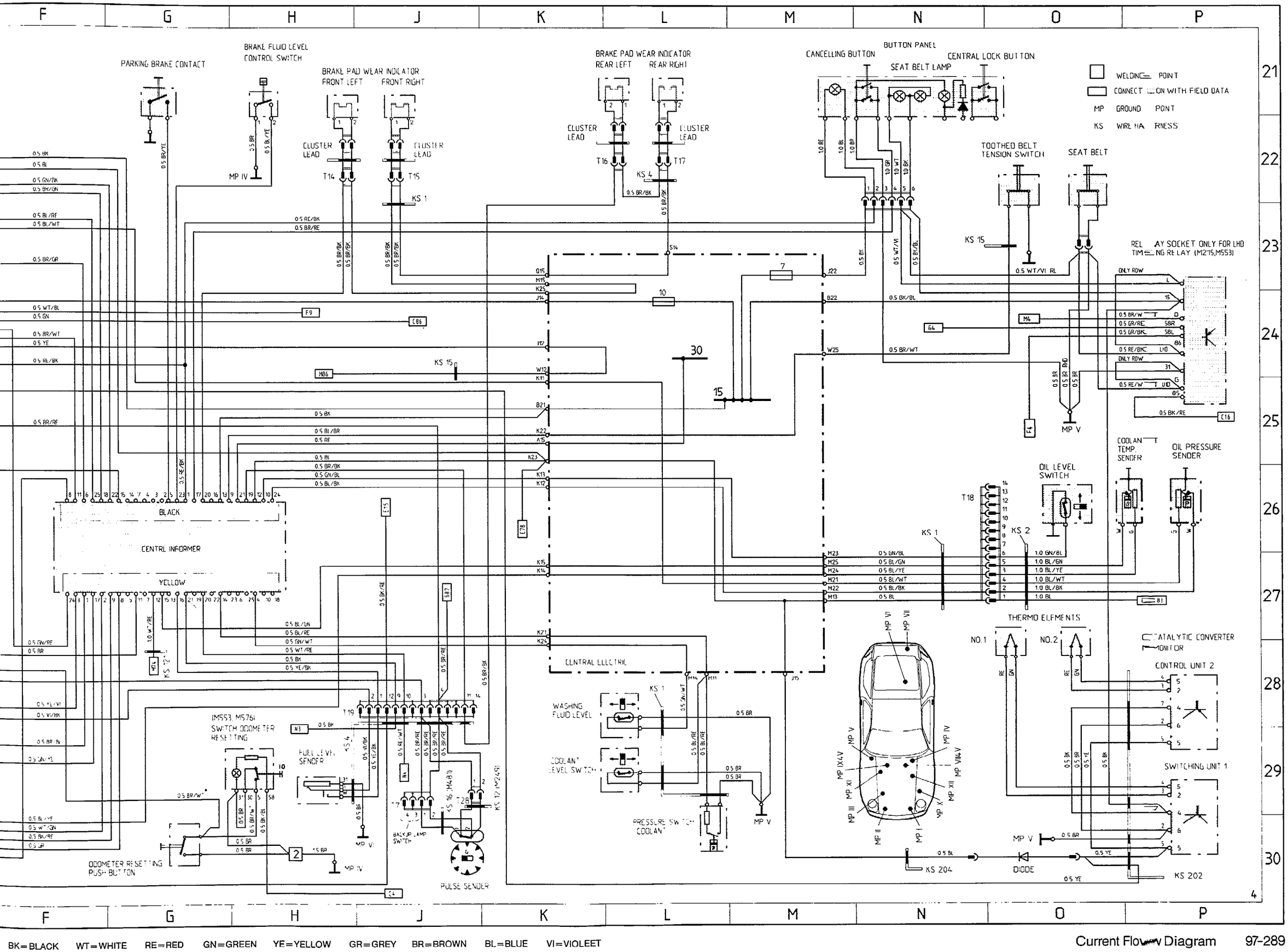
Wiring Diagram Type 928 S Model 88 page 4

INSTRUMENT CLUSTER AND SENDERS



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BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S
Model 88 page 5

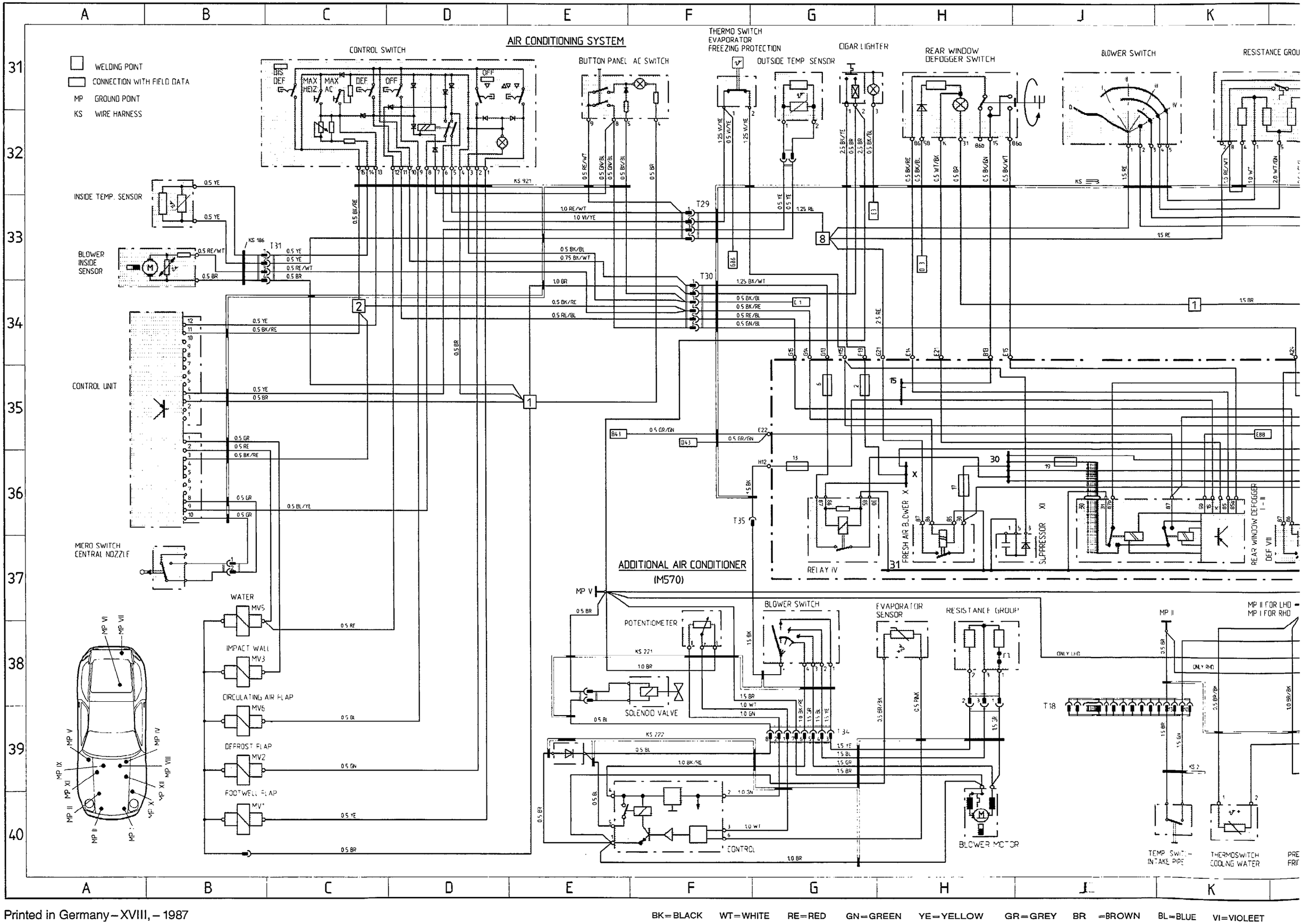
ENGINE COOLING, HEATER,
AIR CONDITIONER

COORDINATES

31- 40

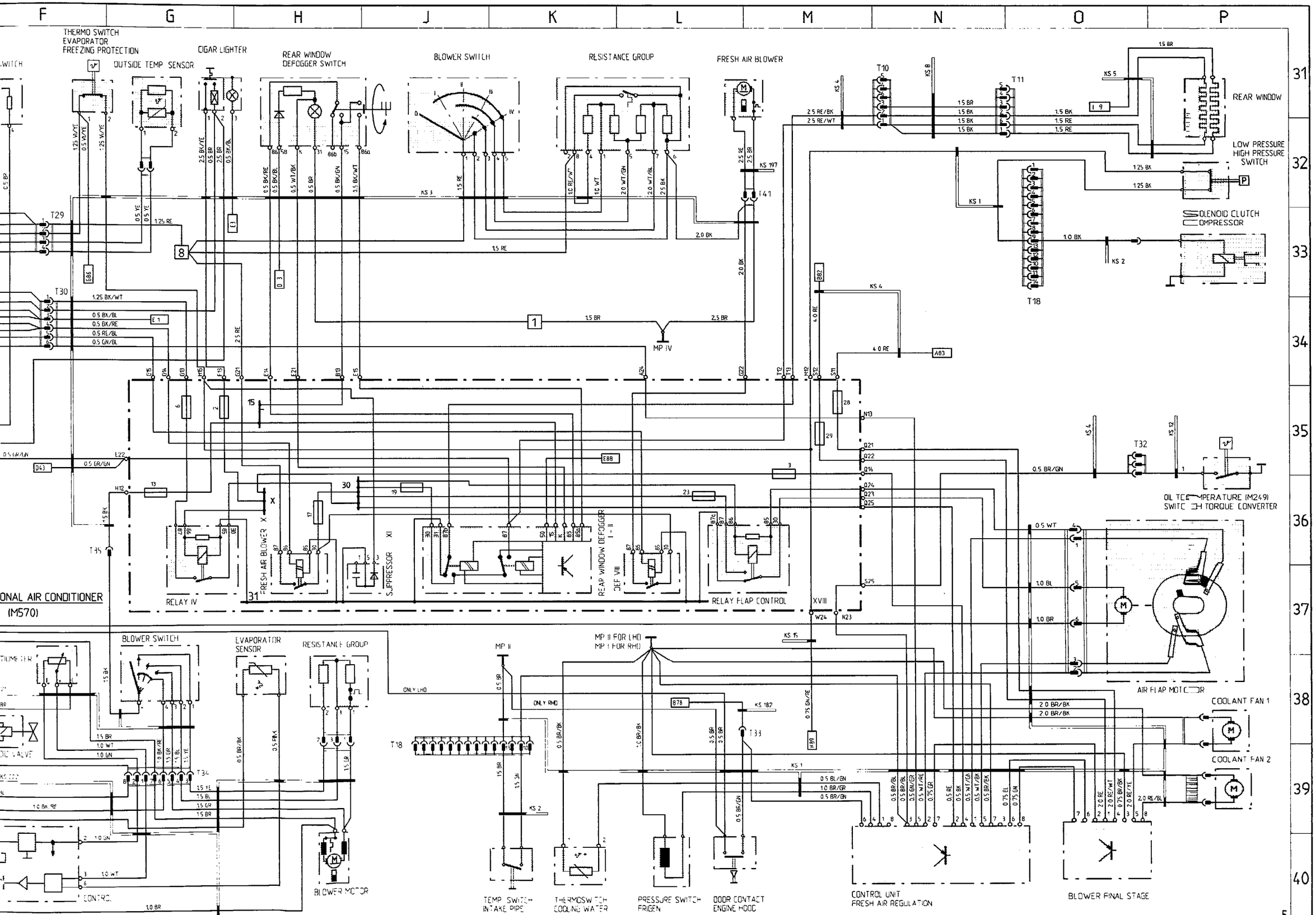
Wiring Diagram Type 928 S Model 88 page 5

ENGINE COOLING, HEATER, AIR CONDITIONER



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BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLEET



BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S Model 88 page 6

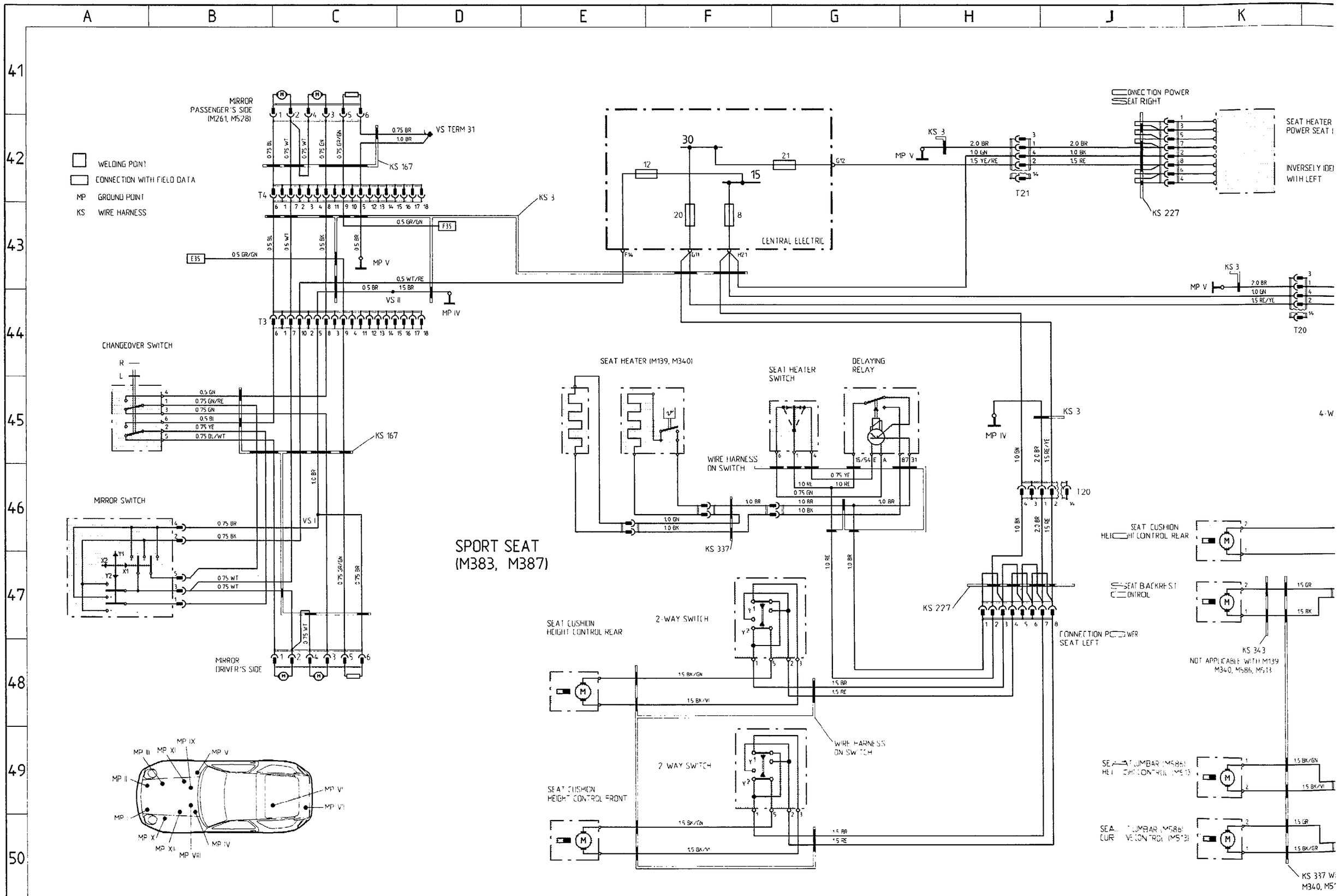
OUTSIDE MIRROR, POWER SEAT

COORDINATES

41- 50

Wiring Diagram Type 928 S Model 88 page 6

OUTSIDE MIRROR, POWER SEAT



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BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

COMFORT SEAT - STANDARD LEFT

SEAT HEATER (M139, M340)

CONNECTION POWER SEAT RIGHT

SEAT HEATER AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

KS 227

T21

KS 3

MP V

2.0 BR
1.0 GN
1.5 YE/RE

2.0 BR
1.0 BK
1.5 RE

30

21

15

20

8

G12

CENTRAL ELECTRIC

G11

H21

DELAYING RELAY

SEAT HEATER SWITCH

SEAT HEATER

KS 337

WIRE HARNESS ON SWITCH

0.75 GN
0.75 YE

1.0 RE

1.0 BK

1.0 BR

1.0 GN

T20

MP IV

T20

4-WAY SWITCH

WIRE HARNESS ON SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

1.5 BK/GN

1.5 BK/VI

SEAT BACKREST CONTROL

1.5 GR

1.5 BK

KS 343

NOT APPLICABLE WITH M139 M340, M586, M513

4-WAY SWITCH

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

SEAT LUMBAR (M586) CURVE CONTROL (M513)

KS 337 WITH M139 M340, M513, M586

4-WAY SWITCH

SEAT CUSHION HEIGHT CONTROL FRONT

SEAT BACK FORWARD CONTROL

CONNECTION POWER SEAT LEFT

KS 227

1 2 3 4 5 6 7 8

41 42 43 44 45 46 47 48 49 50

6

BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S
Model 88 page 7

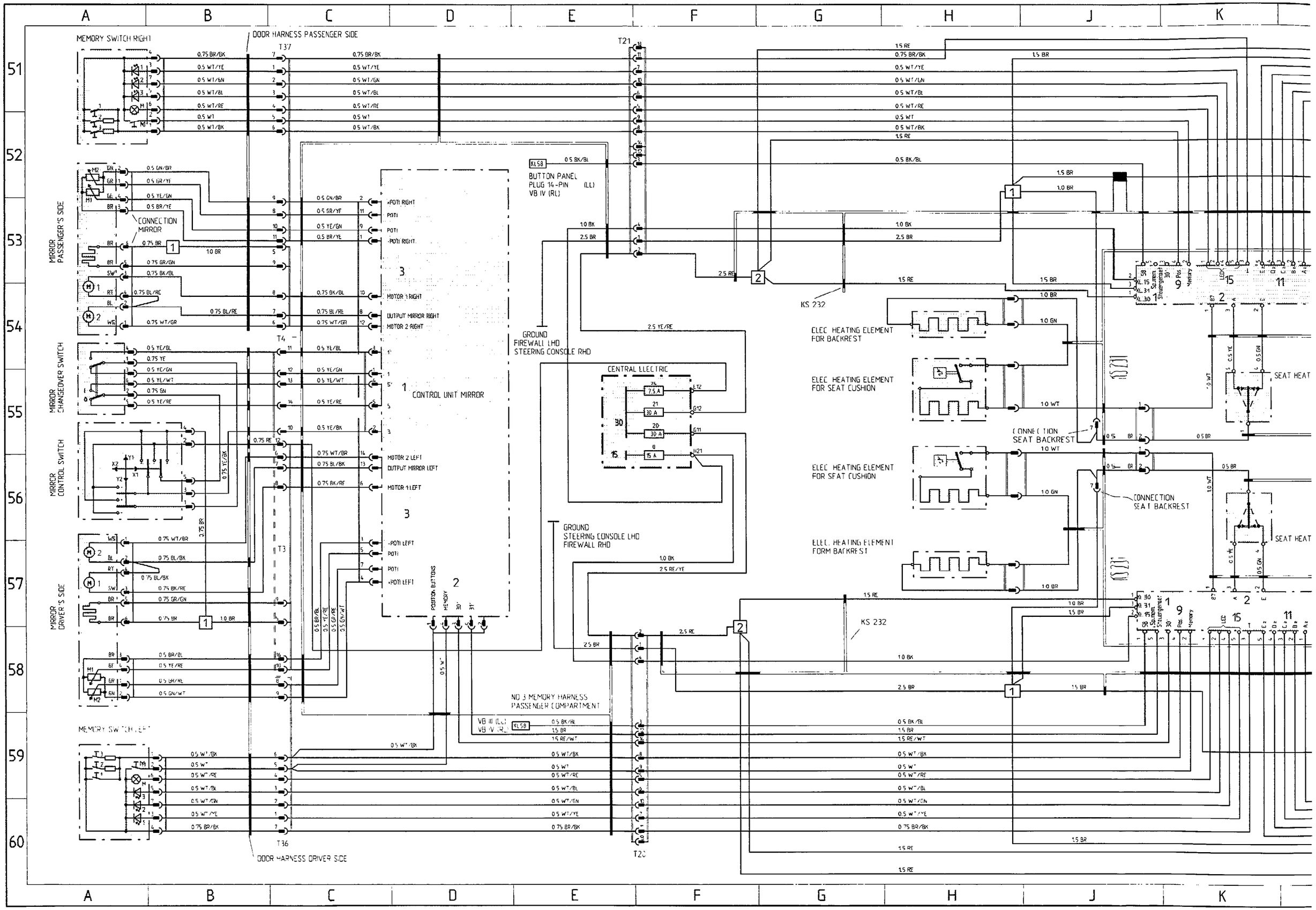
SEAT AND MIRROR MEMORY

COORDINATES

51- 60

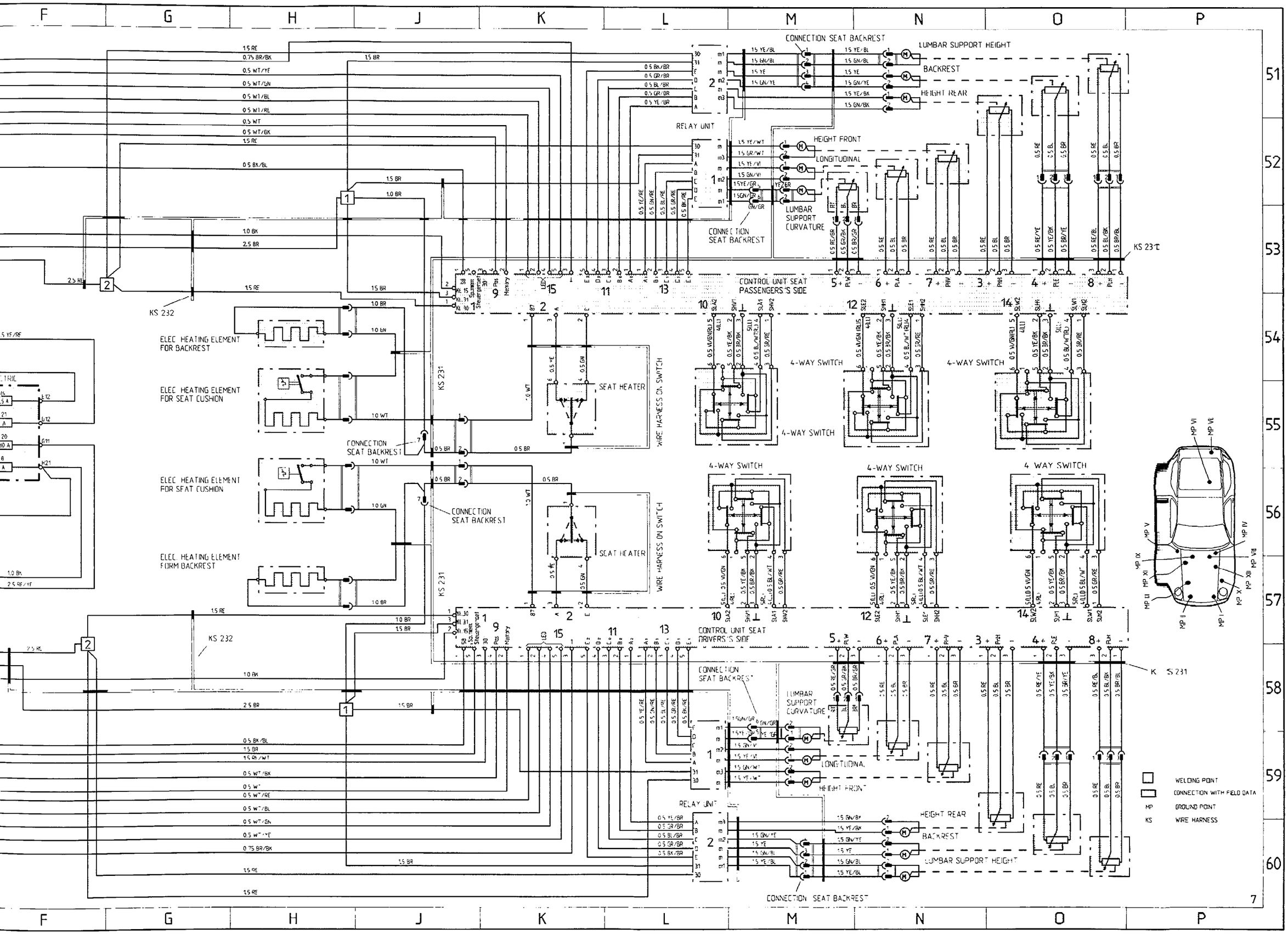
Wiring Diagram Type 928 S Model 88 page 7

SEAT AND MIRROR MEMORY



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BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S
Model 88 page 8

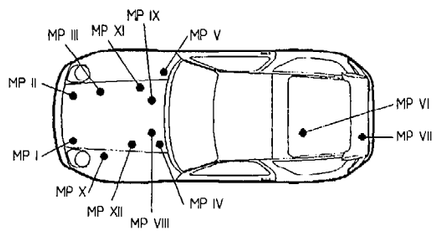
RADIO

COORDINATES

61- 70

Wiring Diagram Type 928 S Model 88 page 8

RADIO

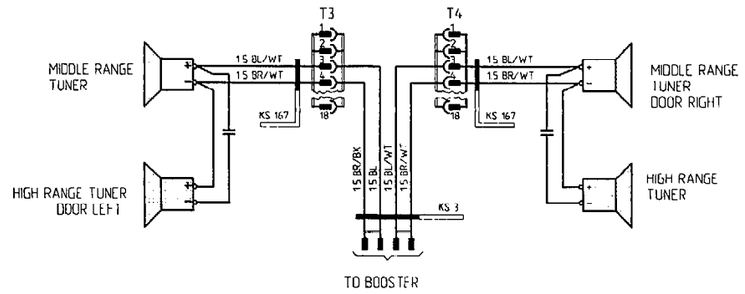


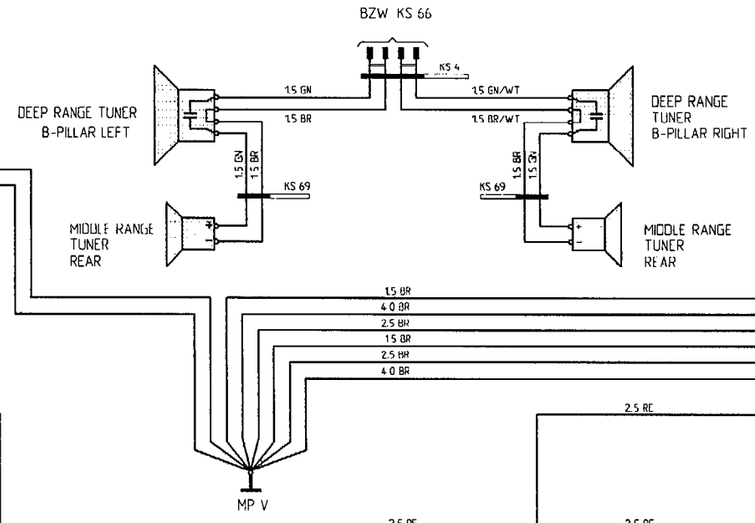
RADIO

(M158, M686, M 368, M328, M330, M329)

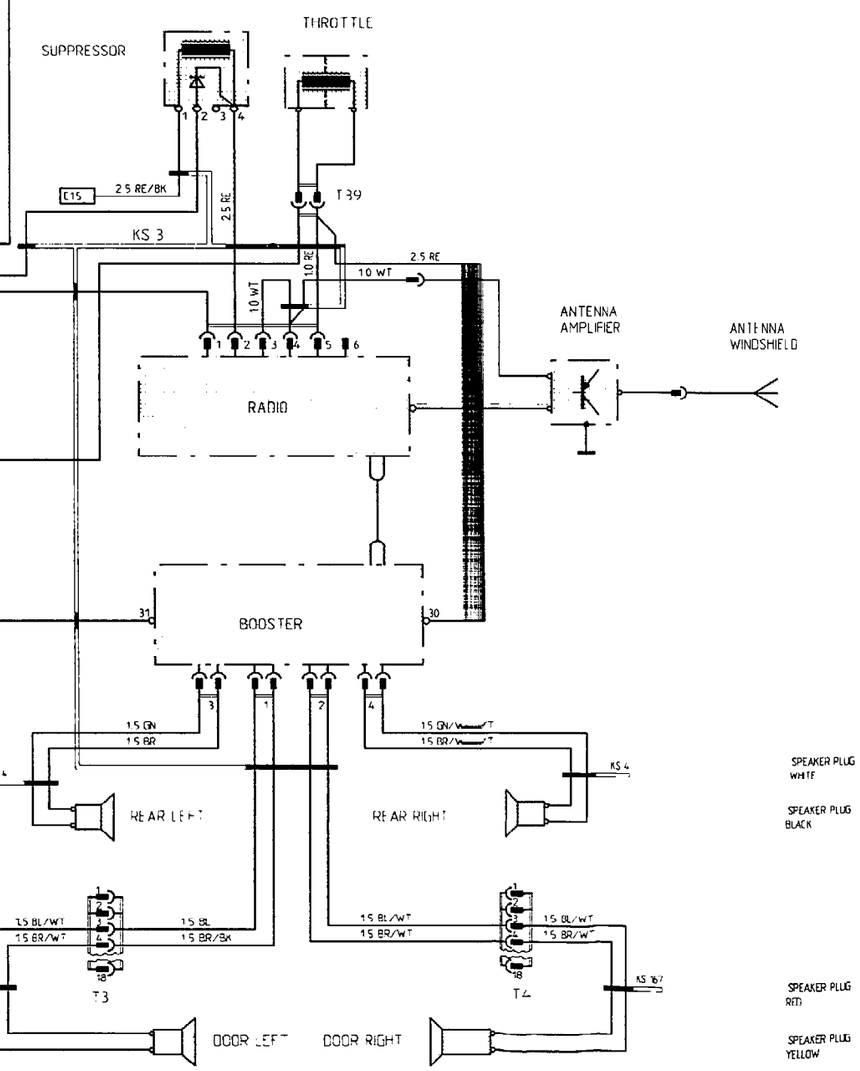
STANDARD WITHOUT RADIO

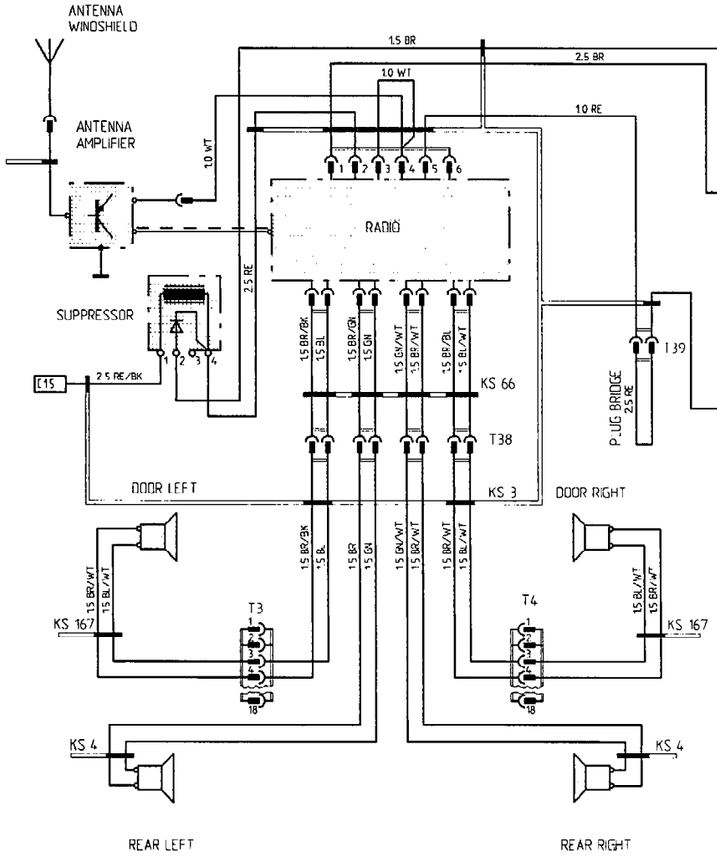
HIFI SYSTEM (M490)

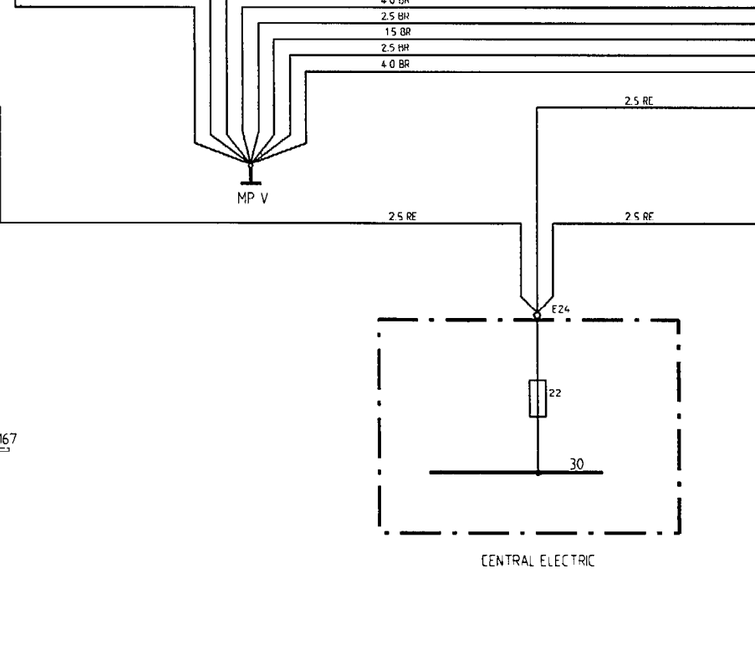




BOOSTER (M 494)







WELDING POINT

CONNECTION WITH FIELD DATA

MP GROUND POINT

KS WIRE HARNESS

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BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLEET

F G H J K L M N O P

61 62 63 64 65 66 67 68 69 70

M490)

T4

1.5 BL/WT
1.5 BR/WT

MIDDLE RANGE TUNER DOOR RIGHT

KS 167

HIGH RANGE TUNER

KS 3

KS 4

1.5 GN/WT
1.5 BR/WT

DEEP RANGE TUNER B-PILLAR RIGHT

KS 69

1.5 BR
1.5 GN

MIDDLE RANGE TUNER REAR

2.5 RE

2.5 RE

E24

22

30

CENTRAL ELECTRIC

BOOSTER (M 494)

SUPPRESSOR

THROTTLE

C15

2.5 RE/BK

KS 3

T39

2.5 RE

1.0 WT

1.0 RE

1 2 3 4 5 6

RADIO

ANTENNA AMPLIFIER

ANTENNA WINDSHIELD

BOOSTER

33 30

1 2 3 4

1.5 GN
1.5 BR

1.5 GN/WT
1.5 BR/WT

KS 4

REAR LEFT

REAR RIGHT

1.5 BL/WT
1.5 BR/WT

1.5 BL
1.5 BR/BK

KS 167

T3

T4

DOOR LEFT

DOOR RIGHT

RADIO BERLIN (M 326)

SUPPRESSOR

THROTTLE

C15

2.5 RE/BK

KS 3

T39

2.5 RE

1.0 WT

1.0 RE

1 2 3 4 5 6

ANTENNA AMPLIFIER

ANTENNA WINDSHIELD

RADIO

1.0 BK

0.5 WT

911 665 263 00

RECEIVER

31 30

2.5 RE

1.5 GN
1.5 BR

1.5 GN/WT
1.5 BR/WT

KS 4

REAR LEFT

REAR RIGHT

1.5 BL/WT
1.5 BR/WT

1.5 BL
1.5 BR/BK

KS 167

T3

T4

DOOR LEFT

DOOR RIGHT

CONNECTION PLAN BOOSTER

SPEAKER PLUG FRONT LEFT WHITE

SPEAKER PLUG FRONT RIGHT BLACK

SPEAKER PLUG REAR RIGHT RED

SPEAKER PLUG REAR LEFT YELLOW

CONNECTION LEAD BOOSTER

RE

BR

CONNECTION PLAN RA 10

SPEAKER PLUG FRONT RIGHT BLACK

SPEAKER PLUG FRONT LEFT WHITE

WT BR RE

SPEAKER PLUG REAR RIGHT RED

SPEAKER PLUG REAR LEFT YELLOW

+12V

8

F G H J K L M N O P

BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S Model 88 page 9

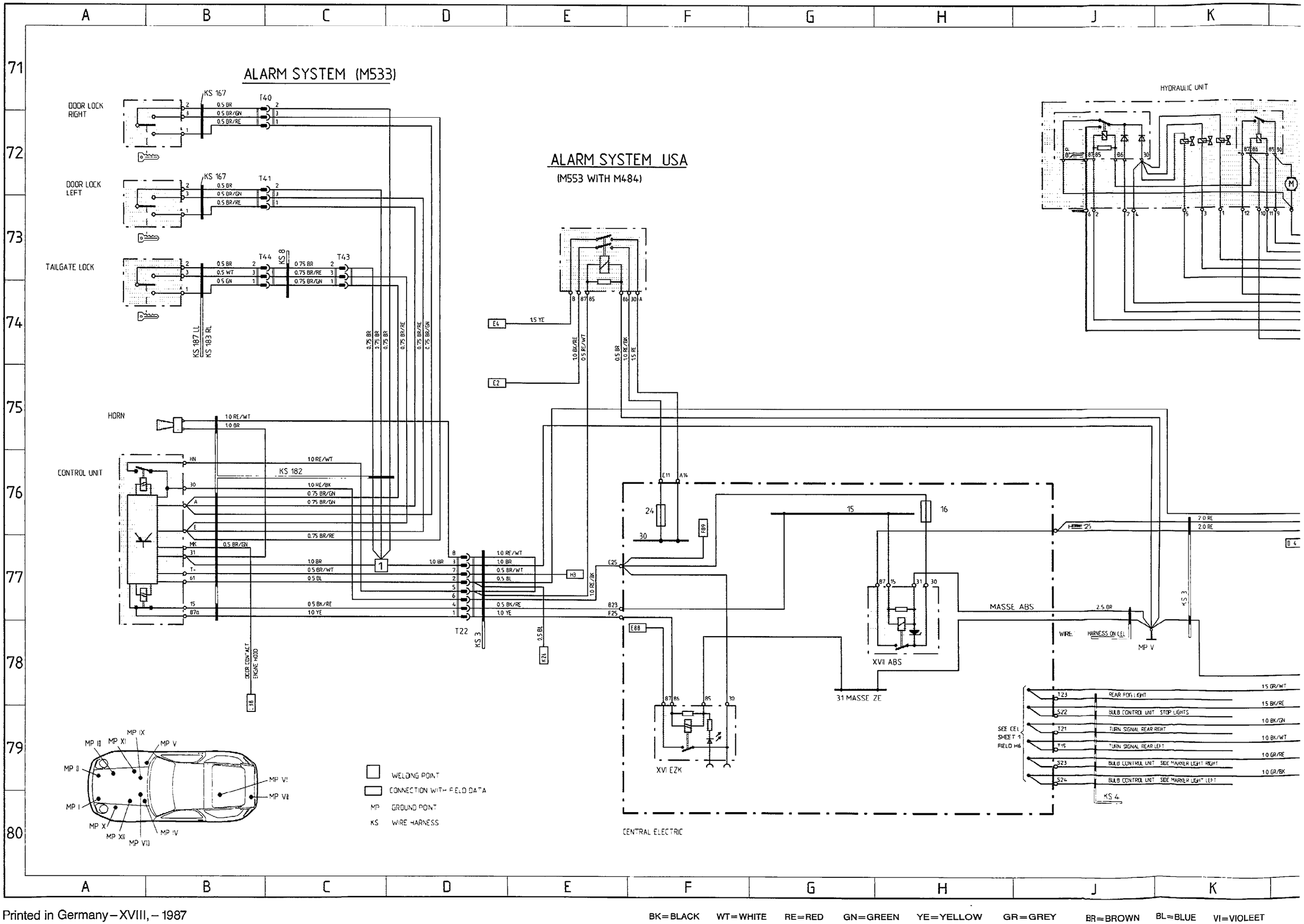
ABS, ALARM SWITCH, TRAILER HITCH

COORDINATES

71- 80

Wiring Diagram Type 928 S Model 88 page 9

ABS, ALARM SWITCH, TRAILER HITCH



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F G H J K L M N O P

71 72 73 74 75 76 77 78 79 80

1 USA

A B S SYSTEM (M593)

HYDRAULIC UNIT

CONTROL UNIT

MP X

GROUND STRAP
NR. 928.612.189 01

6 mm²

0.75 GN/BK
1.0 BR/GN
1.5 GN
1.5 GN/YE
1.5 GN/RE
4.0 RE
1.0 GN/WT
1.0 WT
0.75 GN/BL
4.0 RE

G28

KS 121

1.0 BR
1.0 BR
1.0 BR

MP IV

0.5 YE
0.5 YE
0.5 WT
0.5 WT
0.5 GN
0.5 GN
0.5 BL
0.5 BL

WIRE CONNECTOR

2.0 RE

KS 2

685

2.5 BK/BR
0.5 BK/GR
2.5 BK/RE
0.75 BK/RE

T23

0.5 BK/RE

T17 T16 T15 T14

MP VI MP VI MP XI MP XII

CLUSTER LEAD

MP WHEEL SUSPENSION

REAR RIGHT REAR LEFT FRONT RIGHT FRONT LEFT

SPEED SENSOR

E11 A14

24

189

15 16

H25

2.0 RE
2.0 RE

87 15 31 30

XVII ABS

MASSE ABS 2.5 BR

WIRE HARNESS ON CEL

MP V

KS 3

31 MASSE ZE

87 86 85 30

XV EZK

TRAILER HITCH
(M 208)

T23	REAR FOG LIGHT	1.5 GR/WT	6	1.5 BR	31
S22	BULB CONTROL UNIT - STOP LIGHTS	1.5 BK/RE	5	1.5 GR/WT	54g
T21	TURN SIGNAL REAR RIGHT	1.0 BK/GN	4	1.5 BK/RE	54
T15	TURN SIGNAL REAR LEFT	1.0 BK/WT	3	1.5 BK/GN	R
S23	BULB CONTROL UNIT - SIDE MARKER LIGHT RIGHT	1.0 GR/RE	2	1.5 BK/WT	L
S24	BULB CONTROL UNIT - SIDE MARKER LIGHT LEFT	1.0 GR/BK	1	1.5 GR/RE	58R
				1.5 GR/BK	58L

SEE ET SHEET 1 FIELD H6

KS 4

KS 161

T24

KS 180

SOCKET FOR TRAILER HITCH

AL ELECTRIC

9

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Wiring Diagram Type 928 S
Model 88 page 10

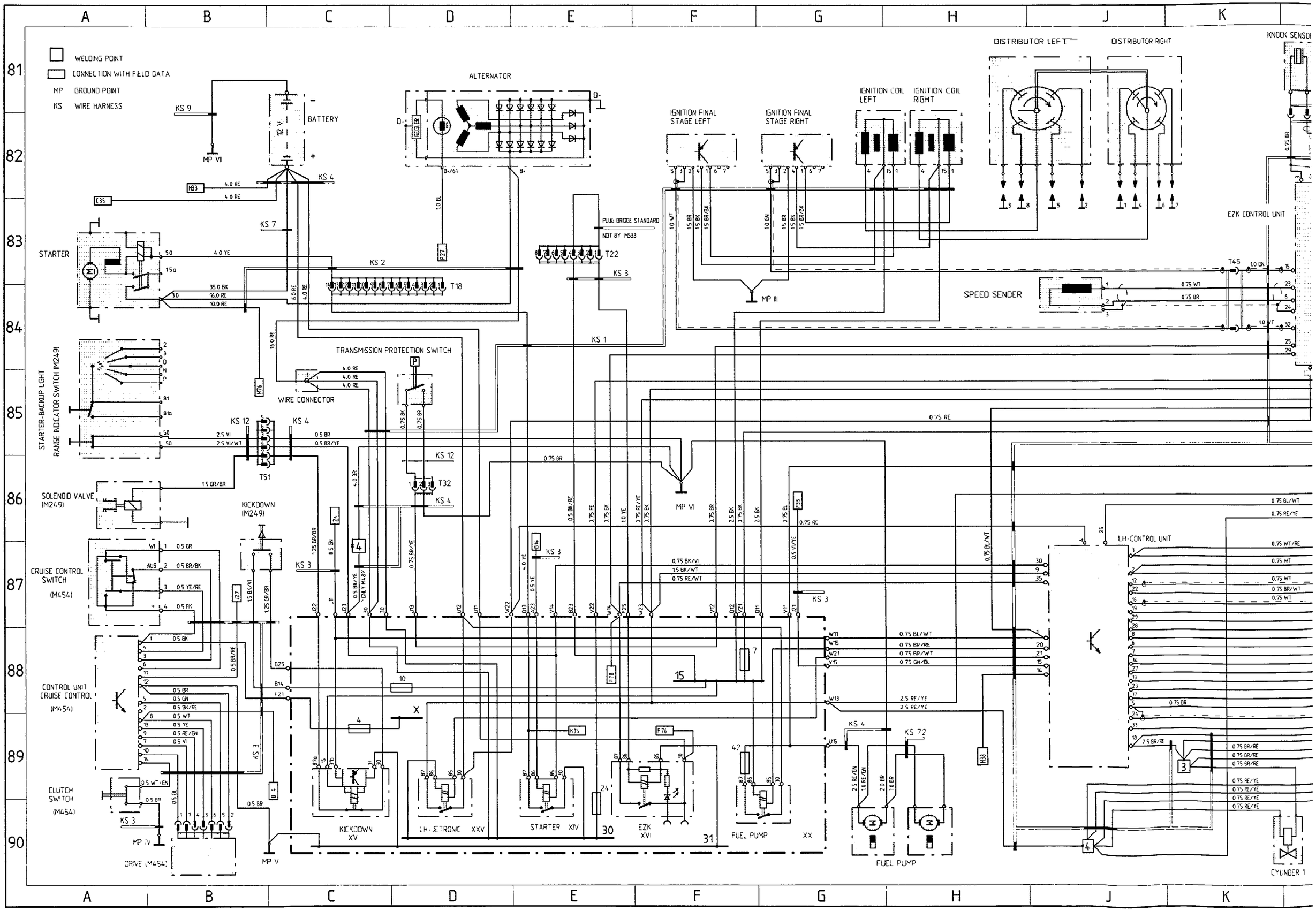
MOTOR, FUEL AND IGNITION,
CRUISE CONTROL

COORDINATES

81- 90

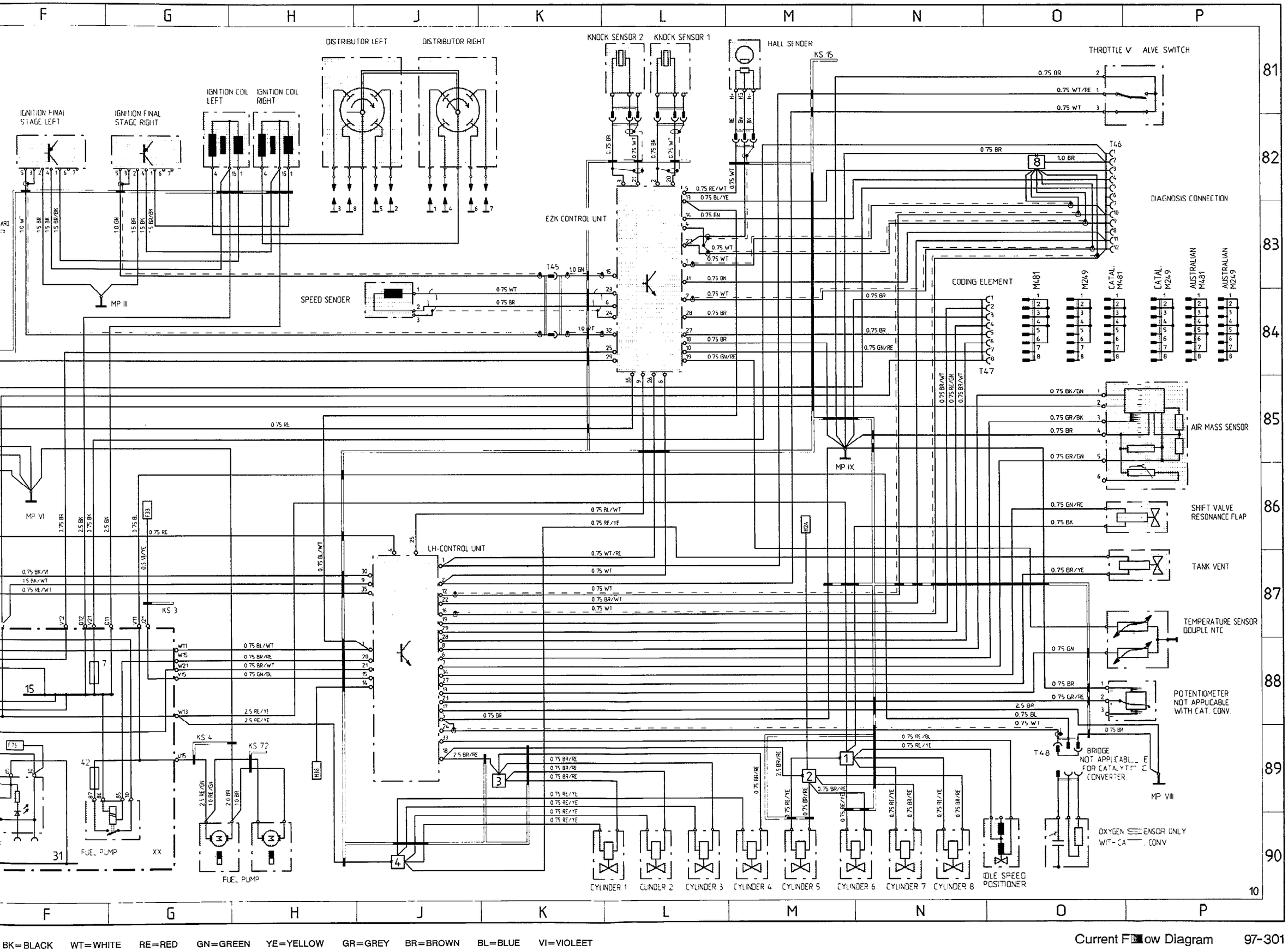
Wiring Diagram Type 928 S Model 88 page 10

MOTOR, FUEL AND IGNITION, CRUISE CONTROL



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Wiring Diagram Type 928 S
Model 88 page 11

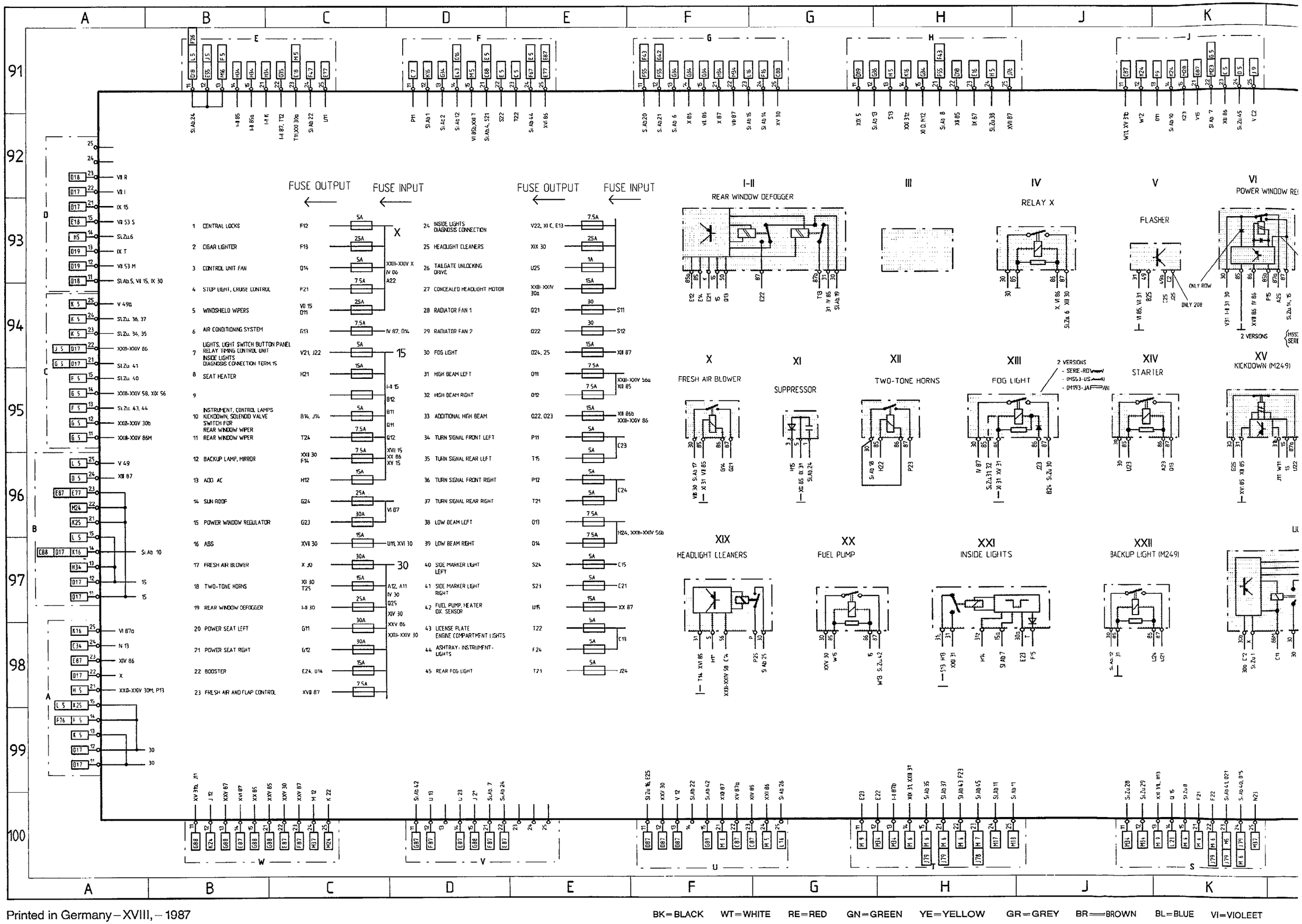
CENTRAL ELECTRIC

COORDINATES

91-100

Wiring Diagram Type 928 S Model 88 page 11

CENTRAL ELECTRIC



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I-II
REAR WINDOW DEFOGGER

III

IV
RELAY X

V
FLASHER

VI
POWER WINDOW REGULATOR
ONLY ROW
ONLY 208
ONLY M553
2 VERSIONS
M553-USA
SERIE-ROW

VII
WIPER INTERMITTENT CONTROL

VIII
DEF

IX
ADDITIONAL CLEANING FLUID PUMP

X
FRESH AIR BLOWER

XI
SUPPRESSOR

XII
TWO-TONE HORNS

XIII
FOG LIGHT
2 VERSIONS
- SERIE-ROW (M553-USA)
- (M193-JAPAN)

XIV
STARTER

XV
KICKDOWN (M249)

XVI
EZK

XVII
ABS (M593)

XVIII
FLAP CONTROL

XIX
HEADLIGHT CLEANERS

XX
FUEL PUMP

XXI
INSIDE LIGHTS

XXII
BACKUP LIGHT (M249)

XXIII-XXIV
LIGHT COMBINATION RELAY

XXV
LH-JETRONIC

XXVI

MASSE ABS
MASSE LICHTKOMBI

BK=BLACK WT=WHITE RE=RED GN=GREEN YE=YELLOW GR=GREY BR=BROWN BL=BLUE VI=VIOLEET

Wiring Diagram Type 928 S
Model 88 page 12

CONSTR. COMPONENTS, PLUG CONNECTIONS,
GROUND POINTS

Wiring Diagram Type 928 S Model 88 page 12

CONSTR. COMPONENTS, PLUG CONNECTIONS, GROUND POINTS

CONSTRUCTION COMPONENTS

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRE DIAGRAM
ABS CONTROL UNIT	7cQ		IN DRVIER'S FOOTWELL ON SIDE PANEL	MNO 72
ABS CONTROL UNIT		7cQ	ABOVE CENTRAL ELECTRICS	MNO 72
ALARM SYSTEM CONTROL UNIT	7cM	7cP	BEHIND GLOVE COMPARTMENT	AB 76,77
ALRAM SYSTEM RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	E73
ANTENNA AMPLIFIER	7cL	7cL	BEHIND CONTROL PANEL RIGHT	A 65, JK 66,0 63
OUTSIDE TEMP SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	HJ 67,68
RECEIVER FOR RADIO BERLIN	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MN 64,65
SUPPRESSOR FOR BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	H 64,N 62
SUPPRESSOR FOR RADIO	8dO	8dO	IN CENTRE CONSOLE IN FRONT OF RADIO	B 67,H 64,M 62
SWITCHING UNIT EX (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
EZK CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	L 82-84
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE COOL KIT COVER	OP 17
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
AIR CONDITIONING SYSTEM CONTROL UNIT	8cN-O	8cN-O	IN HEATER BOX	AB 34-36
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39,40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MNO 39,40
COOLING WATER PRESSURE SWITCH	5cM	5cP	IN COOLANT HOSE BEFORE EXPANSION TANK	L 29,30
COOLING WATER TEMPERATURE SWITCH	6cM	6cP	ON EXPANSION TANK	L 29
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
IDLE SPEED CO ADJUSTMENT POTENIOMETER	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	OP 88
LH JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	O 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 35,36
SWITCHING DEVICE, REDUCED DRIVING LIGHT		7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	H 2,3
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 54
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRVIER'S FOOTWELL ON SIDE PANEL	O 54 57
CRUISE CONTROL CONTROL UNIT	7dN-O	7dN-O	IN CENTRE CONSOLE AT FRONT	AB 89,90
FREEZING PROTECTION SWITCH AIR CONDITIONER	7cM	7cM	UNDER THE WINDSHIELD WIPER COVER	FG 31
WARNING BUZZER	8cP	8cM	ON STEERING PROTECTIVE TUBE	F 21,22
WASHING FLUID LEVEL SWITCH	6cL	6cL	ON WINDSHIELD WASHER TANK	L 28
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL M	ON BLOWER HOUSING	KL 31,32
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
TIME RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	P 23-25
CENTRAL ELECTRIC	7dM	7dP	IN PASSENGER'S FOOTWELL ON FIREWALL	
CENTRL INFORMER	7dQ		IN DRIVER'S FOOTREST	FGH 26,27
CENTRL INFORMER		7dK	IN DRVIER'S FOOTWELL ON SIDE PANEL	FGH 26,27

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIEL WIR
T1	2	GLOVE BOX LAMP	7cL	7cQ	ABOVE EZK, LH C ONTROL UNIT	D2,D1
T2	3	ENGINE COMPARTMENT LAMP, HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPE R SYSTEM COVER	C4,C1
T3	18	DOOR DRIVER'S SIDE	7cQ	7cL	ABOVE PARCEL S HELF, DRIVER'S SIDE	H1,G1
T4	18	DOOR PASSENGER'S SIDE	7cL	7cQ	ABOVE EZK, LH C ONTROL UNIT	J1,M1
T5	3	COUNTRY CODING RHD	6dL	6dQ	BEHIND CONTROL UNIT CONSOLE	G3
T6						
T7	4	TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O5,J2
T8	2	LICENSE PALTE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	N9
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,
T11	8	B-PILLAR / TAILGATE	13aN	13aO	ABOVE THE REAR -LID PANEL	K10
T12	2	SIDE MARKER LAMP LEFT REAR	18cO		UNDER THE TOOL KIT COVER	O10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	O2
T14	2×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPA RTMENT AT SUSPENSION STRUT MOUNT	H22,H
T15	2×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPA RTMENT AT SUSPENSION STRUT MOUNT	J22,L
T16	2×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	L22,C
T17	2×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	L22,F
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPA RTMENT AT RIGHT WHEEL HOUSING	NO26
T19	14	INSTRUMENT PANEL / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL E LECTRICS	E13,J
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT , ADVANCE SEAT	KL43,
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT , ADVANCE SEAT	H42,I
T22	8	ALARM SYSTEM	6dL	6dQ	UNDER THE CENT RAL ELECTRICS	D75-
T23	4	ABS	6dL	6dQ	UNDER THE CENT RAL ELECTRICS	M76
T24	6	TRAILER HITCH	6dl	6dQ	UNDER THE CENT RAL ELECTRICS	L79
T25	2	SUN ROOF	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E12
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPE R SYSTEM COVER	C12
T27	4	RANGE INDICATOR	8bP	8hM	UNDER THE INSTRUMENT SCUTTLE	AB24
T28	2	PULSE SENDER	16dO	16dO	UNDER THE SPARE WHEEL COVER	J29
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O35,C
T33	1	ALARM SYSTEM / ENGINE HOOD CONTACT	6dl	6dQ	UNDER THE CENT RAL ELECTRICS	L38
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dl	6dQ	UNDER THE CENT RAL ELECTRICS	F36
T36	14	DOOR DRIVER'S SIDE BY SEAT AND MIRROR MEMORY	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	C59-
T37	12	DOOR PASSENGER'S SIDE BY SEAT AND MIRROR MEMORY	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C51-5
T38	4×2	LOUDSPEAKER LEADS VEHICLE WITHOUT BOOSTER	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	BC67
T39	2	PLUG BRIDGE INSTEAD BOOSTER THROTTLE	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	O66
T40	3	ALARM SYSTEM / DOOR LOCK	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C72
T41	3	ALARM SYSTEM / DOOR LOCK	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	C73
T42						
T43	3	ALARM SYSTEM / WIRE HARNESS B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	C73
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13aN	13aO	ABOVE THE REAR -LID PANEL	C73
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENT RAL ELECTRICS	K83
T46	12	DIAGNOSIS CONNECTION	7dL	7dQ	ON CONTROL UNIT CONSOLE	O82
T47	8	COOING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	O84
T48	3	OX. SENSOR	6dL	6dQ	UNDER THE CENT RAL ELECTRICS	O89
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	M32
T50	6	AUTOM. TRANSM., COULING TO GEARBOX WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	A23
T51	6	AUTOM. TRANSMISSION, COULING TO REAR WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85

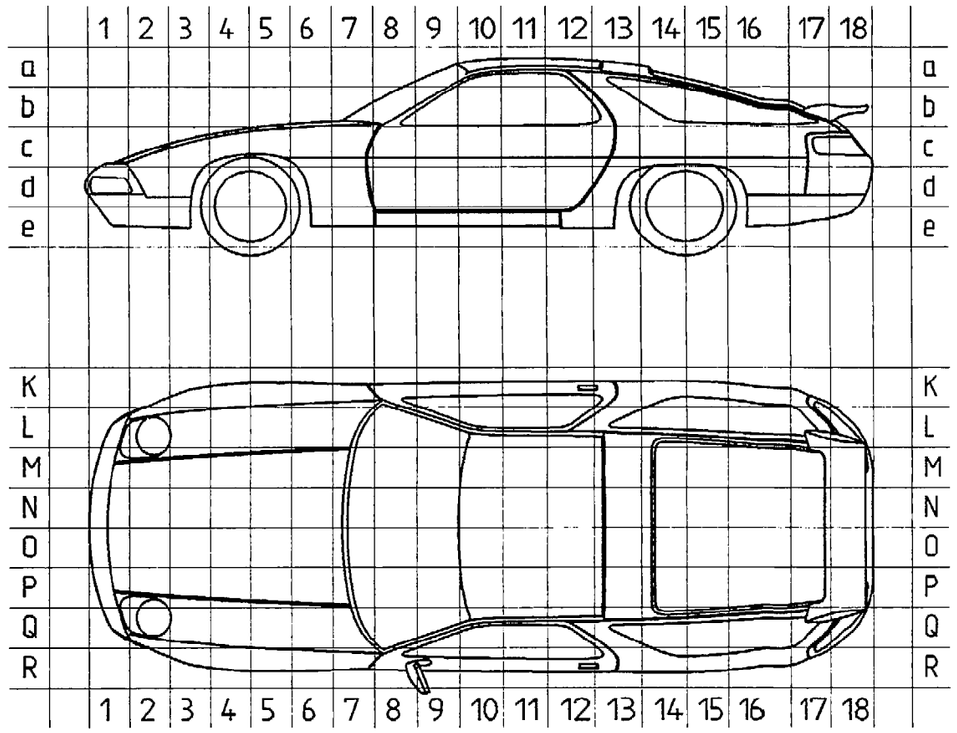
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PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRE DIAGRAM
T1	2	GLOVE BOX LAMP	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	D7,D13
T2	3	ENGINE COMPARTMENT LAMP, HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C4,C11
T3	18	DOOR DRIVER'S SIDE	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	H1,G14,C44,C55-58,B68
T4	18	DOOR PASSENGER'S SIDE	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	J1,M14,C42,C54,C68
T5	3	COUNTRY CODING RHD	6dL	6dQ	BEHIND CONTROL UNIT CONSOLE	G3
T6						
T7	4	TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O5, J29
T8	2	LICENSE PALTE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	N9
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,N31-32
T11	8	B-PILLAR / TAILGATE	13aN	13aO	ABOVE THE REAR-LID PANEL	K10
T12	2	SIDE MARKER LAMP LEFT REAR	18cO		UNDER THE TOOL KIT COVER	O10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	O2
T14	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	H22,N75
T15	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	J22,O75
T16	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	L22,O75
T17	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	L22,P75
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	NO26,D32-33,JK39,C083
T19	14	INSTRUMENT PANEL - / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL ELECTRICS	E13,J28
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	KL43,H46,F58-60
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H42,F51-53
T22	8	ALARM SYSTEM	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	D75-77,E83
T23	4	ABS	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	M76
T24	6	TRAILER HITCH	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	L79
T25	2	SUN ROOF	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E12
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	E12
T27	4	RANGE INDICATOR	8hP	8hM	UNDER THE INSTRUMENT SCUTTLE	AB24
T28	2	PULSE SENDER	16dO	16dO	UNDER THE SPARE WHEEL COVER	J29
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-34
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O35,O86
T33	1	ALARM SYSTEM / ENGINE HOOD CONTACT	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	L38
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	F36
T36	14	DOOR DRIVER'S SIDE BY SEAT AND MIRROR MEMORY	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	C59-60
T37	12	DOOR PASSENGER'S SIDE BY SEAT AND MIRROR MEMORY	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C51 52
T38	4x2	LOUDSPEAKER LEADS VEHICLE WITHOUT BOOSTER	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	BC67
T39	2	PLUG BRIDGE INSTEAD BOOSTER THROTTLE	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	D66
T40	3	ALARM SYSTEM / DOOR LOCK	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C72
T41	3	ALARM SYSTEM / DOOR LOCK	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	C73
T42						
T43	3	ALARM SYSTEM / WIRE HARNESS B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	C73
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13aN	13aO	ABOVE THE REAR-LID PANEL	C73
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	K83-84
T46	12	DIAGNOSIS CONNECTION	7dL	7dQ	ON CONTROL UNIT CONSOLE	O82-83
T47	8	COIING ELEMENT FOR IGNITION SYSTEM AND LH-JE TRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	O84
T48	3	OX SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	O89
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	M32
T50	6	AUTOM. TRANSM., COULING TO GEARBOX WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	A23
T51	6	AUTOM. TRANSMISSION, COULING TO REAR WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85,M2

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE
MP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
MP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
MP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
MP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
MP V	FIREWALL	8dM	8dM	ABOVE CENTRAL ELECTRICS
MP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
MP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
MP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
MP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
MP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
MP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
MP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT



Wiring Diagram Type 928 S
Model 89

	Coordinates	
Sheet 1	1 - 10	Lights Row
Sheet 2	1 - 10	Lights USA
Sheet 3	11 - 20	Body
Sheet 4	21 - 30	Instrument Cluster and Senders
Sheet 5	31 - 40	Engine Cooling, Heater, Air Conditioner
Sheet 6	41 - 50	Outside Mirror, Power Seat
Sheet 7	51 - 60	Seat and Mirror Memory
Sheet 8	61 - 70	Radio, Alarm System
Sheet 9	71 - 80	Antilock System, Tire Pressure Control, Porsche Lock Differential, Trailor Coupling
Sheet 10	81 - 90	Motor, Fuel and Ingnition, Cruise Control
Sheet 11	91 - 100	Central Electric
Sheet 12		Constr. Components, Plug Connections, Ground Points

Wiring Diagram Type 928 S
Model 89

The wiring diagram comprises of 11 individual wiring diagrams and 1 sheet construction components, plug connections and ground points. They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central-electrical system within a dash-dot frame.

This part of the central-electrical system shows all the lines and relays required for the individual wiring diagram.

The ground-connecting points are designated with "MP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Parts 2, is the "module element".

Both parts are identified by the digits 1.....5.

Part 3 is a "coding element".

The designations of the plug connections in the wiring diagram for central electrical system refer e.g. from A 11.....15, to the "initial element", from A 21.....25 to module element.

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Wiring Diagram Type 928 S
Model 89 Sheet 1

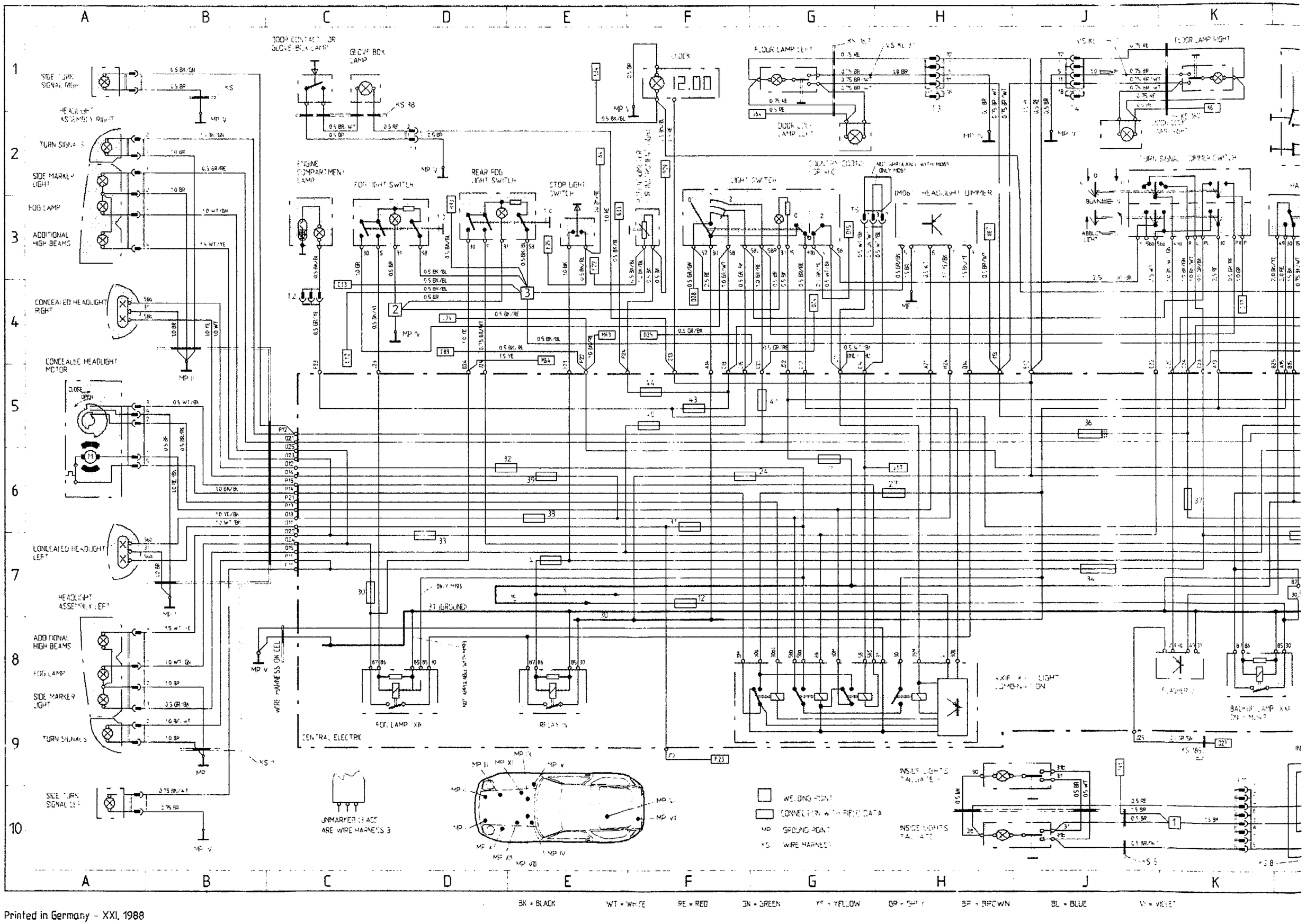
Lights Row

Coordinates

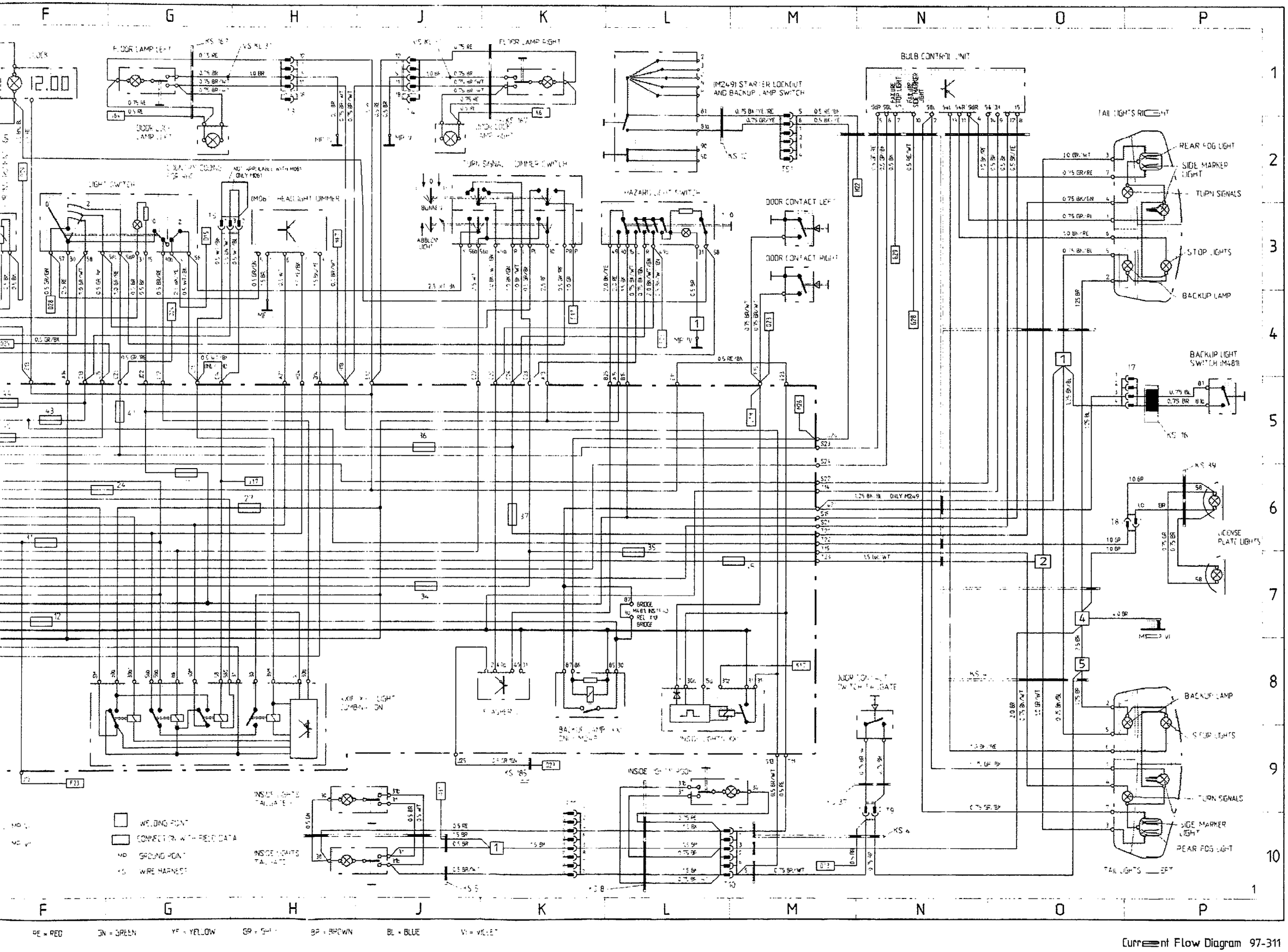
1-10

Wiring Diagram Type 928 S Model 89 Sheet 1

LIGHTS ROW



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FLOOR LAMP LEFT
FLOOR LAMP RIGHT
DOOR LOCK LAMP LEFT
DOOR LOCK LAMP RIGHT
LIGHT SWITCH
(M06) HEADLIGHT DIMMER
TURN SIGNAL DIMMER SWITCH
HAZARD LIGHT SWITCH
DOOR CONTACT LEFT
DOOR CONTACT RIGHT
(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH
BULB CONTROL UNIT
TAIL LIGHTS RIGHT
REAR FOG LIGHT
SIDE MARKER LIGHT
TURN SIGNALS
STOP LIGHTS
BACKUP LAMP
BACKUP LIGHT SWITCH (M48)
LICENSE PLATE LIGHTS
TAIL LIGHTS LEFT
INSIDE LIGHTS
BRIDGE M48 INSTEAD OF REL KW BRIDGE
WELDING POINT
CONNECTION WITH FIELD DATA
GROUND POINT
WIRE HARNESS
RE = RED
GN = GREEN
YE = YELLOW
BR = BROWN
BL = BLUE
VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 2

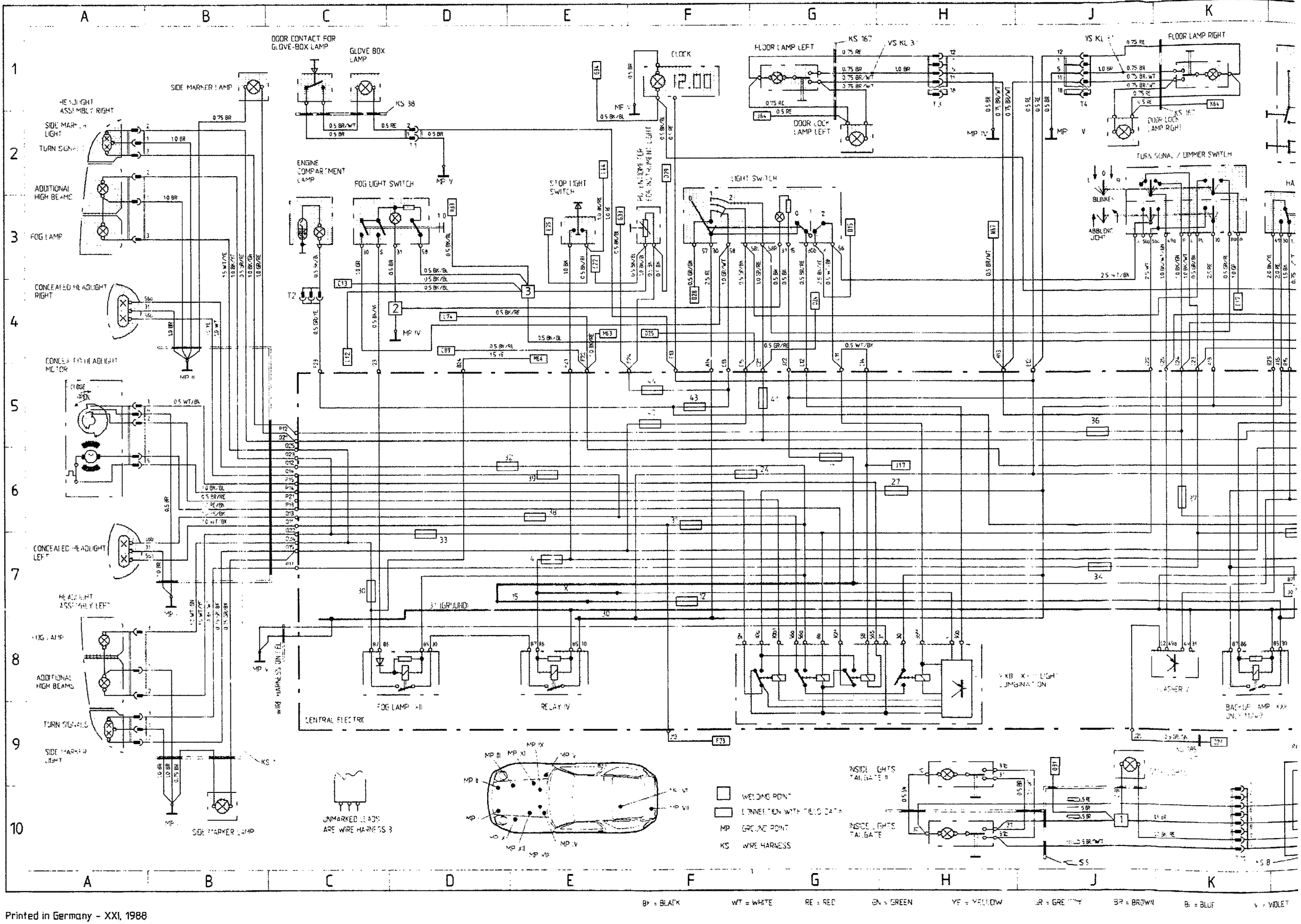
Lights USA

Coordinates

1 - 10

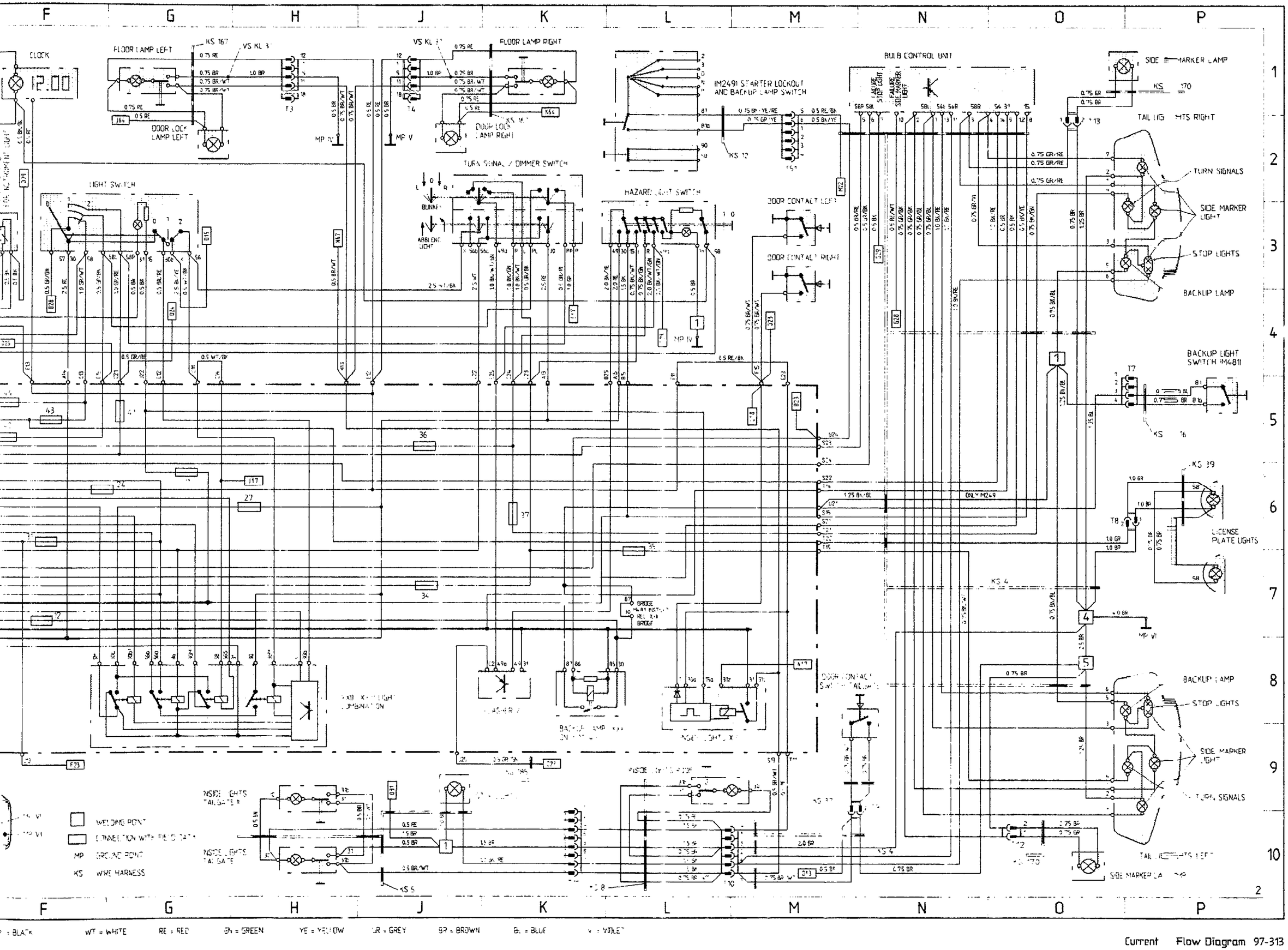
Wiring Diagram Type 928 S Model 89 Sheet 2

LIGHTS USA



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE V = VIOLET

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Current Flow Diagram 97-313

Wiring Diagram Type 928 S
Model 89 Sheet 3

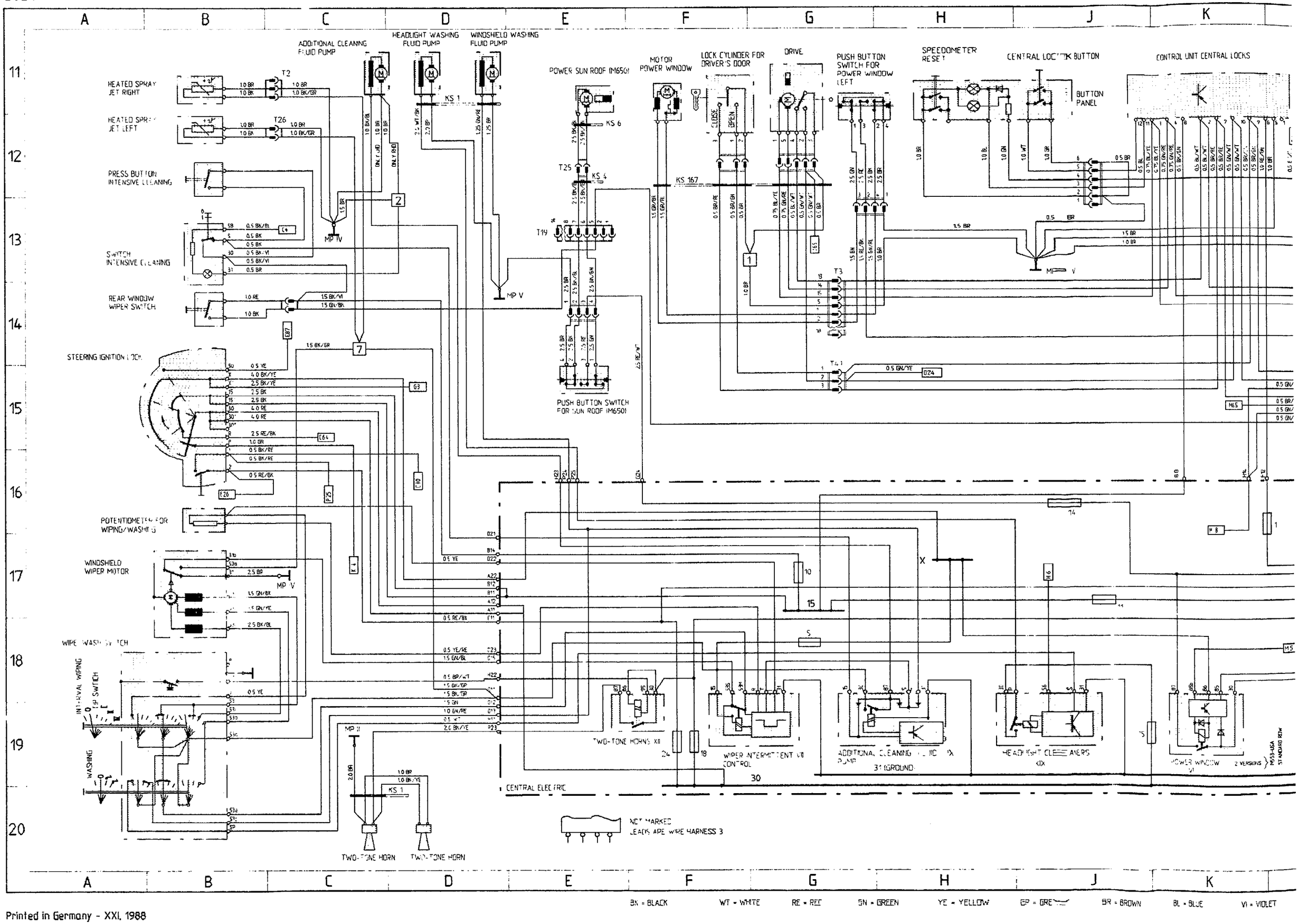
Body

Coordinates

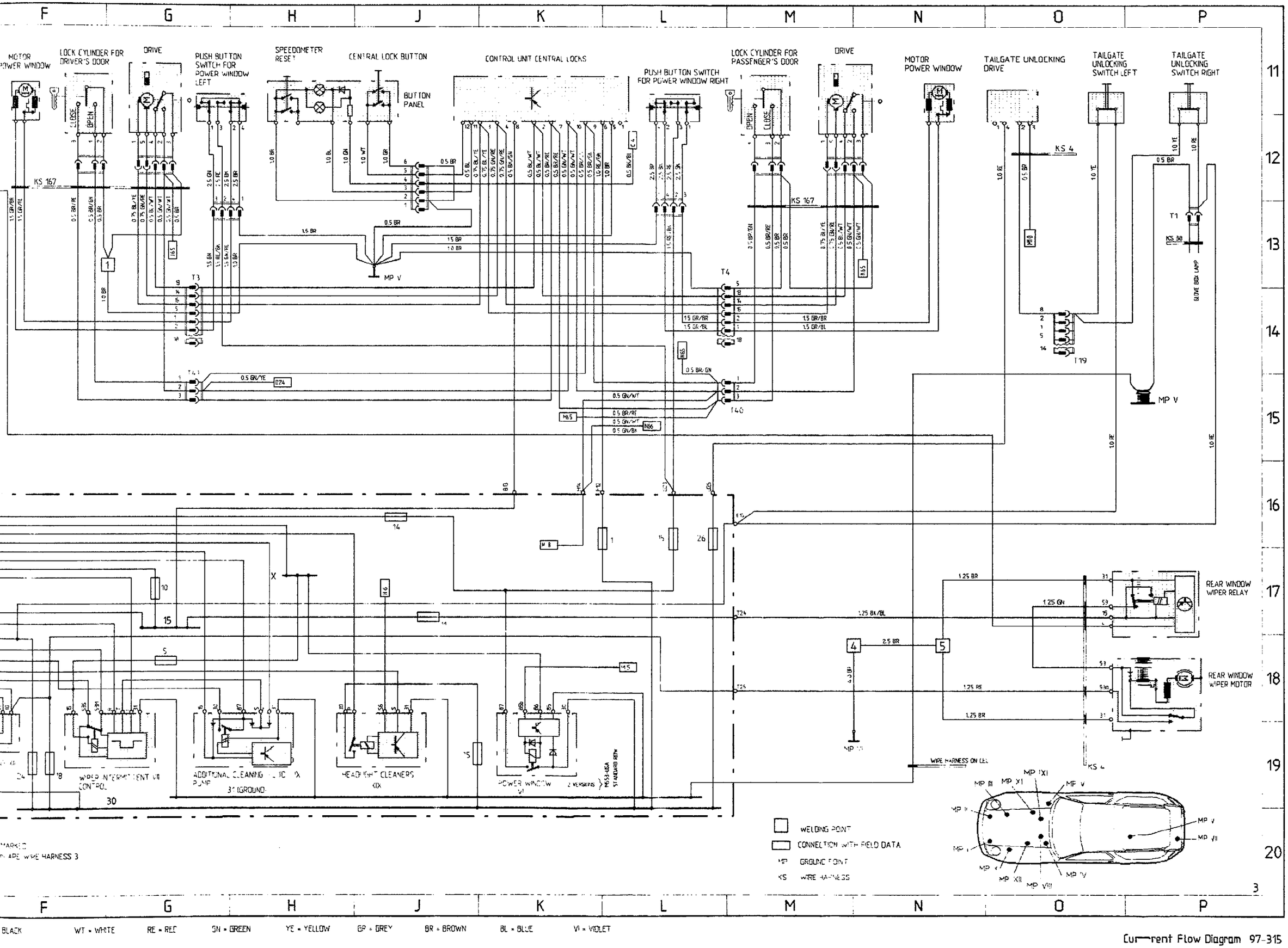
11-20

Wiring Diagram Type 928 S Model 89 Sheet 3

BODY



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BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 4

Instrument Cluster and Senders

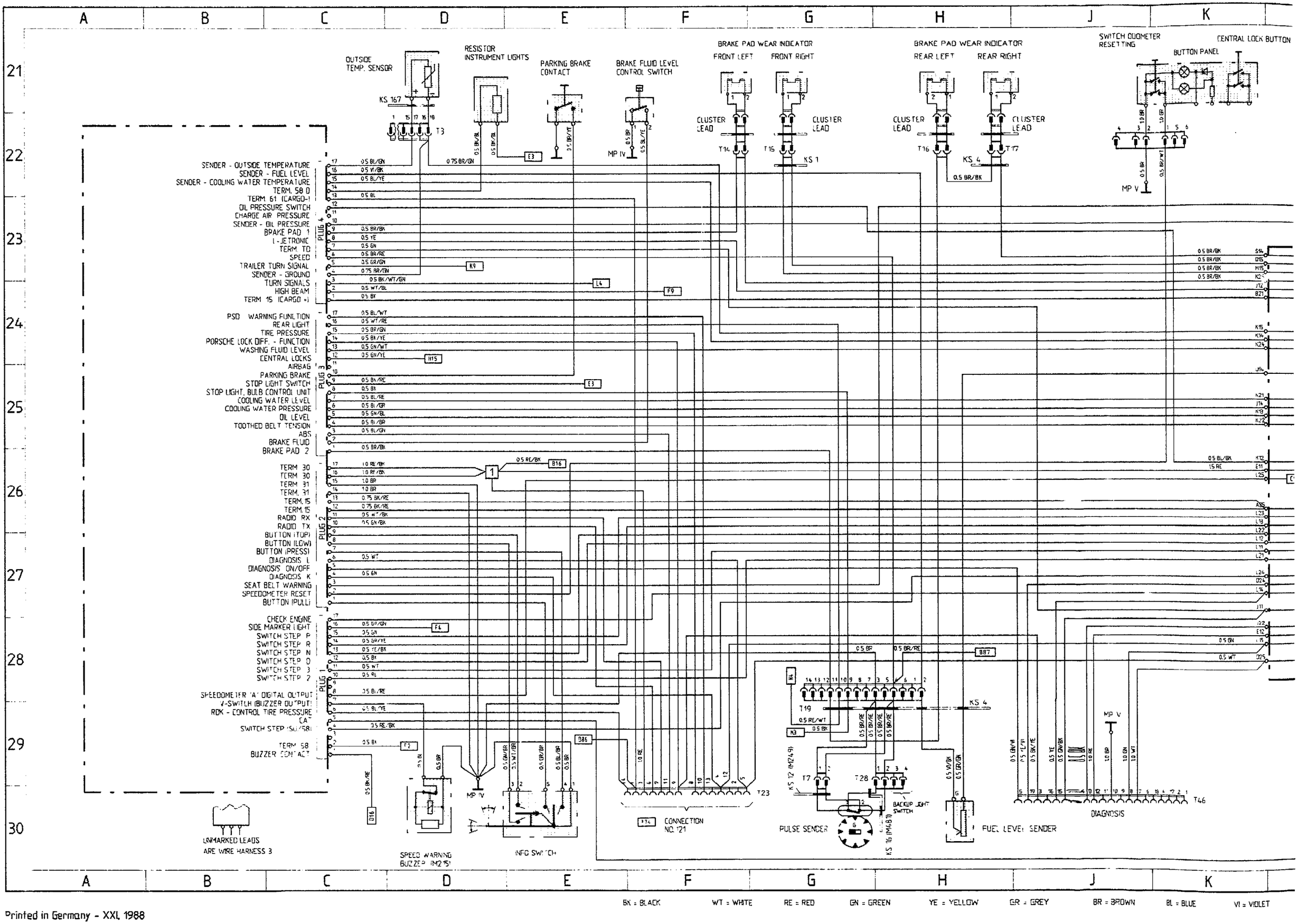
Coordinates

21-30

Current Flow Diagram 97-317

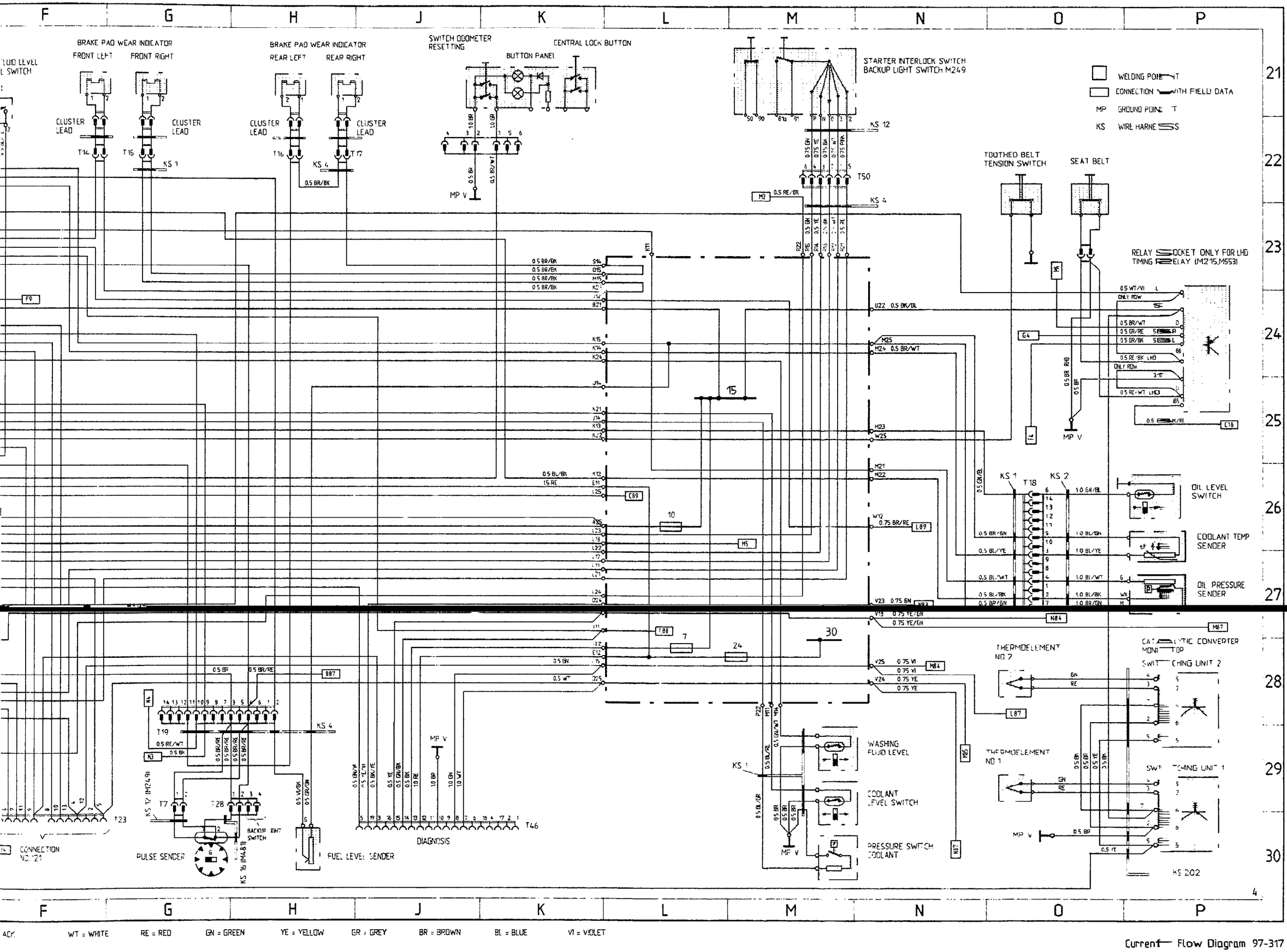
Wiring Diagram Type 928 S Model 89 Sheet 4

INSTRUMENT CLUSTER AND SENDERS



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

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F
G
H
J
K
L
M
N
O
P
21
22
23
24
25
26
27
28
29
30
4
BRAKE PAD WEAR INDICATOR
FRONT LEFT
FRONT RIGHT
REAR LEFT
REAR RIGHT
CLUSTER LEAD
T14
T15
T16
T17
KS 1
KS 4
0.5 BR/BK
SWITCH ODOMETER RESETTING
BUTTON PANEL
CENTRAL LOCK BUTTON
MP V
STARTER INTERLOCK SWITCH
BACKUP LIGHT SWITCH M249
KS 12
T50
M2
0.5 RE/BK
TOOTHED BELT TENSION SWITCH
SEAT BELT
WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
KS WIRE HARNESS
RELAY SOCKET ONLY FOR LHD
TIMING RELAY (M215,M553)
K11
15
10
7
Z4
30
M5
F9
B87
T23
CONNECTION NO. 121
T7
T28
BACKUP LIGHT SWITCH
PULSE SENDER
KS 16 (M4.8.1)
FUEL LEVEL SENDER
T19
KS 17 (M7.4.9)
T46
DIAGNOSIS
KS 1
KS 2
T18
OIL LEVEL SWITCH
COOLANT TEMP SENDER
OIL PRESSURE SENDER
WASHING FLUID LEVEL
COOLANT LEVEL SWITCH
PRESSURE SWITCH COOLANT
THERMOELEMENT NO 2
THERMOELEMENT NO 1
CATALYTIC CONVERTER MONITOR
SWITCHING UNIT 2
SWITCHING UNIT 1
KS 202
M87
M84
M85
M86
L87
G4
T4
C16
C89
E89
L89
W12
W25
W23
W24
U22
V23
V24
V25
N84
N86
N87
P22
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 5

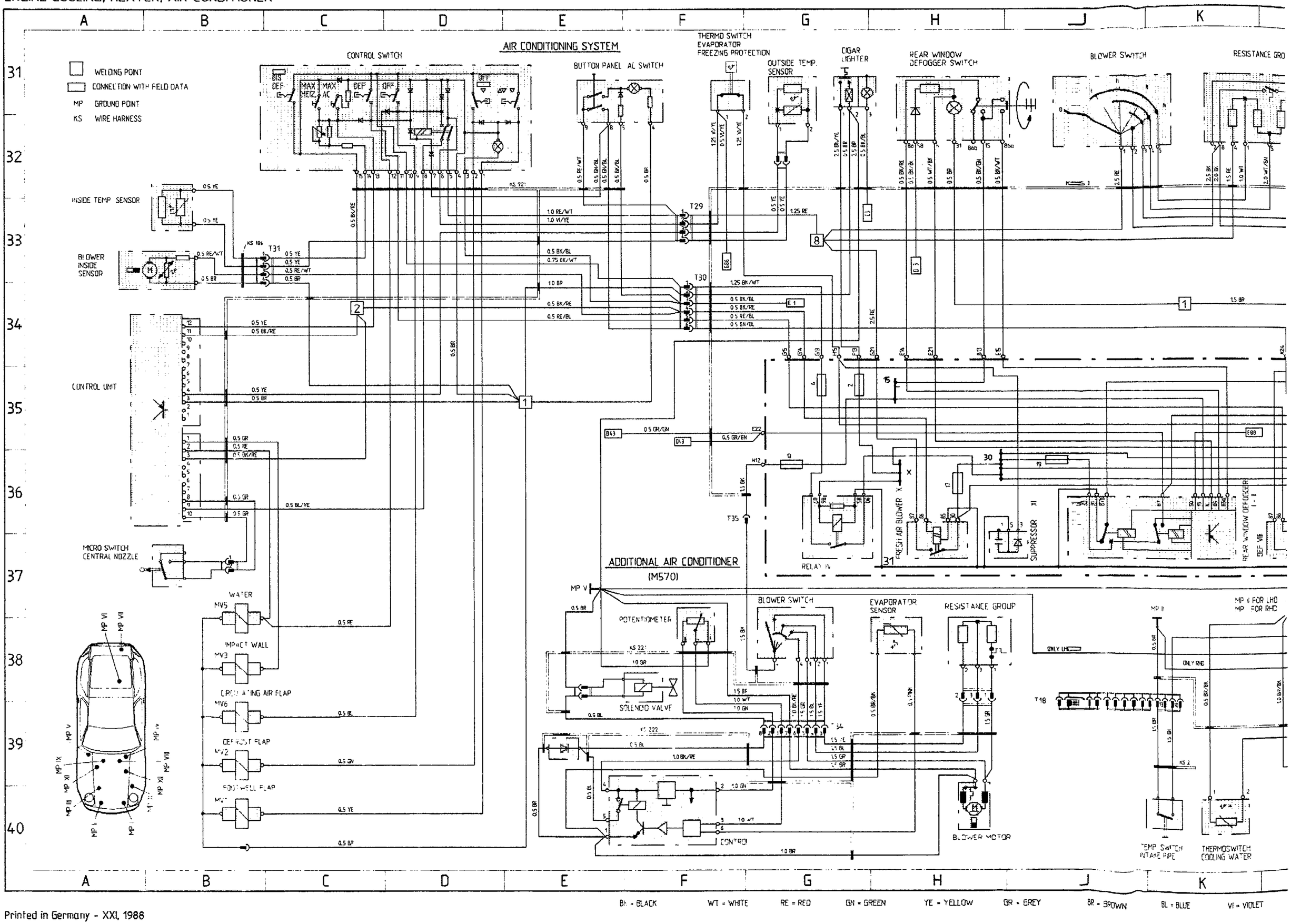
**Engine Cooling, Heater,
Air Conditioner**

Coordinates

31-40

Wiring Diagram Type 928 S Model 89 Sheet 5

ENGINE COOLING, HEATER, AIR CONDITIONER



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F G H J K L M N O P

THERMO SWITCH EVAPORATOR FREEZING PROTECTION

OUTSIDE TEMP. SENSOR

CIGAR LIGHTER

REAR WINDOW DEFOGGER SWITCH

BLOWER SWITCH

RESISTANCE GROUP

FRESH AIR BLOWER

T10 T11

REAR WINDOW

LOW PRESSURE HIGH PRESSURE SWITCH

SOLENOID CLUTCH COMPRESSOR

T18

T29 T30 T49

MP IV

RELAY IV

FRESH AIR BLOWER X

SUPPRESSOR XI

REAR WINDOW DEFOGGER I - II

DEF VIII

RELAY FLAP CONTROL

XVIII

OIL TEMPERATURE (M249) SWITCH TORQUE CONVERTER

AIR FLAP MOTOR

COOLANT FAN 1

COOLANT FAN 2

NAL AIR CONDITIONER (M570)

BLOWER SWITCH

EVAPORATOR SENSOR

RESISTANCE GROUP

T34

CONTROL

BLOWER MOTOR

MP II

MP X FOR LHD
MP IV FOR RHD

ONLY LHD

ONLY RHD

T18

T33

TEMP. SWITCH INTAKE PIPE

THERMOSWITCH COOLING WATER

PRESSURE SWITCH FRIGEN

DOOR CONTACT ENGINE HOOD

CONTROL UNIT FRESH AIR REGULATION

BLOWER FINAL STAGE

31 32 33 34 35 36 37 38 39 40

5

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 6

Outside Mirror, Power Seat

Coordinates

41-50

Wiring Diagram Type 928 S Model 89 Sheet 6

OUTSIDE MIRROR, POWER SEAT

WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
KS WIRE HARNESS

MIRROR PASSENGER'S SIDE (M261, M528)

MIRROR DRIVER'S SIDE

CHANGEOVER SWITCH

MIRROR SWITCH

VS TERM.31

KS 167

KS 3

KS 227

T4

T3

T21

T20

MP V

MP IV

MP II

VS I

VS II

CENTRAL ELECTRIC

CONNECTION POWER SEAT RIGHT

CONNECTION POWER SEAT LEFT

SEAT HEATER POWER SEAT

INVERSELY TO WITH LEFT

SPORT SEAT (M383, M387)

2-WAY SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

SEAT CUSHION HEIGHT CONTROL FRONT

WIRE HARNESS ON SWITCH

SEAT BACKREST CONTROL

NOT APPLICABLE WITH M139 M340, M586, M513

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

SEAT LUMBAR (M586) CURVE CONTROL (M513)

KS 337 V. M340, M5

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

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F G H J K L M N O P

41 42 43 44 45 46 47 48 49 50

ADJUSTABLE SEAT HEATING (M139, M340)

COMFORT SEAT - STANDARD LEFT

ORT SEAT 383, M387)

30 21 15 20 8 CENTRAL ELECTRIC G11 H21 G12

KS 3 MP V 2.0 BR 1.0 GN 1.5 YE/RE 2.0 BR 1.0 BK 1.5 RE T21

CONNECTION POWER SEAT RIGHT KS 227

SEAT HEATER AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

DELAYING RELAY SEAT HEATER SWITCH

BACKREST SEAT SIDE ELEMENTS

KS 337/338/340

WIRE HARNESS ON SWITCH

0.75 RE 0.75 YE 1.0 BK 1.0 BR 1.0 BK/RE 1.0 BR 1.0 BK 1.0 BR 1.0 GN 1.0 BR 1.0 GN 1.0 GN 1.0 GN 1.0 GN 1.0 GN 1.0 GN

KS 3 MP V 2.0 BR 1.0 GN 1.5 RE/YE 2.0 BR 1.0 BK 1.5 RE T20 KS 227

KS 3 MP IV 1.0 GN 2.0 BR 1.5 RE/YE T20 1.0 BK 2.0 BR 1.5 RE KS 227 CONNECTION POWER SEAT LEFT

4-WAY SWITCH WIRE HARNESS ON SWITCH

4-WAY SWITCH

2-WAY SWITCH 1.5 BK/GN 1.5 BK/VI 1.5 BR 1.5 RE WIRE HARNESS ON SWITCH

2-WAY SWITCH 1.5 BK/GN 1.5 BK/VI 1.5 BR 1.5 RE

SEAT CUSHION HEIGHT CONTROL REAR 1.5 BK/GN 1.5 BK/VI 1.5 RE 1.5 BR

SEAT BACKREST CONTROL 1.5 GR 1.5 BK 1.5 GR 1.5 BK

KS 343 NOT APPLICABLE WITH M139 M340, M586, M513

4-WAY SWITCH

SEAT LUMBAR (M586) HEIGHT CONTROL (M513) 1.5 BK/GN 1.5 BK/VI 1.5 BK/GN 1.5 BK/VI WIRE HARNESS ON SWITCH 1.5 RE 1.5 BR

SEAT LUMBAR (M586) CURVE CONTROL (M513) 1.5 BR 1.5 BK/GR 1.5 GR 1.5 BK

KS 337 WITH M139, M340, M513, M586

4-WAY SWITCH

WIRE HARNESS ON SWITCH 1.5 BR 1.5 RE

SEAT CUSHION HEIGHT CONTROL FRONT 1.5 BK/GN 1.5 BK/VI

SEAT BACK FORWARD CONTROL 1.5 GR 1.5 BK

6

F G H J K L M N O P

BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 7

Seat and Mirror Memory

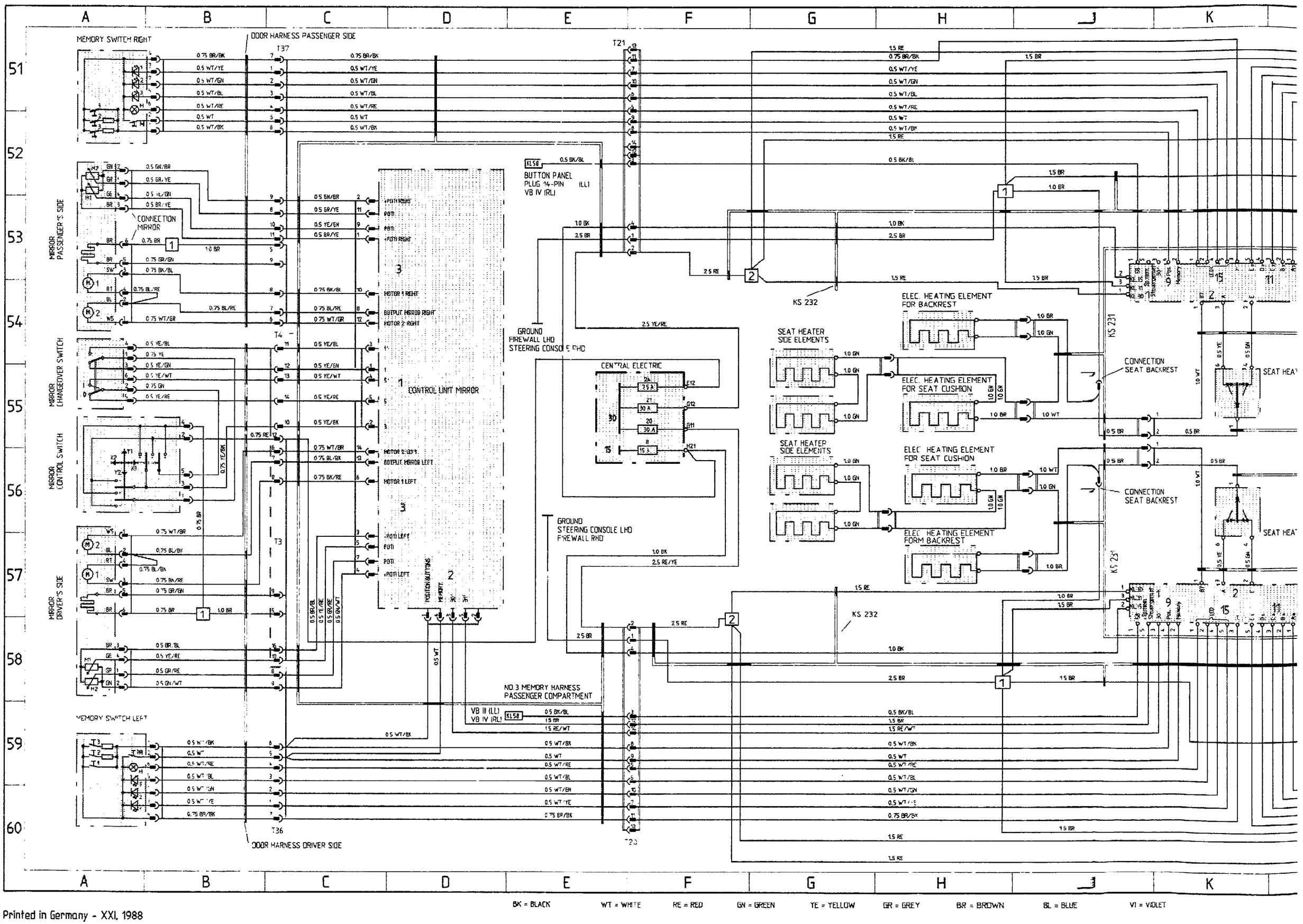
Coordinates

51-60

Current Flow Diagram 97-323

Wiring Diagram Type 928 S Model 89 Sheet 7

SEAT AND MIRROR MEMORY



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F G H J K L M N O P

51 52 53 54 55 56 57 58 59 60

CONNECTION SEAT BACKREST
LUMBAR SUPPORT HEIGHT
BACKREST
HEIGHT REAR
HEIGHT FRONT
LONGITUDINAL
RELAY UNIT
LUMBAR SUPPORT CURVATURE
CONNECTION SEAT BACKREST
KS 231
KS 232
CONTROL UNIT SEAT PASSENGER'S SIDE
CONTROL UNIT SEAT DRIVER'S SIDE
ELEC. HEATING ELEMENT FOR BACKREST
SEAT HEATER SIDE ELEMENTS
ELEC. HEATING ELEMENT FOR SEAT CUSHION
ELEC. HEATING ELEMENT FORM BACKREST
SEAT HEATER
WIRE HARNESS ON SWITCH
4-WAY SWITCH

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI

WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
KS WIRE HARNESS

7

RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 8

Radio, Alarm System

Coordinates

61-70

Wiring Diagram Type 928 S Model 89 Sheet 8

RADIO, ALARM SYSTEM

ROOF ANTENNA (M326)

SUPPRESSOR

THROTTLE (M326)

T39

KS 63 (M326)

BRIDGE (NOT M326)

ANTENNA EXTENSION WIRE (NOT M326)

E15

RADIO OPERATION CONTROL

ANTENNA EXTENSION WIRE (M326)

NF-WIRE (M326)

BUS-WIRE (M326)

RECEIVER RADIO BERLIN (M326)

KS 63 (M326)

MP V

NF-WIRE (NOT M326)

BOOSTER LEFT RIGHT

T3

T4

KS 167 LEFT

KS 167 RIGHT

FREQUENCY SWITCH DOOR LEFT

FREQUENCY SWITCH DOOR RIGHT

KS 4

HIGH RANGE RADIO SPEAKER FRONT LEFT

MIDDLE RANGE SPEAKER

DEEP RANGE SPEAKER

KS 69 LEFT

KS 69 RIGHT

REAR LEFT

REAR RIGHT

HIGH RANGE RADIO SPEAKER FRONT RIGHT

MIDDLE RANGE SPEAKER

DEEP RANGE SPEAKER

MIDDLE RANGE SPEAKER

HIGH RANGE RADIO SPEAKER

ALARM-PRIMED INDICATOR LAMPS (M533, M525)

LEFT

RIGHT

KS 167 LEFT

KS 167 RIGHT

B13

K13

E24

24

30

22

87

XVI E2K

CENTRAL ELECTRIC

CONNECTION PLAN BOOSTER

SPEAKER PLUG DEEP RANGE TUNER LEFT YELLOW

SPEAKER PLUG DEEP RANGE TUNER RIGHT RED

PRE-AMPLIFIER INPUT NF-WIRE

CONNECTION PLUG 6-PIN

SPEAKER PLUG FRONT LEFT WHITE

SPEAKER PLUG FRONT RIGHT BLACK

SPEAKER PLUG REAR RIGHT RED

SPEAKER PLUG REAR LEFT YELLOW

CONNECTION PLAN RADIO

ANTENNA EXTENSION WIRE GR

+12V

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI

WELD

CONNE

MP GROU

WIRE

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

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F G H J K L M N O P

61 62 63 64 65 66 67 68 69 70

BOOSTER RIGHT LEFT

T3 T4

KS 167 RIGHT

KS 4

FREQUENCY SWITCH DOOR RIGHT

HIGH RANGE RADIO SPEAKER

FRONT RIGHT

MIDDLE RANGE SPEAKER

DEEP RANGE SPEAKER

KS 69 LEFT

KS 69 RIGHT

MIDDLE RANGE SPEAKER

REAR RIGHT

HIGH RANGE RADIO SPEAKER

ALARM-PRIMED INDICATOR LAMPS (M533, M525)

LEFT RIGHT

KS 167 LEFT

KS 167 RIGHT

ALARM SYSTEM USA

(M533 WITH M484)

ALARM SYSTEM (M533, M525)

T43 T44

KS 187 LL

KS 183 RL

TAILGATE LOCK

CLOSE

OPEN

KS 8

KS 4

RADIO SUPPORTING FRAME

T19

KS 3

ADDITIONAL CONTROL UNIT ALARM SYSTEM

HORN

CONTROL UNIT

T 33

KS 1

DOOR CONTACT ENGINE HOOD

CENTRAL ELECTRIC

31 GROUND CE

MP V

RADIO

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI

WELDING POINT

CONNECTION WITH FIELD DATA

MP GROUND POINT

KS WIRE HARNESS

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 9

Antilock System, Tire Pressure Control, Porsche Lock Differential, Trailor Coupling

Coordinates

71-80

Wiring Diagram Type 928 S Model 89 Sheet 9

ANTILOCK SYSTEM, TIRE PRESSURE CONTROL, PORSCHE LOCK DIFFERENTIAL, TRAILER COUPLING

ABS - ANTILOCK SYSTEM (M593)

PSD - PORSCHE LOCK DIFFERENTIAL (M221)

CONTROL UNIT ABS 35-PIN PLUG

CONTROL UNIT ABS + PORSCHE LOCK DIFF. 55-PIN PLUG

1 COMPARTM. NO., VARIANT WITH 35-CONTACT CONNECTOR

(1) COMPARTM. NO., VARIANT WITH 55-CONTACT CONNECTOR

SOLENOID VALVE (M221)

HYDRAULIC UNIT ABS

MP X

GROUND STRAP NR. 928 612.169.01

PUMP (M221)

PUMP RELAIS (M221)

WIRE CONNECTOR

KS 2

ACCELERATING SENSOR (M221)

MP IV

T 23

ONLY M482

F30

CONTROL UNIT TIRE PRESSUR

KS 121

RDK - TIRE PRESSURE CO (M482)

COMBINATION LEADS

MP VI

MP XI

MP XII

T17

T16

T15

T14

MP WHEEL SUSPENSION

HF SENDER (M482)

SPEED SENSOR

REAR RIGHT

REAR LEFT

FRONT RIGHT

FRONT LEFT

MP I

MP II

MP III

MP V

MP VII

MP VIII

MP IX

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

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PSD - PORSCHE LOCK DIFFERENTIAL (M221)

35-PIN PLUG
55-PIN PLUG
T CONNECTOR
CT CONNECTOR

ACCELERATING SENSOR (M221)

0.5 BR/BL
0.5 YE/BL
0.5 RE/BL

MP IV

T 23

ONLY M482 8
0.5 BR 12
0.75 BK/RE 11
0.5 BL/GN 9
ONLY M221 0.5 BK/YE 3
ONLY M221 0.5 RE 10
0.5 BL/WT 13
2.0 BK/RE 14
7
6
0.5 WT 5
0.5 GN 4
2
0.5 BL 1
0.5 BL 22
0.5 BK/WT 33
0.5 GN 20
0.5 WT 19
0.5 GN/BK 1
0.5 WT/BK 2
0.5 BL/YE 3
0.5 VI/RE 29
0.5 VI/GN 28
0.5 VI/WT 26
0.5 VI/YE 8
0.5 BR 13
0.5 BK/YE 35
0.5 BK/WT 18
0.5 BK/GN 17
0.5 BK/RE 34

F30

0.5 BK/RE → B4
2.0 RE → H25
0.5 BK/WT → F14

KS 3

CONTROL UNIT TIRE PRESSURE CONTROL

KS 121

RDK - TIRE PRESSURE CONTROL (M482)

1.0 BR MP IV

MP VI MP XI MP XII

T15 T14

COMBINATION LEADS

MP WHEEL SUSPENSION

SPEED SENSOR (M482) REAR LEFT
HF SENDER (M482) SPEED SENSOR FRONT RIGHT
HF SENDER (M482) SPEED SENSOR FRONT LEFT

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI MP XII

TRAILER COUPLING (M 208)

PLUG SOCKET TRAILER COUPLING

31 15 BR
54g 15 GR/WT
54 15 BK/RE
R 15 BK/GN
L 15 BK/WT
58R 15 GR/RE
58L 15 GR/BK

KS 180
T24
KS 161

15 BR/WT
15 BK/RE
1.0 BK/GN
1.0 BK/WT
1.0 GR/RE
1.0 GR/BK

REAR FOG LIGHT
BULB CONTROL UNIT - STOP LIGHTS
TURN SIGNAL REAR RIGHT
TURN SIGNAL REAR LEFT
BULB CONTROL UNIT - SIDE MARKER LIGHT RIGHT
BULB CONTROL UNIT - SIDE MARKER LIGHT LEFT

KS 4

L67
15
12
16
31
GROUND ABS
WIRE HARNESS ON CEL
KS 3
MP V
87 85 31 30
XVII ABS

T23
S22
T21
T15
S23
S24

SEE CEL SHEET 1 FIELD H6

CENTRAL ELECTRIC

WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
KS WIRE HARNESS

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 10

Motor, Fuel and
Ignition, Cruise Control

Coordinates

81-90

Current Flow Diagram 97-329

Wiring Diagram Type 928 S Model 89 Sheet 10

MOTOR, FUEL AND IGNITION, CRUISE CONTROL

WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
KS WIRE HARNESS

BATTERY
ALTERNATOR
STARTER
SOLENOID VALVE (M249)
KICKDOWN (M249)
CRUISE CONTROL SWITCH (M454)
CONTROL UNIT CRUISE CONTROL (M454)
CLUTCH SWITCH (M454+M481)
BRIDGE (M454+M249)
DRIVE (M454)
STARTER-BACKUP LIGHT RANGE INDICATOR SWITCH (M249)
IGNITION COIL RIGHT
IGNITION COIL LEFT
IGNITION FINAL STAGE RIGHT
IGNITION FINAL STAGE LEFT
DISTRIBUTOR LEFT
DISTRIBUTOR RIGHT
IGNITION CIRCUIT CONTROL
THERMO ELEMENTS
NO 1
NO 2
HALL SEN
SPEED SENDER
TRANSMISSION SAFETY SWITCH
WIRE CONNECTOR
KICKDOWN XV
LH-JETRONIC XXV
STARTER XIV
EZK XVI
FUEL PUMP XX
FUEL PUMPS
LH-CONTROL UNIT
THROTTLE VALVE SWITCH
CYLINDER 1

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

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F G H J K L M N O P

81 82 83 84 85 86 87 88 89 90

IGNITION COIL RIGHT
IGNITION COIL LEFT
IGNITION CIRCUIT CONTROL
THERMO ELEMENTS
NO 1
NO 2
HALL SENDER
KNOCK SENSOR 2
KNOCK SENSOR 1
MP IX4V
MP III
MP XI
MP V
MP II
MP VI
MP VII
MP I
MP X
MP XII
MP IV
MP VI14V
KS 1
KS 15
DISTRIBUTOR LEFT
DISTRIBUTOR RIGHT
SPEED SENDER
E2K CONTROL UNIT
CODING ELEMENT
M4.81
M2.49
CATALYZER M4.81
CATALYZER M2.49
AUSTRALIAN M4.81
AUSTRALIAN M2.49
T47
MP III
MP IX
AIR MASS SENSOR
SHIFT VALVE RESONANCE FLAP
TANK VENT
TEMPERATURE SENSOR DOUPLE NTC
POTENTIOMETER NOT APPLICABLE WITH CAT. CONV.
BRIDGE NOT APPLICABLE CATALYTIC CONVERTER
T48
MP VIII
OXYGEN SENSOR ONLY WITH CAT. CONV.
MP VI
KS 3
KS 4
LH-CONTROL UNIT
FUEL PUMP
FUEL PUMPS
THROTTLE VALVE SWITCH
IDLE SPEED POSITIONER
CYLINDER 1
CYLINDER 4
CYLINDER 6
CYLINDER 7
CYLINDER 2
CYLINDER 3
CYLINDER 5
CYLINDER 8

WHT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 11

Central Electric

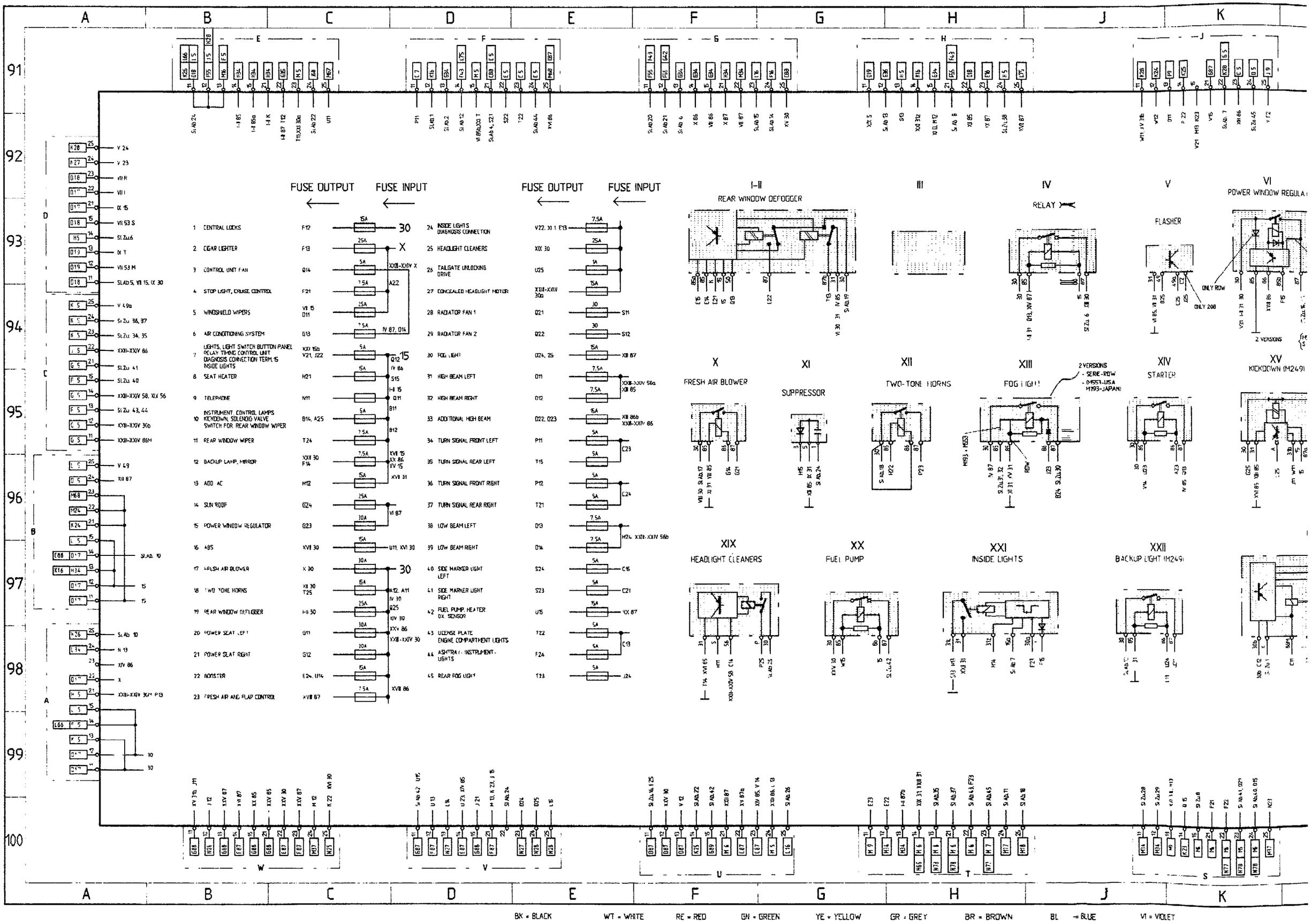
Coordinates

91-100

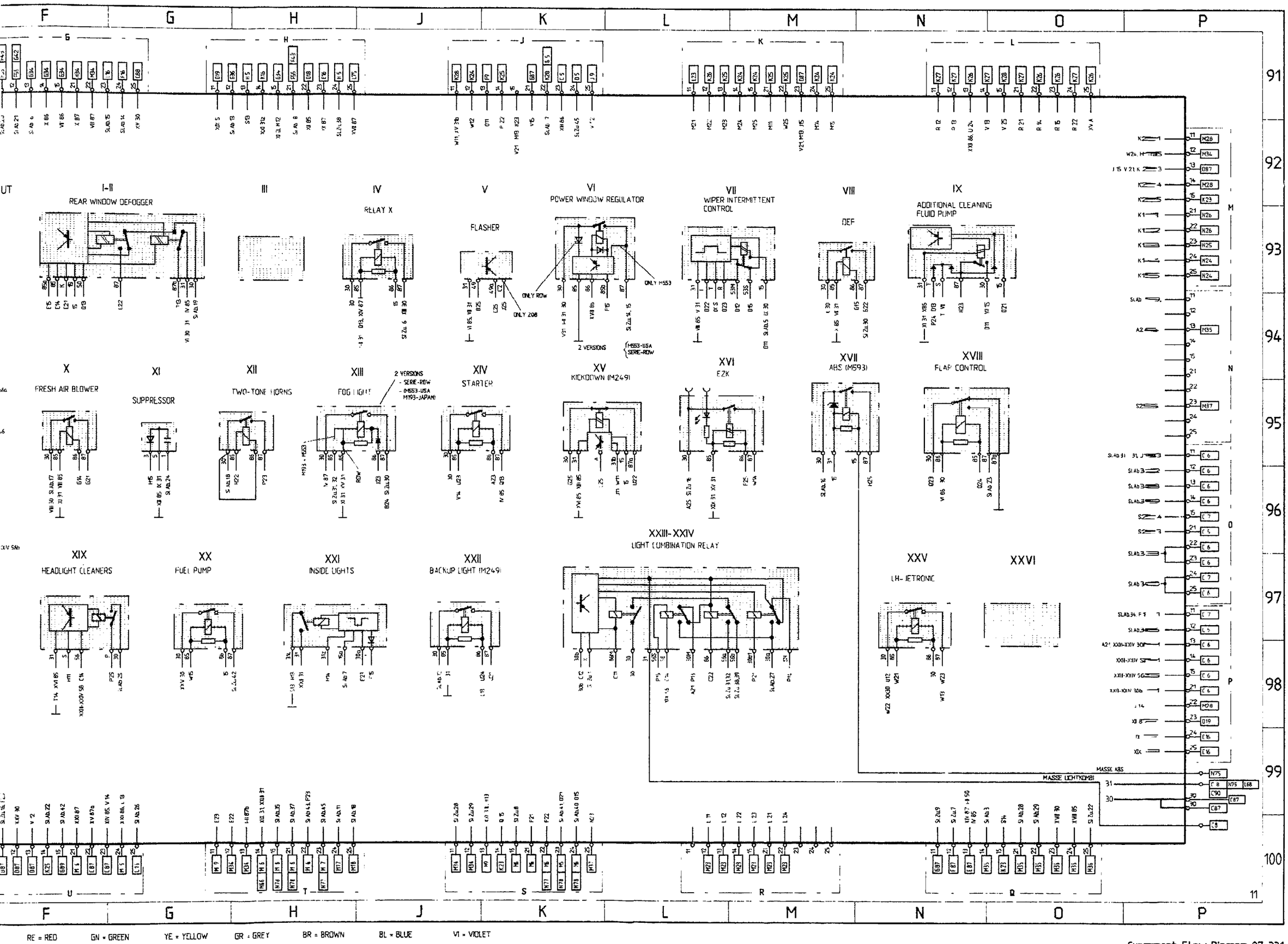
Current Flow Diagram 97-331

Wiring Diagram Type 928 S Model 89 Sheet 11

CENTRAL ELECTRIC



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91
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I-II
REAR WINDOW DEFOGGER
III
IV
RELAY X
V
FLASHER
ONLY ROW
ONLY 208
VI
POWER WINDOW REGULATOR
ONLY M553
2 VERSIONS
M553-USA
SERIE-ROW
VII
WIPER INTERMITTENT CONTROL
VIII
DEF
IX
ADDITIONAL CLEANING FLUID PUMP
X
FRESH AIR BLOWER
XI
SUPPRESSOR
XII
TWO-TONE HORNS
XIII
FOG LIGHT
2 VERSIONS
- SERIE-ROW
- M553-USA
M193-JAPAN
XIV
STARTER
XV
KICKDOWN (M249)
XVI
EZK
XVII
ABS (M593)
XVIII
FLAP CONTROL
XIX
HEADLIGHT CLEANERS
XX
FUEL PUMP
XXI
INSIDE LIGHTS
XXII
BACKUP LIGHT (M249)
XXIII-XXIV
LIGHT COMBINATION RELAY
XXV
LH-JETRONIC
XXVI
MASSE ABS
MASSE LICHTKOMBI
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET

Wiring Diagram Type 928 S
Model 89 Sheet 12

Constr. Components, Plug Connections, Ground Points

Wiring Diagram Type 928 S Model 89 Sheet 12

CONSTR. COMPONENTS, PLUG CONNECT., GROUND POINTS

CONSTRUCTION COMPONENTS

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRE DIAGRAM
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT	7cQ		IN DRIVER'S FOOTWELL ON SIDE	AB 73-76
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT		7cQ	ABOVE CENTRAL ELECTRICS	AB 73-76
ALARM SYSTEM CONTROL UNIT	7cM	7cP	BEHIND GLOVE COMPARTMENT	OP 67,68
ALRAM SYSTEM RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	LM 62,63
ALARM SYSTEM ADDITIONAL CONTROL UNIT	8dN	8dN	IN CENTRE CONSOLE BELOW RADIO	OP 64,65
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
ACCELERATING SENSOR	10eQ	10eQ	UNDER THE LEFT SEAT	K 73
BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	FG 62,63
RECEIVER FOR RADIO BERLIN	7cL		IN FRONT PASSENGER'S TRAY	C66
SUPPRESSOR FOR RADIO BERLIN	11eK		UNDER THE COVER ON PASSENGER'S SIDE SILL	A62
SUPPRESSOR FOR RADIO	8dO	8dO	IN CENTRE CONSOLE IN FRONT OF RADIO	C 62
SWITCHING UNIT EX (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
EZK CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	L 82-84
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE COOL KIT COVER	OP 17
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
AIR CONDITIONING SYSTEM CONTROL UNIT	8cN-O	8cN-O	IN HEATER BOX	AB 34-36
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39,40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MNO 39,40
COOLING WATER PRESSURE SWITCH	5cM	5cP	IN COOLANT HOSE BEFORE EXPANSION TANK	MN 29,30
COOLING WATER TEMPERATURE SWITCH	6cM	6cP	ON EXPANSION TANK	MN 29
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
IDLE SPEED CO ADJUSTMENT POTENIOMETER	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	OP 88
LH JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	O 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 35,36
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
SWITCHING DEVICE, REDUCED DRIVING LIGHT	7dN		IN DRIVER'S FOOTWELL BELOW THE FOOT REST	H 2,3
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
CONTROL TIRE PRESSURE CONTROL UNIT	7cP	7cM	ON INTRUMENT PANEL	K 76 78
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 54
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	O 54-57
CRUISE CONTROL CONTROL UNIT	7dN-O	7dN-O	IN CENTRE CONSOLE AT FRONT	AB 89,90
FREEZING PROTECTION SWITCH AIR CONDITIONER	7cM	7cM	UNDER THE WINDSHIELD WIPER COVER	FG 31
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
WARNING BUZZER	8cP	8cM	ON STEERING PROTECTIVE TUBE	O 30
WASHING FLUID LEVEL SWITCH	6cL	6cL	ON WINDSHIELD WASHER TANK	M 29
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL-M	ON BLOWER HOUSING	KL 31,32
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
TIME RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	P 23-25
CENTRAL ELECTRIC	7dM	7dP	IN PASSENGER'S FOOTWELL ON FIREWALL	
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRE
T1	2	GLOVE BOX LAMP	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	D2,P
T2	3	ENGINE COMPARTMENT LAMP, HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C4,C
T3	18	DOOR DRIVER'S SIDE	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	H1,G1
T4	18	DOOR PASSENGER'S SIDE	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	J1,M1
T5	3	COUNTRY CODING RHD	6dL	6dQ	BEHIND CONTROL UNIT CONSOLE	G3
T6						
T7	4	TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	05,G
T8	2	LICENSE PALTE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	N9
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10
T11	8	B-PILLAR / TAILGATE	13aN	13aO	ABOVE THE REAR LID PANEL	K10,I
T12	2	SIDE MARKER LAMP LEFT REAR	18cO		UNDER THE TOOL KIT COVER	O10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	02
T14	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	F22,I
T15	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	G22,I
T16	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	H22,I
T17	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	H22,I
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	NO2
T19	14	INSTRUMENT PANEL - / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL ELECTRICS	E13,I
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	KL43
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H42,I
T22						
T23	14	ABS	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	K74
T24	6	TRAILER COUPLING	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	OP74
T25	2	SUN ROOF	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E12
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C12
T27						
T28	2	PULSE SENDER	16dO	16dO	UNDER THE SPARE WHEEL COVER	GZ9
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC32
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O35,I
T33	3	FRONT END / INSTRUMENT PANEL WIRE HARNESS	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	L38,N
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	F36
T36	14	DOOR DRIVER'S SIDE BY SEAT AND MIRROR MEMORY	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	C59
T37	12	DOOR PASSENGER'S SIDE BY SEAT AND MIRROR MEMORY	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C51-
T38						
T39	2	PLUG BRIDGE INSTEAT RADIO BERLIN	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	A62
T40	3	DOOR PASSENGER'S SIDE	7cL	7cO	ABOVE EZK, LH CONTROL UNIT	M15
T41	3	DOOR DRIVER'S SIDE	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	G15
T42						
T43	3	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	N63
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13aN	13aO	ABOVE THE REAR LID PANEL	O63
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	K83-
T46	19	DIAGNOSIS CONNECTION	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	J30
T47	8	CODING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N84
T48	3	OX. SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	O89
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	M32
T50	6	AUTOM TRANSM. COUPLING TO GEARBOX WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	M22
T51	6	AUTOM TRANSMISSION, COUPLING TO REAR WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85

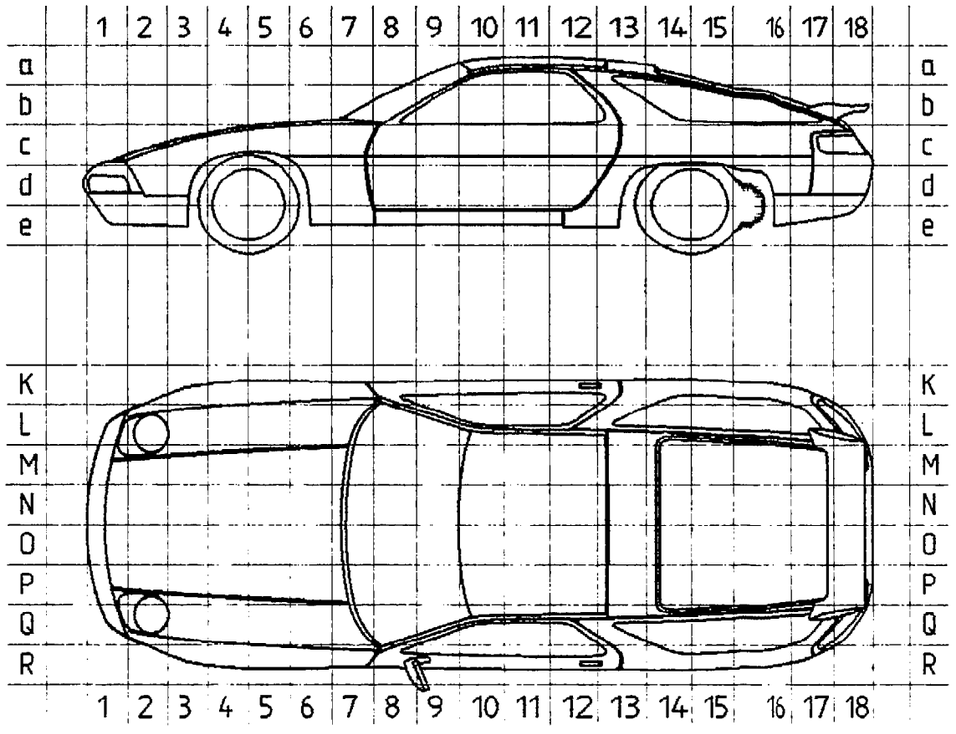
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PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRE DIAGRAM
T1	2	GLOVE BOX LAMP	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	D2,P13
T2	3	ENGINE COMPARTMENT LAMP, HEATED SPRAY JET RIGHT	6cQ	6cQ	UNDER THE WIPER SYSTEM COVER	C4,C11
T3	18	DOOR DRIVER'S SIDE	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	H1,G14,D22,C44,C55-58,F63
T4	18	DOOR PASSENGER'S SIDE	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	J1,M14,C42,C54,G63
T5	3	COUNTRY CODING RHD	6dL	6dQ	BEHIND CONTROL UNIT CONSOLE	G3
T6						
T7	4	TRANSMISSION	16dQ	16dQ	UNDER THE SPARE WHEEL COVER	05,G29
T8	2	LICENSE PALTE LIGHTS	18cN	18cQ	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cQ	18cQ	UNDER CARPET IN FRONT OF TOOL KIT	N9
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,N31-32
T11	8	B-PILLAR / TAILGATE	13aN	13aQ	ABOVE THE REAR LID PANEL	K10,N031
T12	2	SIDE MARKER LAMP LEFT REAR	18cQ		UNDER THE TOOL KIT COVER	010
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	02
T14	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	F22,G78
T15	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	G22,F78
T16	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dQ	16dQ	UNDER THE SPARE WHEEL COVER	H22,E78
T17	2x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dQ	16dQ	UNDER THE SPARE WHEEL COVER	H22,E78
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	N026,032-33,K39,D83
T19	14	INSTRUMENT PANEL - / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL ELECTRICS	E13,014,GH28,N64
T20	14	SEAT DRIVER'S SIDE	10eQ	10eL	UNDER THE SEAT, ADVANCE SEAT	K143,H46,F58-60
T21	14	SEAT PASSENGER'S SIDE	10eL	10eQ	UNDER THE SEAT, ADVANCE SEAT	H42,F51-53
T22						
T23	14	ABS	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	K74-76,F30
T24	6	TRAILER COUPLING	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	OP74
T25	2	SUN ROOF	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E12
T26	2	HEATED SPRAY JET LEFT	6cQ	6cQ	UNDER THE WIPER SYSTEM COVER	C12
T27						
T28	2	PULSE SENDER	16dQ	16dQ	UNDER THE SPARE WHEEL COVER	GZ9
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-34
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dQ	16dQ	UNDER THE SPARE WHEEL COVER	035,D86
T33	3	FRONT END / INSTRUMENT PANEL WIRE HARNESS	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	L38,N69
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	F36
T36	14	DOOR DRIVER'S SIDE BY SEAT AND MIRROR MEMORY	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	C59-60
T37	12	DOOR PASSENGER'S SIDE BY SEAT AND MIRROR MEMORY	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C51-52
T38						
T39	2	PLUG BRIDGE INSTEAT RADIO BERLIN	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	A62
T40	3	DOOR PASSENGER'S SIDE	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	M15
T41	3	DOOR DRIVER'S SIDE	7cQ	7cL	ABOVE PARCEL SHELF, DRIVER'S SIDE	G15
T42						
T43	3	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	N63
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13aN	13aQ	ABOVE THE REAR LID PANEL	D63
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	K83-84
T46	19	DIAGNOSIS CONNECTION	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	J30
T47	8	COOLING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N84
T48	3	OX. SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRICS	089
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	M32
T50	6	AUTOM. TRANSM., COUPLING TO GEARBOX WIRE HARNESS	16dQ	16dQ	UNDER THE SPARE WHEEL COVER	M22
T51	6	AUTOM. TRANSMISSION, COUPLING TO REAR WIRE HARNESS	16dQ	16dQ	UNDER THE SPARE WHEEL COVER	BC85,M2

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE
MP I	BODY FRONT LEFT	1cQ	1cQ	IN ENGINE COMPARTMENT AT FRONT END PANEL
MP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
MP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
MP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
MP V	FIREWALL	8dM	8dM	ABOVE CENTRAL ELECTRICS
MP VI	BODY REAR	16dQ	16dQ	UNDER THE SPARE WHEEL COVER
MP VII	GROUND STRAP BATTERY	18dQ	18dQ	UNDER THE TOOL KIT COVER
MP VIII	ENGINE POWER	6cQ	6cQ	ON UPPER CRANKCASE, REAR LEFT
MP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
MP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
MP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART ON RIGHT SUSPENSION STRUT MOUNT
MP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT



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Modifications in wiring diagram 928, Model 89

Sheet 5, K/L 31/32

Bimetal switch of the resistance group is closed in idle state.

Sheet 6, M/N 42

Time-lag relay
Terminal P becomes E/A
Terminal E becomes P+

Seat heater switch
Terminal E becomes +
Terminal P becomes E/A
Terminal A becomes –

Sheet 7, K/L 54/55 and 56/57

Seat heater switch drawn incorrectly. See model 90

Sheet 8, N/O 65

Terminal 7 on the controller not used.

Sheet 13

Cooling water temperature switch must be called *cooling water level switch.*

Please modify the wiring diagram accordingly.

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Wiring Diagram Type 928 S
Model 90

	Coordinates	
Sheet 1	1 - 10	Lights Row
Sheet 2	1 - 10	Lights USA
Sheet 3	11 - 20	Body
Sheet 4	21 - 30	Instrument Cluster and Senders
Sheet 5	31 - 40	Engine Cooling, Heater, Air Conditioner
Sheet 6	41 - 50	Outside Mirror, Power Seat
Sheet 7	51 - 60	Seat and Mirror Memory
Sheet 8	61 - 70	Radio, Alarm System
Sheet 9	71 - 80	Antilock System, Tire Pressure Control, Airbag, Porsche Lock Differential, Trailor Coupling, Brake Pad Wear Indicator
Sheet 10	81 - 90	Motor, Fuel and Ingnition, Cruise Control
Sheet 11	91 - 100	Central Electric
Sheet 12		Legend, M-Numbers
Sheet 13		Constr. Components, Plug Connections, Ground Points

Wiring Diagram Type 928 S
Model 90

The wiring diagram comprises of 11 individual wiring diagrams and 1 sheet construction components, plug connections and ground points and 1 sheet legend. They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central-electrical system within a dash-dot frame.

This part of the central-electrical system shows all the lines and relays required for the individual wiring diagram.

The ground-connecting points are designated with "MP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Parts 2, is the "module element".

Both parts are identified by the digits 1.....5.

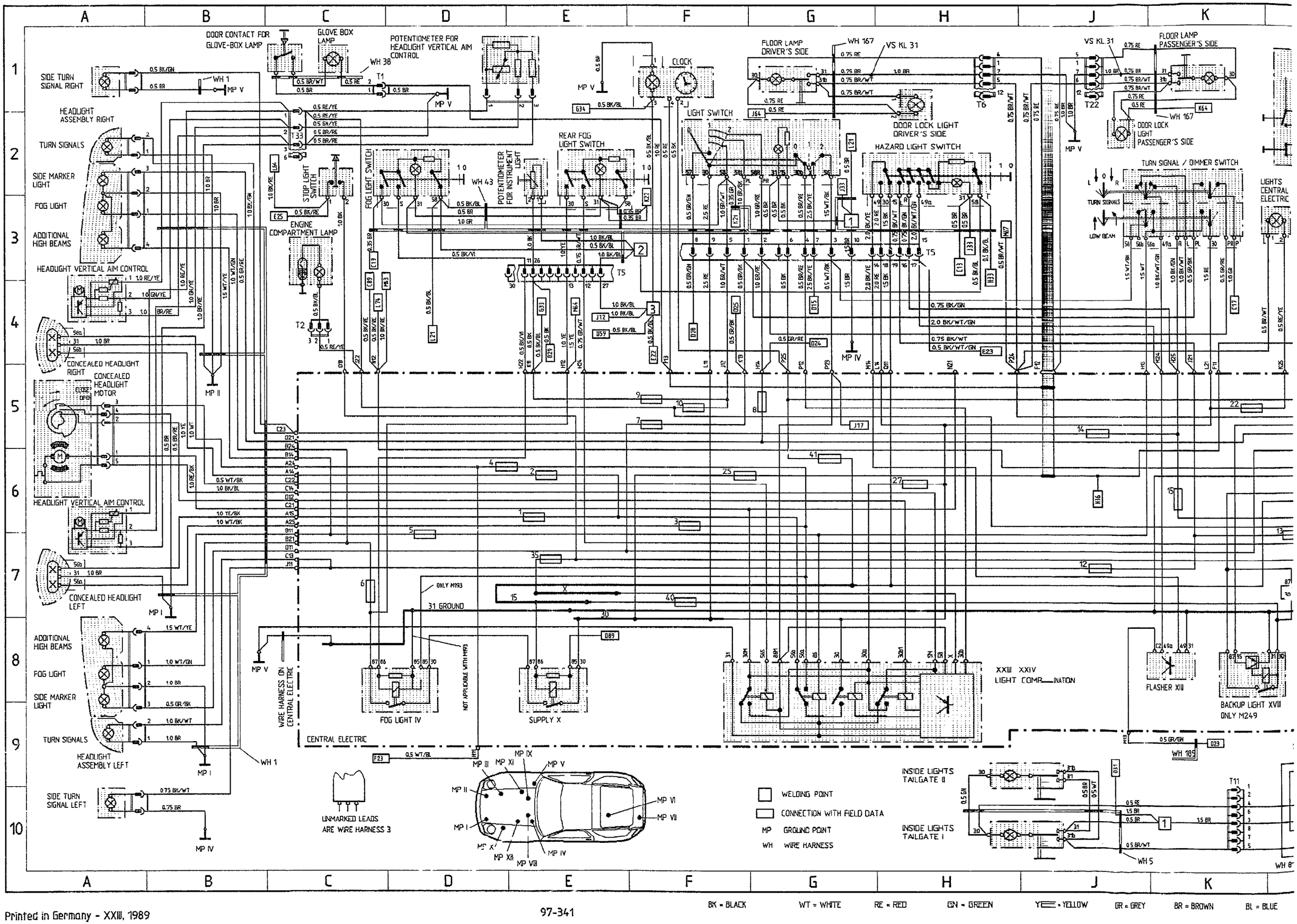
Part 3 is a "coding element".

The designations of the plug connections in the wiring diagram for central electrical system refer e.g. from A 11.....15, to the "initial element", from A 21.....25 to module element.

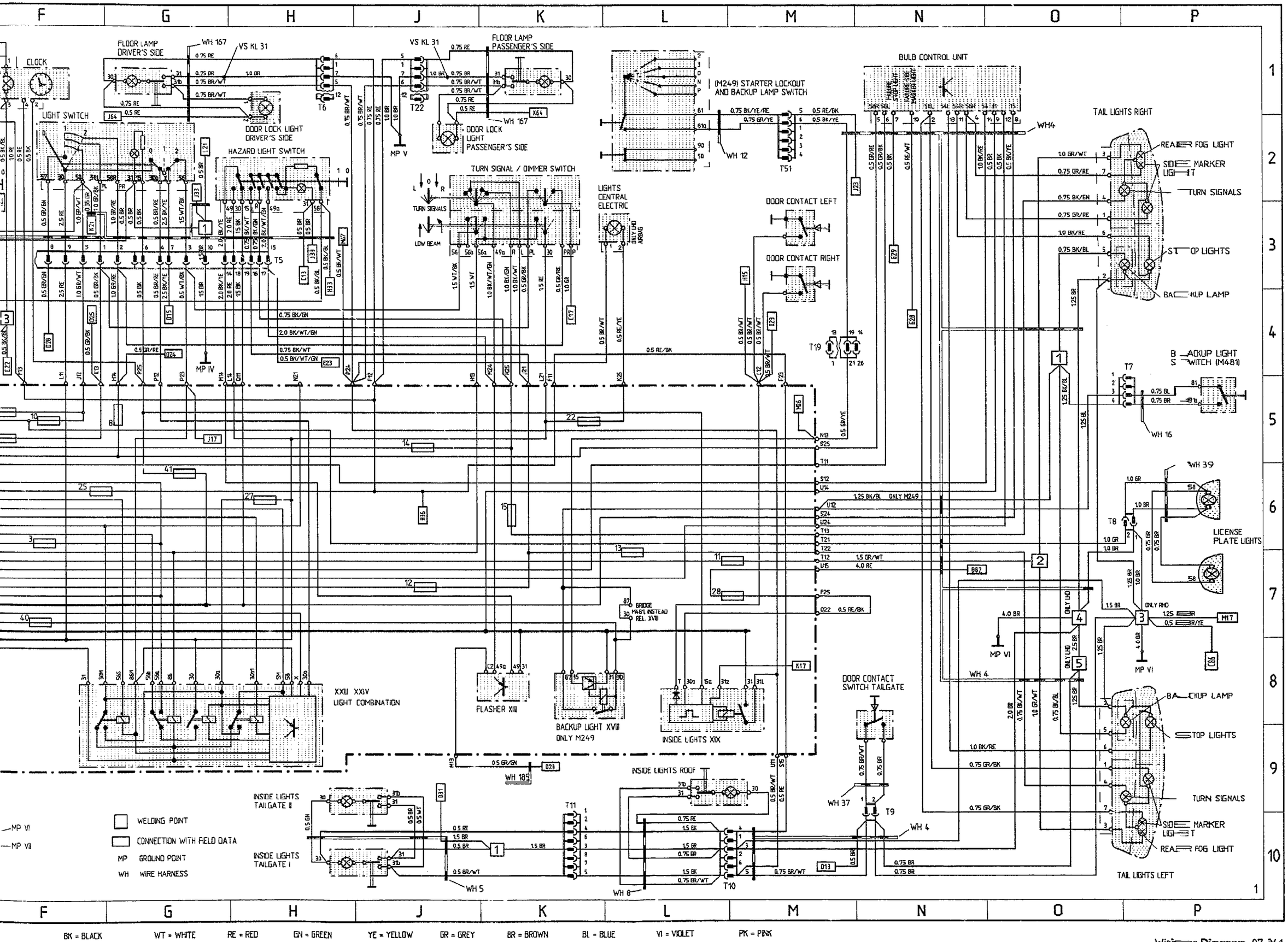
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928 S Model 90 Sheet 1

LIGHTS ROW

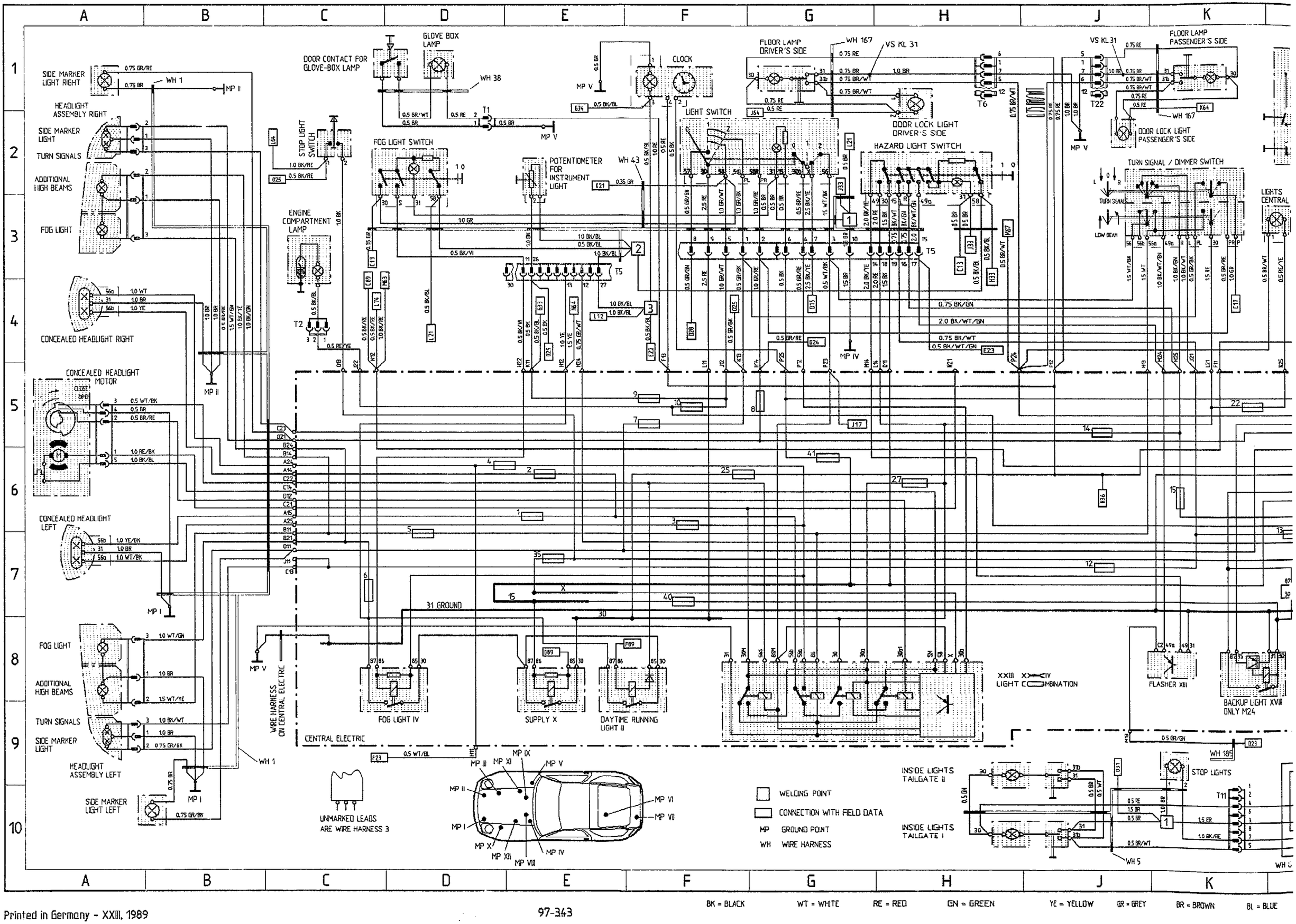


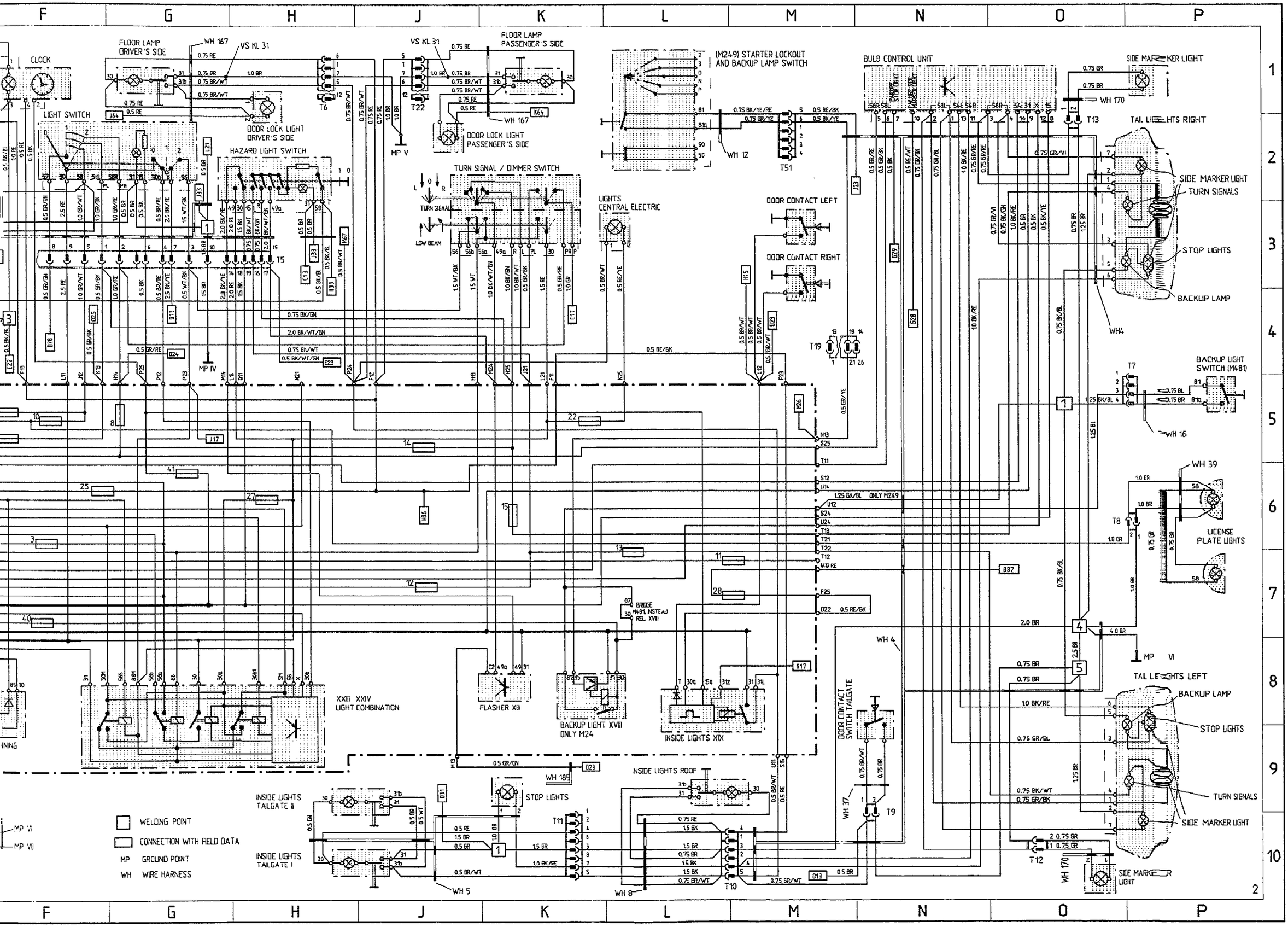
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE


CLOCK
LIGHT SWITCH
FLOOR LAMP DRIVER'S SIDE
WH 167
VS KL 31
DOOR LOCK LIGHT DRIVER'S SIDE
HAZARD LIGHT SWITCH
TURN SIGNAL / DIMMER SWITCH
TURN SIGNALS
LOW BEAM
FLOOR LAMP PASSENGER'S SIDE
DOOR LOCK LIGHT PASSENGER'S SIDE
MP V
T6
T22
T5
(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH
WH 12
T51
LIGHTS CENTRAL ELECTRIC
ONLY UHD AIRBAG
DOOR CONTACT LEFT
DOOR CONTACT RIGHT
T19
BULB CONTROL UNIT
PARKING LIGHT
MARKER SIDE PASSENGER LIGHT
WH4
TAIL LIGHTS RIGHT
REAR FOG LIGHT
SIDE MARKER LIGHT
TURN SIGNALS
STOP LIGHTS
BACKUP LAMP
BACKUP LIGHT SWITCH (M48)
T7
WH 16
WH 39
T8
LICENSE PLATE LIGHTS
ONLY RHD
MP VI
WH 4
BACKUP LAMP
STOP LIGHTS
TURN SIGNALS
SIDE MARKER LIGHT
REAR FOG LIGHT
TAIL LIGHTS LEFT
XXIII XXIV LIGHT COMBINATION
FLASHER XIII
BACKUP LIGHT XVII ONLY M249
INSIDE LIGHTS XIX
BRIDGE M48 INSTEAD REL. XVII
DOOR CONTACT SWITCH TAILGATE
WH 37
T9
INSIDE LIGHTS ROOF
INSIDE LIGHTS TAILGATE II
INSIDE LIGHTS TAILGATE I
WH 185
WH 5
WH 8
T11
T10
1.25 BK/BL ONLY M249
MP VI
MP VII
WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
WH WIRE HARNESS
BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

928 S Model 90 Sheet 2

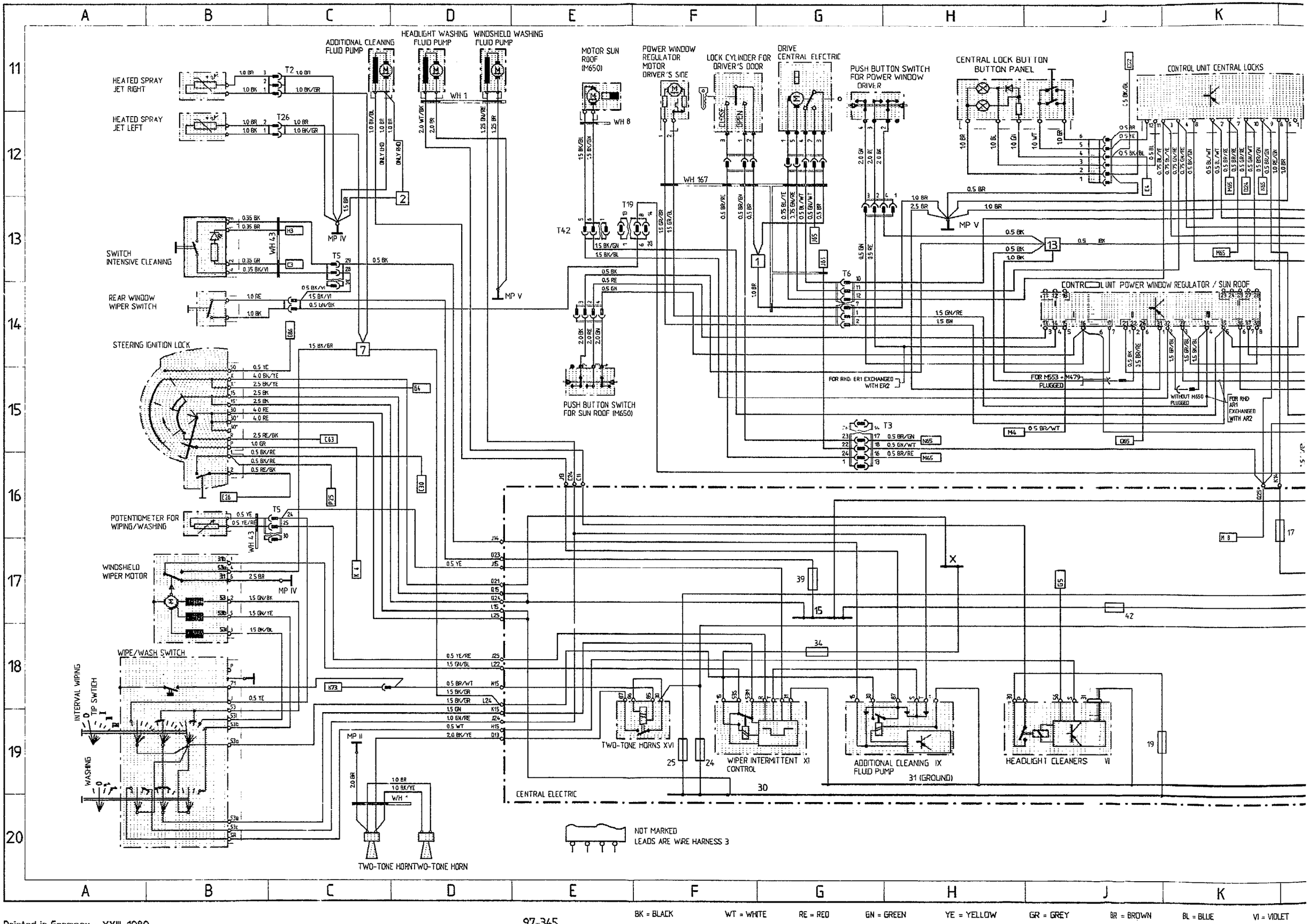
LIGHTS USA



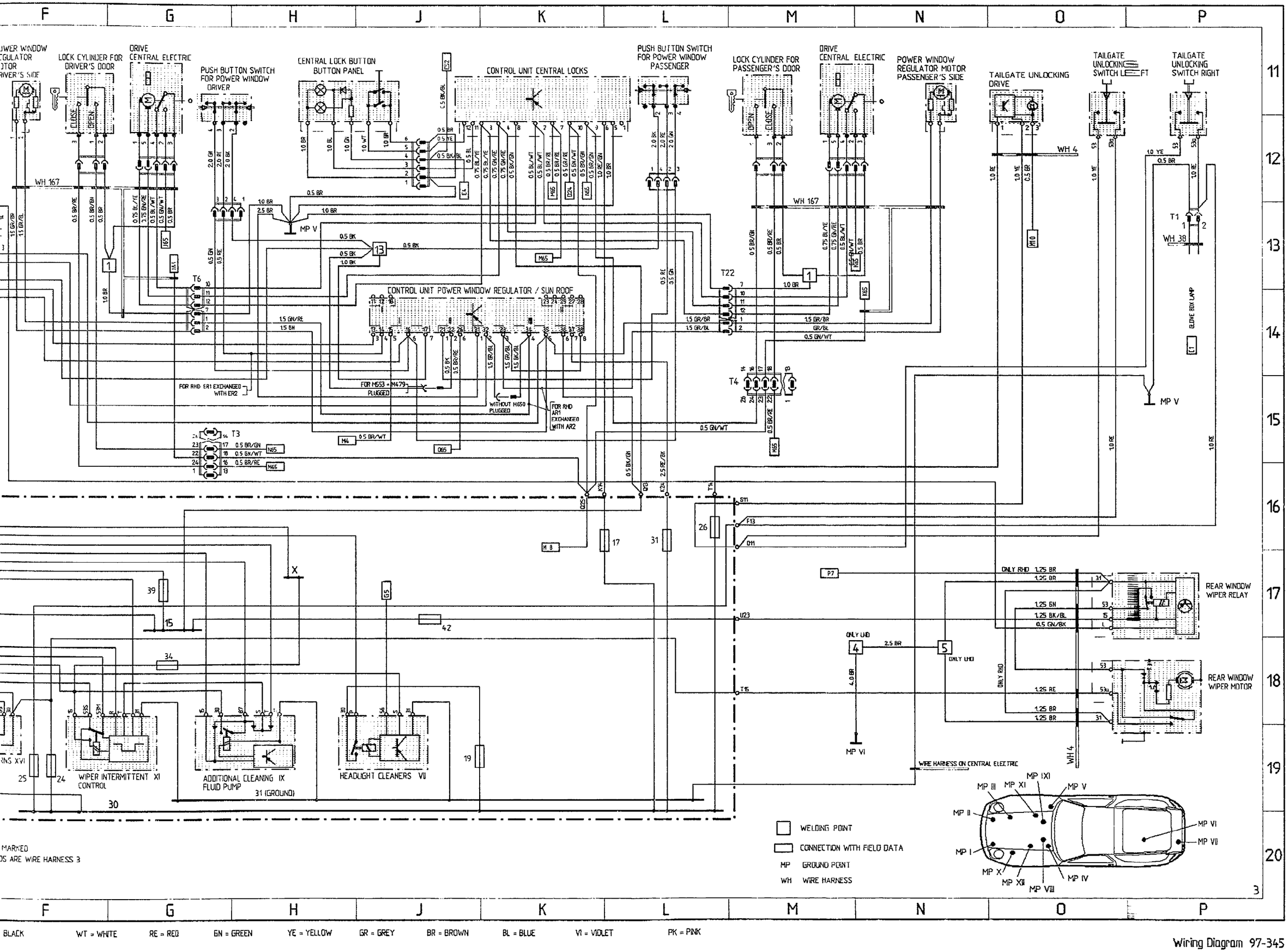

CLOCK
LIGHT SWITCH
FLOOR LAMP DRIVER'S SIDE
WH 167
VS KL 31
DOOR LOCK LIGHT DRIVER'S SIDE
HAZARD LIGHT SWITCH
FLOOR LAMP PASSENGER'S SIDE
DOOR LOCK LIGHT PASSENGER'S SIDE
MP V
TURN SIGNAL / DIMMER SWITCH
(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH
WH 12
T51
LIGHTS CENTRAL ELECTRIC
DOOR CONTACT LEFT
DOOR CONTACT RIGHT
BULB CONTROL UNIT
SIDE MARKER LIGHT
WH 170
TAIL LIGHTS RIGHT
SIDE MARKER LIGHT
TURN SIGNALS
STOP LIGHTS
BACKUP LAMP
WH4
BACKUP LIGHT SWITCH (M481)
WH 16
WH 39
LICENSE PLATE LIGHTS
MP VI
TAIL LIGHTS LEFT
BACKUP LAMP
STOP LIGHTS
TURN SIGNALS
SIDE MARKER LIGHT
T12
WH 170
SIDE MARKER LIGHT
XXIII XXIV LIGHT COMBINATION
FLASHER XII
BACKUP LIGHT XVIII ONLY M24
BRIDGE M481 INSTEAD REL. XVII
INSIDE LIGHTS XIX
WH 4
DOOR CONTACT SWITCH TAILGATE
WH 37
T9
INSIDE LIGHTS TAILGATE II
INSIDE LIGHTS TAILGATE I
STOP LIGHTS
WH 185
NSIDE LIGHTS ROOF
WH 5
WH 8
T10
T11
MP VI
MP VII
WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
WH WIRE HARNESS
BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

928 S Model 90 Sheet 3

BODY

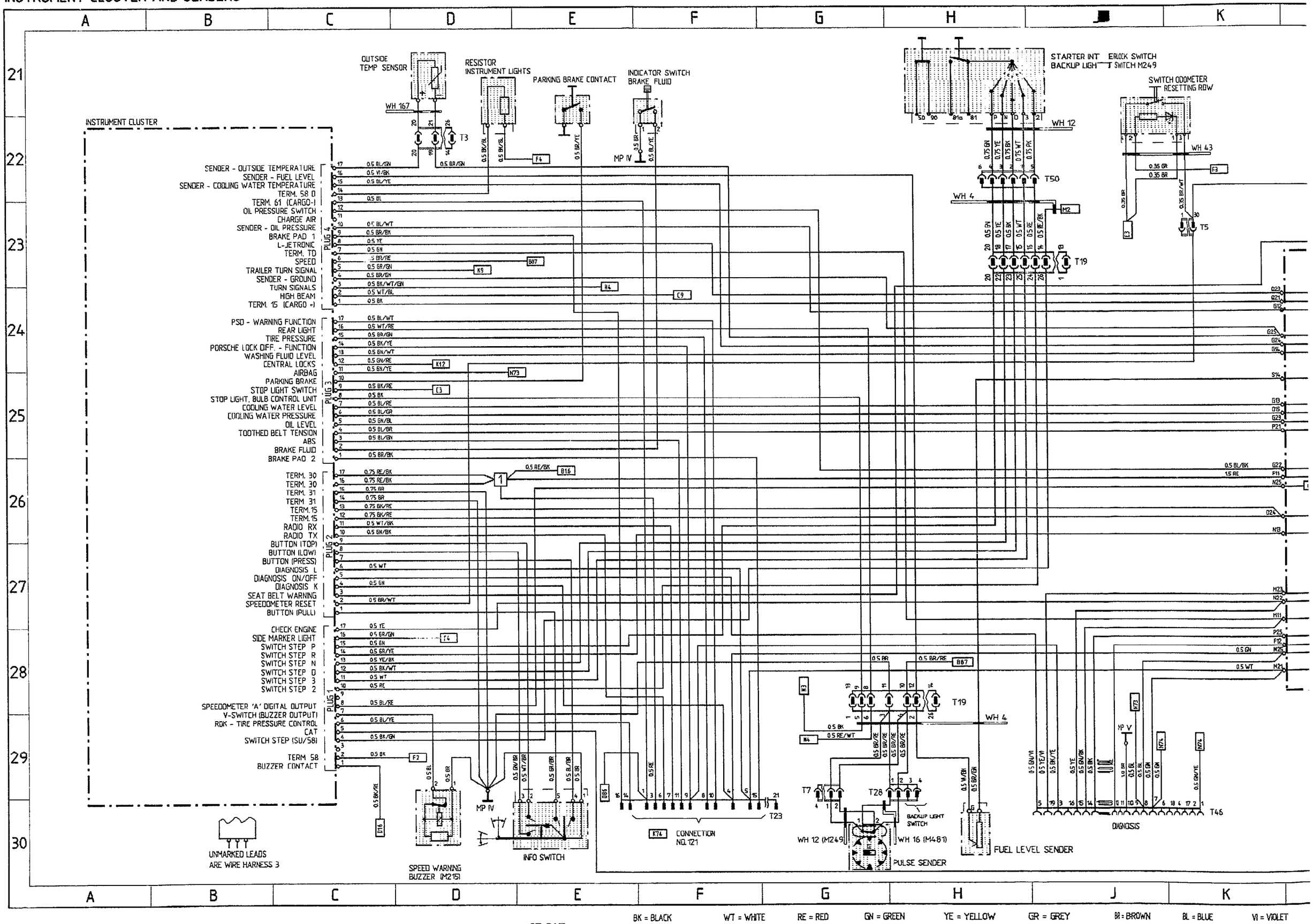


BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET


F
G
H
J
K
L
M
N
O
P
11
12
13
14
15
16
17
18
19
20
POWER WINDOW REGULATOR MOTOR DRIVER'S SIDE
LOCK CYLINDER FOR DRIVER'S DOOR
CLOSE
OPEN
DRIVE CENTRAL ELECTRIC
PUSH BUTTON SWITCH FOR POWER WINDOW DRIVER
CENTRAL LOCK BUTTON BUTTON PANEL
CONTROL UNIT CENTRAL LOCKS
PUSH BUTTON SWITCH FOR POWER WINDOW PASSENGER
LOCK CYLINDER FOR PASSENGER'S DOOR
DRIVE CENTRAL ELECTRIC
POWER WINDOW REGULATOR MOTOR PASSENGER'S SIDE
TAILGATE UNLOCKING DRIVE
TAILGATE UNLOCKING SWITCH LEFT
TAILGATE UNLOCKING SWITCH RIGHT
WH 167
WH 4
WH 38
MP V
MP VI
MP VII
MP I
MP II
MP III
MP IV
MP VIII
MP IX
MP X
MP XI
MP XII
CONTROL UNIT POWER WINDOW REGULATOR / SUN ROOF
T6
T22
T4
T3
FOR RHD: ER1 EXCHANGED WITH ER2
FOR M653 + M679 PLUGGED
WITHOUT M650 PLUGGED
FOR RHD: AR1 EXCHANGED WITH AR2
GLOVE BOX LAMP
E1
WIPER INTERMITTENT XI CONTROL
ADDITIONAL CLEANING IX FLUID PUMP
31 (GROUND)
HEADLIGHT CLEANERS VII
REAR WINDOW WIPER RELAY
REAR WINDOW WIPER MOTOR
ONLY RHD
ONLY LHD
WIRE HARNESS ON CENTRAL ELECTRIC
WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
WH WIRE HARNESS
MARKED
OS ARE WIRE HARNESS 3
BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

928 S Model 90 Sheet 4

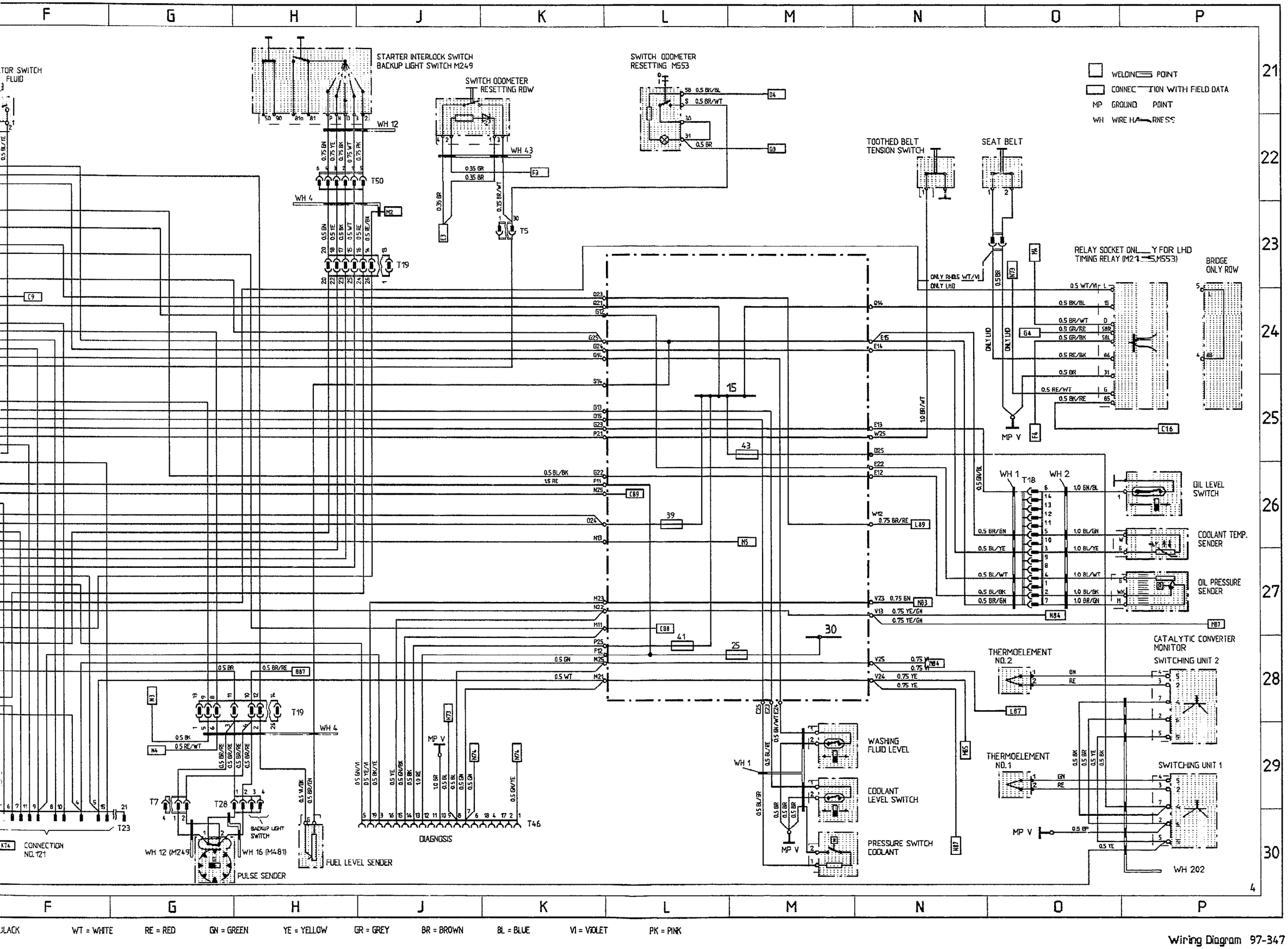
INSTRUMENT CLUSTER AND SENDERS



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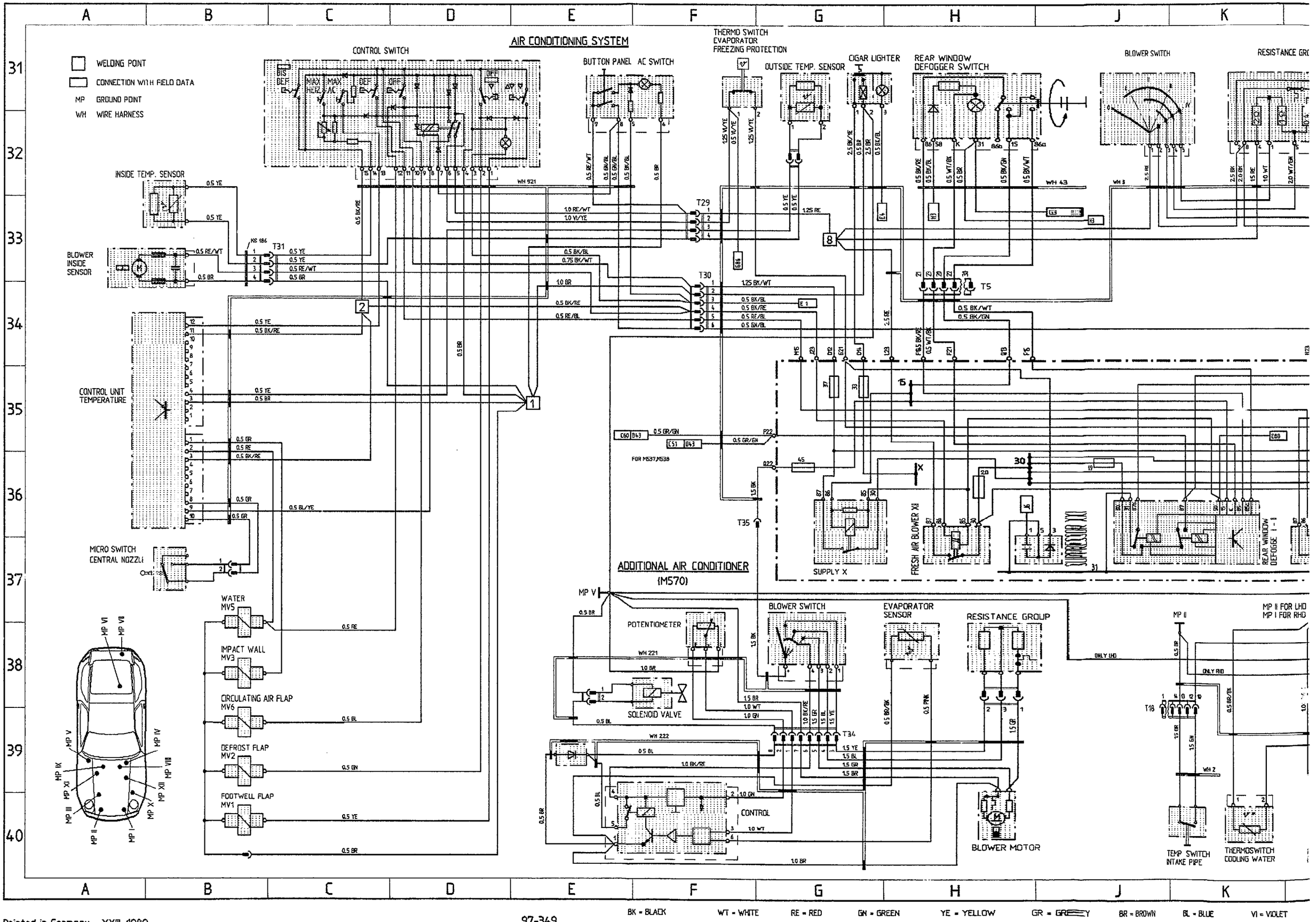
97-347

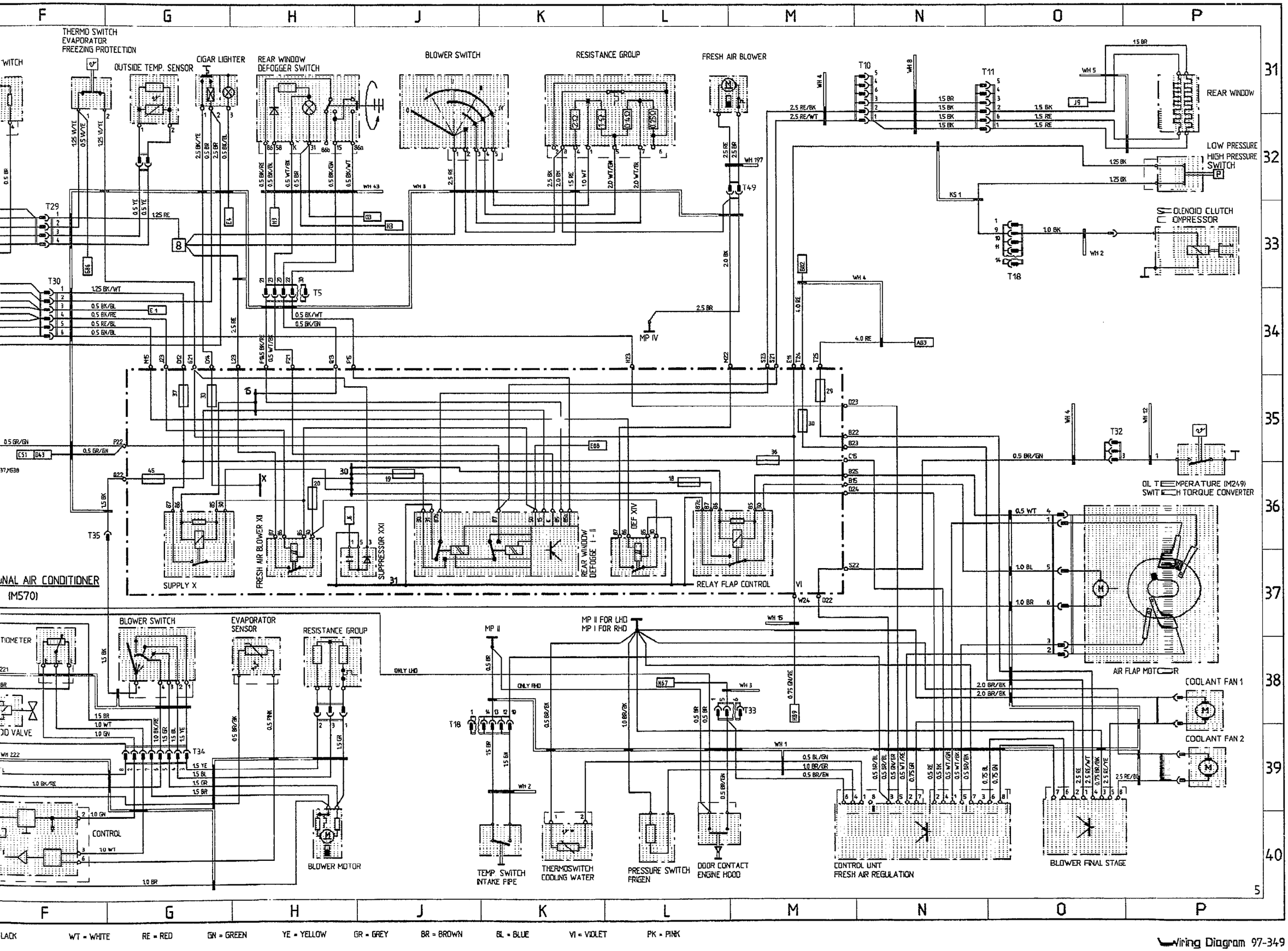


BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 90 Sheet 5

ENGINE COOLING, HEATER, AIR CONDITIONER





BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 90 Sheet 6

OUTSIDE MIRROR, POWER SEAT

WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
WH WIRE HARNESS

MIRROR PASSENGER'S SIDE (M261, M528)

VS TERM.31
WH 167
WH 3
WH 227
WH 337
WH 343
F35
E35
MP V
MP IV
T4
T22
T6
T3
T21
T20
M12
CENTRAL ELECTRIC
CONNECTION POWER SEAT RIGHT
SEAT HEATER POWER SEAT
INVERSELY TO WITH LEFT

CHANGEOVER SWITCH
MIRROR SWITCH
MIRROR DRIVER'S SIDE

SPORT SEAT
(M383, M387)

2-WAY SWITCH
SEAT CUSHION HEIGHT CONTROL REAR
SEAT CUSHION HEIGHT CONTROL FRONT
WIRE HARNESS ON SWITCH
CONNECTION SEAT LEFT
POWER
SEAT BACKREST CONTROL
SEAT LUMBAR (M586) HEIGHT CONTROL (M513)
SEAT LUMBAR (M586) CURVE CONTROL (M513)
NOT APPLICABLE WITH M139 M340, M586, M513

MP I, MP II, MP III, MP IV, MP V, MP VI, MP VII, MP VIII, MP IX, MP X, MP XI, MP XII

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

F G H J K L M N O P

41 42 43 44 45 46 47 48 49 50

ADJUSTABLE SEAT HEATING (M139, M340)

COMFORT SEAT - STANDARD LEFT

ORT SEAT
383, M387)

30 23 15 22 44 CENTRAL ELECTRIC X25 P13 M12

MP V MP V MP IV

T21 T20 T20

CONNECTION POWER SEAT RIGHT

WH 227

SEAT HEATER AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

WIRE HARNESS ON SWITCH

DELAYING RELAY

SEAT HEATER SWITCH

BACKREST SEAT SIDE ELEMENTS

WH 337/338/340

4-WAY SWITCH

WIRE HARNESS ON SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

SEAT BACKREST CONTROL

WH 343
NOT APPLICABLE WITH M139 M340, M586, M513

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

SEAT LUMBAR (M586) CURVE CONTROL (M513)

WH 337 WITH M139, M340, M513, M586

4-WAY SWITCH

WIRE HARNESS ON SWITCH

SEAT CUSHION HEIGHT CONTROL FRONT

SEAT BACK FORWARD CONTROL

2-WAY SWITCH

2-WAY SWITCH

WIRE HARNESS ON SWITCH

WH 227

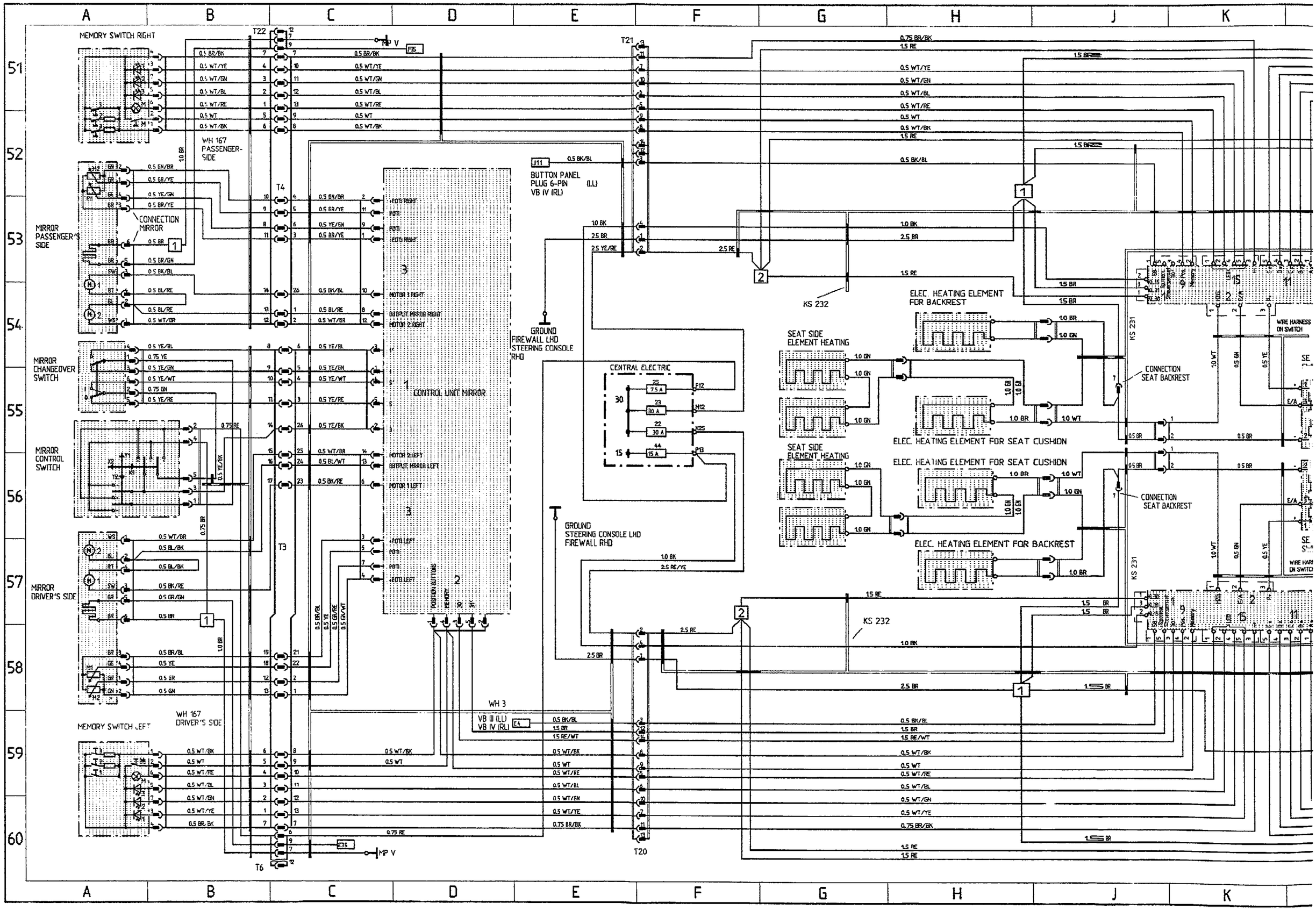
CONNECTION POWER SEAT LEFT

6

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 90 Sheet 7

(M537, M538) SEAT AND MIRROR MEMORY



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97-353

F G H J K L M N O P

51 52 53 54 55 56 57 58 59 60

CONNECTION SEAT BACKREST
LUMBAR SUPPORT HEIGHT
BACKREST
HEIGHT REAR
RELAY UNIT
HEIGHT FRONT
LONGITUDINAL
LUMBAR SUPPORT CURVATUR
CONNECTION SEAT BACKREST
KS 231
CONTROL UNIT SEAT PASSENGER'S SIDE
KS 232
ELEC. HEATING ELEMENT FOR BACKREST
SEAT SIDE ELEMENT HEATING
WIRE HARNESS ON SWITCH
SEAT HEATER SWITCH
4-WAY SWITCH
ELEC. HEATING ELEMENT FOR SEAT CUSHION
CONNECTION SEAT BACKREST
CONTROL UNIT SEAT DRIVER'S SIDE
LUMBAR SUPPORT CURVATURE
LONGITUDINAL
HEIGHT FRONT
RELAY UNIT
HEIGHT REAR
BACKREST
LUMBAR SUPPORT HEIGHT
CONNECTION SEAT BACKREST

MP I MP II MP III MP IV MP V MP VI MP VII MP IX MP X MP XI MP XII MP XV

WELDING POINT
CONNECTION WITH FIELD DATA
MP GROUND POINT
WH WIRE HARNESS

7

F G H J K L M N O P

WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 90 Sheet 8

RADIO, ALARM SYSTEM

ROOF ANTENNA (M326)

COIL (M326)

SUPPRESSOR

WH 63 (M326)

BRIDGE (NOT M326)

T39

ANTENNA EXTENSION WIRE (NOT M326)

ANTENNA EXTENSION WIRE (M326)

RADIO OPERATION CONTROL

CD-PLAYER (M690)

NF-WIRE (M326)

BUS-WIRE (M326)

RECEIVER RADIO BERLIN (M326)

MP V

NF-WIRE (NOT M326)

ALARM CONTACT SUPPORTING FRAME FOR RADIO

BOOSTER LEFT RIGHT

T6

T22

WH 167 LEFT

WH 167 RIGHT

WH 4

FREQUENCY SWITCH DOOR LEFT

FREQUENCY SWITCH DOOR RIGHT

HIGH RANGE RADIO SPEAKER

FRONT LEFT

FRONT RIGHT

MIDDLE RANGE SPEAKER

DEEP RANGE SPEAKER

REAR LEFT

REAR RIGHT

WH 69 LEFT

WH 69 RIGHT

ALARM-PRIMED INDICATOR LAMPS (M533, M525)

LEFT

RIGHT

CENTRAL ELECTRIC

CONNECTION PLAN BOOSTER

SPEAKER PLUG DEEP RANGE TUNER LEFT YELLOW

SPEAKER PLUG DEEP RANGE TUNER RIGHT RED

PRE-AMPLIFIER INPUT NF-WIRE

CONNECTION PLUG 6-PIN

SPEAKER PLUG FRONT LEFT WHITE

SPEAKER PLUG FRONT RIGHT BLACK

SPEAKER PLUG REAR RIGHT RED

SPEAKER PLUG REAR LEFT YELLOW

CONNECTION PLAN RADIO

ANTENNA EXTENSION WIRE

+12V

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI MP XII

WELD

CONNE

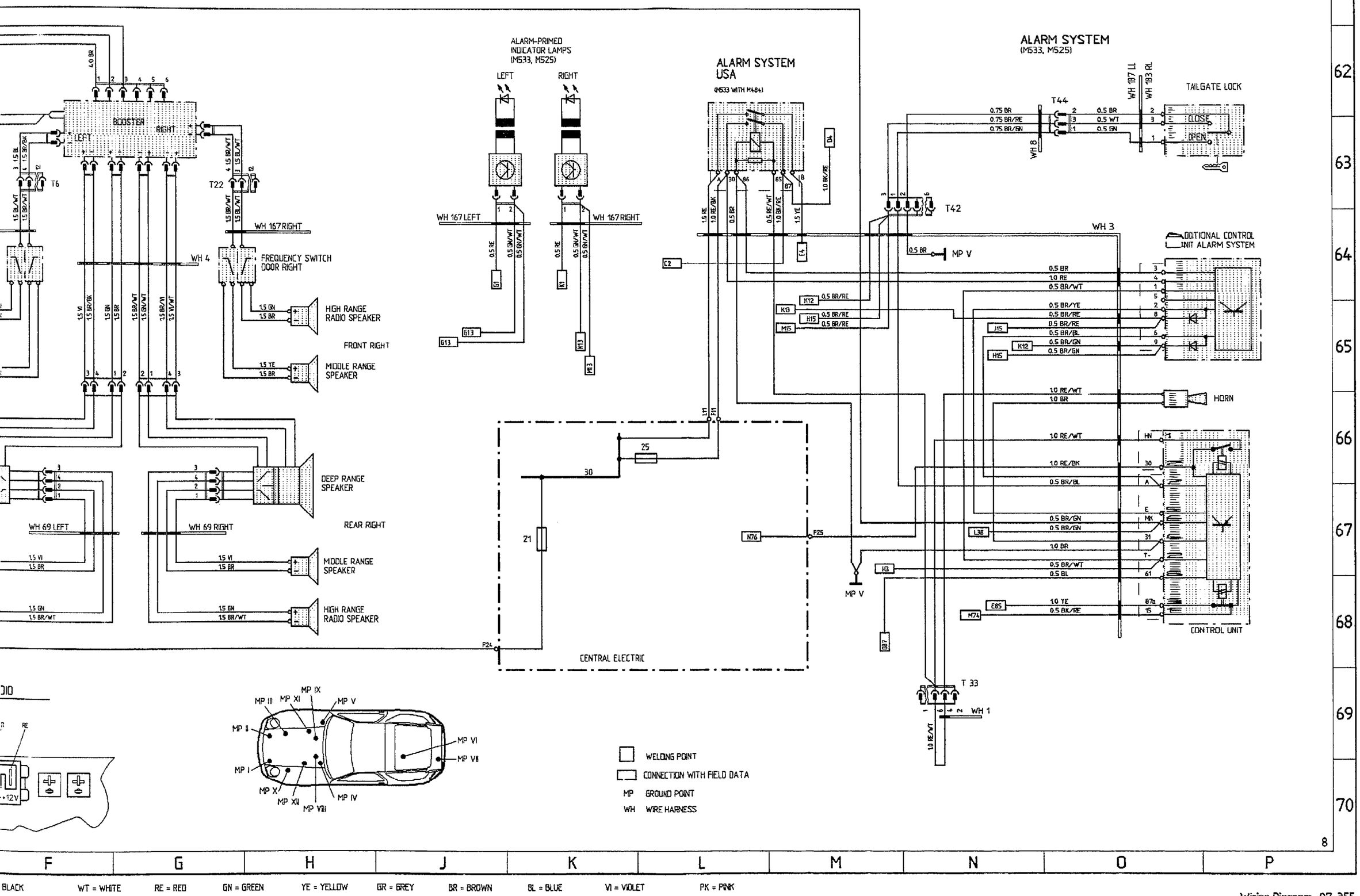
MP GROU

WH WIRE

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

97-355

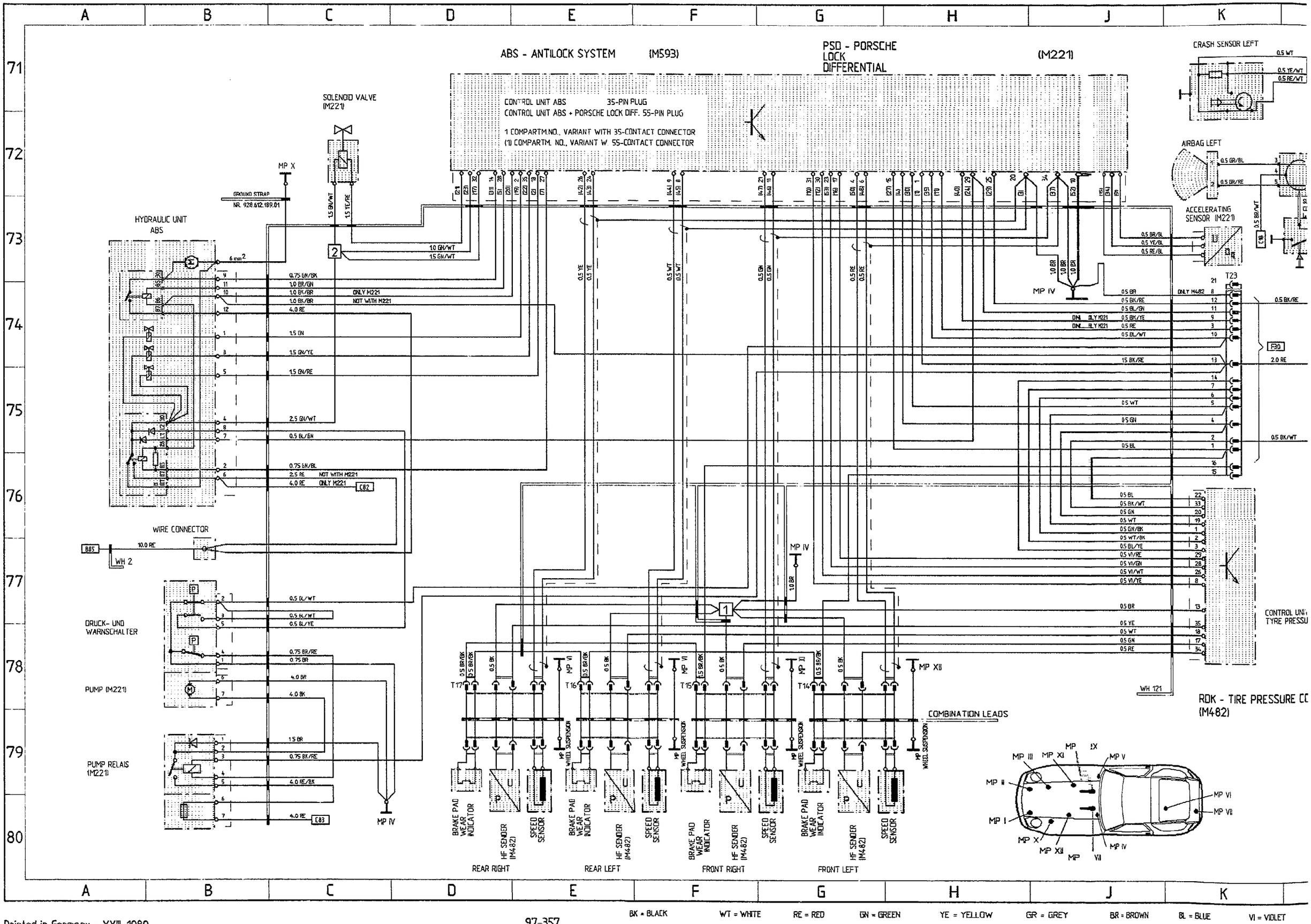
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928 S Model 90 Sheet 9

ABS, TIRE PRESSURE CONTROL, AIRBAG, PORSCHE LOCK DIFFERENTIAL, BRAKE PAD WEAR INDICATOR TRAILER COUPLING



F G H J K L M N O P

71 72 73 74 75 76 77 78 79 80

PSD - PORSCHE LOCK DIFFERENTIAL (M221)

CRASH SENSOR LEFT

AIRBAG CONTROL UNIT

TRAILER COUPLING (M 208)

PLUG SOCKET TRAILER COUPLING

AIRBAG LEFT

ACCELERATING SENSOR (M221)

SLIDING CONTACT UNIT

STEERING WHEEL WITH HORN CONTACT

AIRBAG (M562)

AIRBAG RIGHT

CRASH SENSOR RIGHT

WH 84

WH 180

WH 161

WH 3

WH 4

WH 121

T52 T53 T23 T24

MP IV MP V MP VI MP XI MP XII

F30 F89

GROUND ABS

WIRE HARNESS ON CEL

REAR FOG LIGHT

BULB CONTROL UNIT - STOP LIGHTS

TURN SIGNAL REAR RIGHT

TURN SIGNAL REAR LEFT

BULB CONTROL UNIT - SIDE MARKER LIGHT RIGHT

BULB CONTROL UNIT - SIDE MARKER LIGHT LEFT

XV ABS

CONTROL UNIT TYRE PRESSURE CONTROL

RDK - TIRE PRESSURE CONTROL (M482)

CENTRAL ELECTRIC

SEE SHEET 1 FIELD M5-7 (CONNECTION TO CENTRAL ELECTRIC)

COMBINATION LEADS

FRONT RIGHT FRONT LEFT

BRAKE PAD WEAR INDICATOR

HF SENDER (M482)

SPEED SENSOR

WHEEL SUSPENSION

WELDING POINT

CONNECTION WITH FIET D DATA

MP GROUND POINT

WH WIRE HARNESS

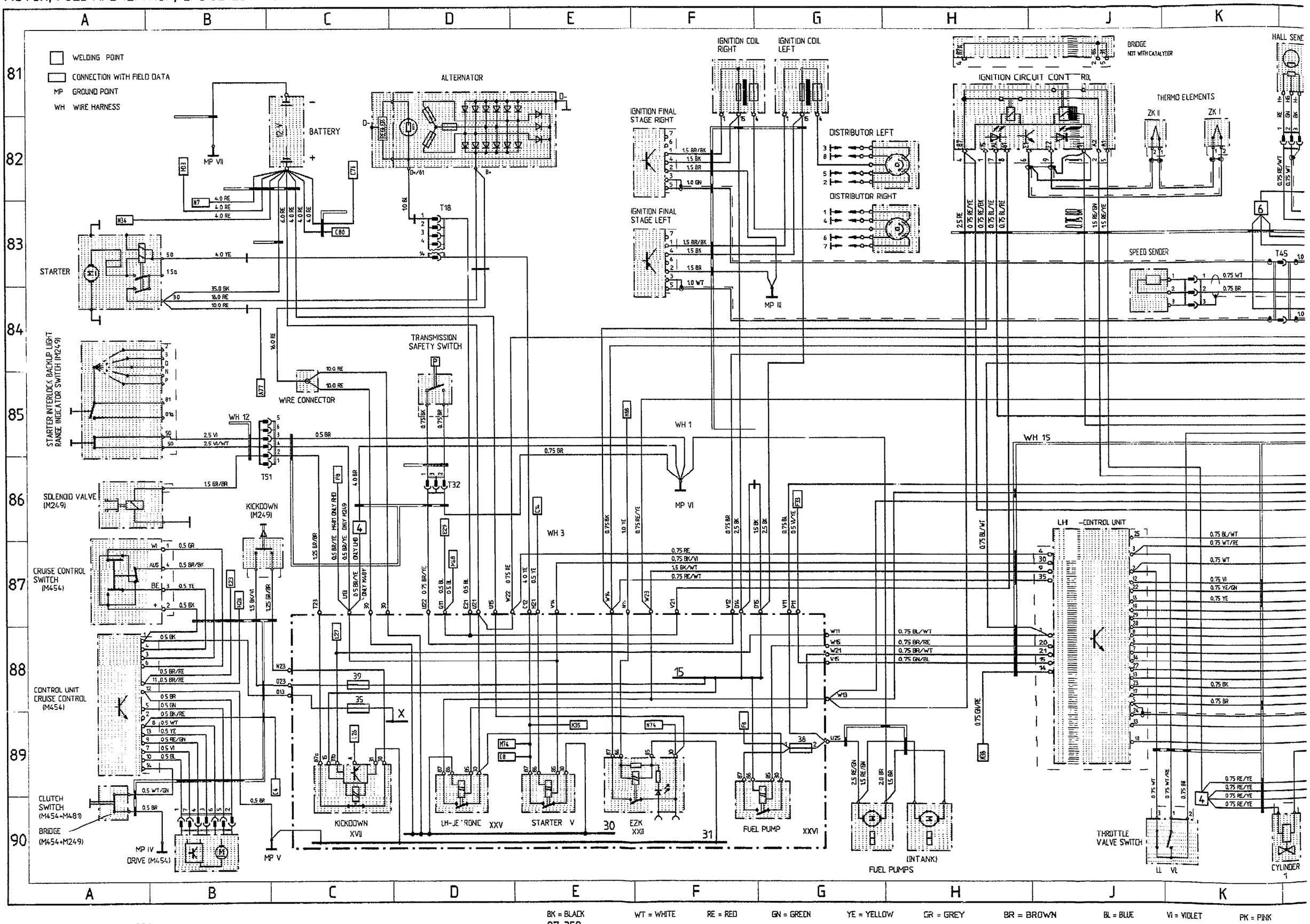
9

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 90 Sheet 10

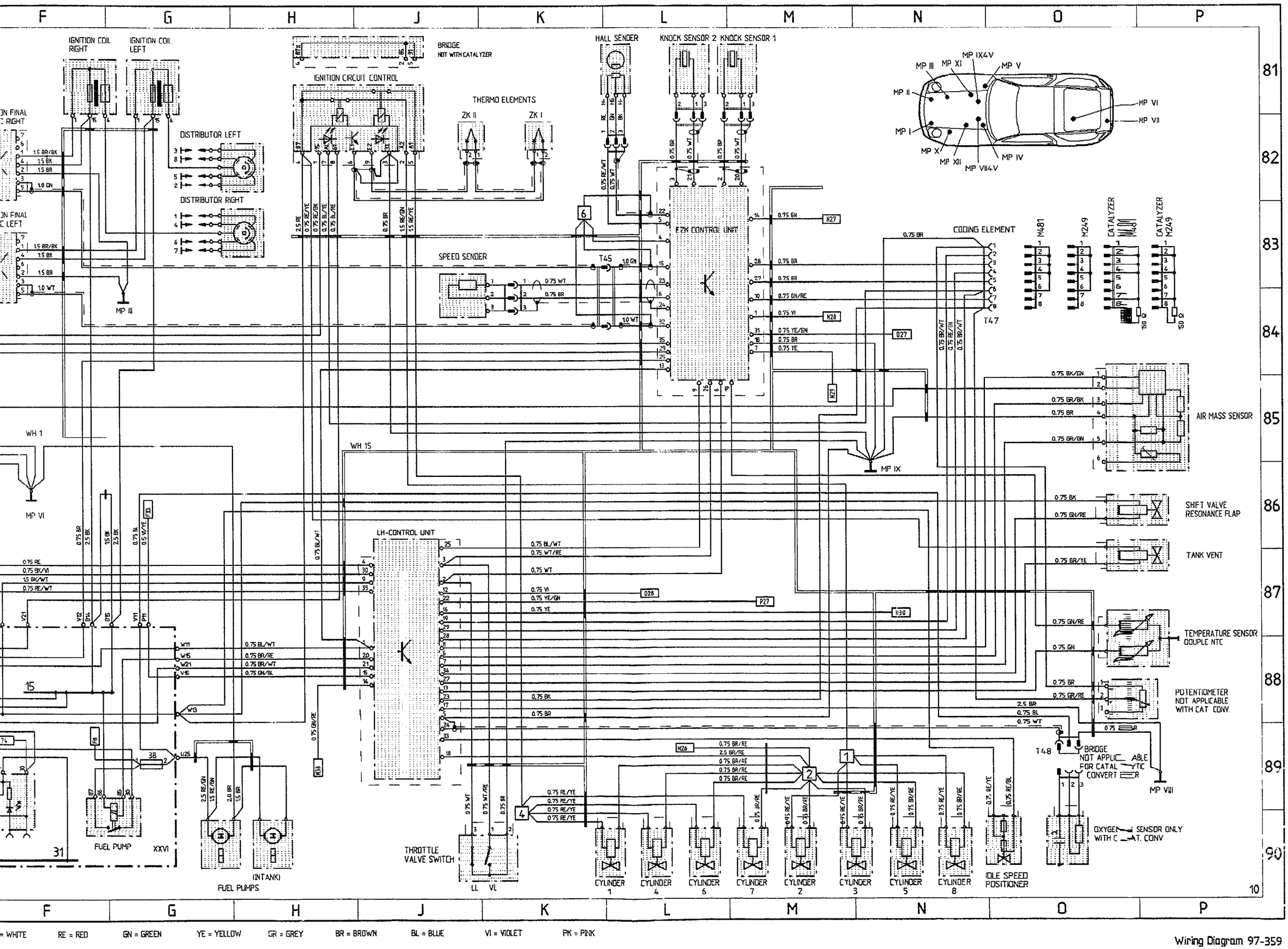
MOTOR, FUEL AND IGNITION, CRUISE CONTROL



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

97-359

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BK = BLACK WH = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 90 Sheet 11

CENTRAL ELECTRIC

	FUSE OUTPUT		FUSE INPUT
1	LOW BEAM LEFT	A15	7.5A → XXIII-XXIV 56b
2	LOW BEAM RIGHT	A14	7.5A → XXIII-XXIV 56b
3	HIGH BEAM LEFT	A25	7.5A → XXIII-XXIV 56a, IV 85, VIII 85
4	HIGH BEAM RIGHT	A24	7.5A → XXIII-XXIV 56a, IV 85, VIII 85
5	ADDITIONAL HIGH BEAM	B14	15A → H 13, XXIII-XXIV 86
6	FOG LIGHT	B24, VIII 30	15A → III 87
7	SIDE MARKER LIGHT LEFT	T1/D11	5A → K 13
8	SIDE MARKER LIGHT RIGHT	S25,D21	5A → H 14
9	ASHTRAY- INSTRUMENT- LIGHTS	K11	5A
10	LICENSE PLATE ENGINE COMPARTMENT LIGHTS	J22,T21	5A → J 12
11	REAR FOG LIGHT	T12	5A → H 24
12	TURN SIGNAL FRONT LEFT	J1/C13	5A → J 21
13	TURN SIGNAL REAR LEFT	T22	5A
14	TURN SIGNAL FRONT RIGHT	C23	5A → H 25
15	TURN SIGNAL REAR RIGHT	T13	5A
16	REAR WINDOW DEFOGGER	I-II 30	25A → 30
17	CENTRAL LOCKS	K14	15A
18	COOLANT A. FLAP CONTROL	VI 87	7.5A → X 30
19	HEADLIGHT CLEANERS	VII 30	25A → V 30
20	FRESH AIR BLOWER	XII 30	30A
21	BOOSTER	F24	15A
22	POWER SEAT LEFT	K25	30A → XXIII-XXIV 30
23	POWER SEAT RIGHT	M12	30A → 24

	FUSE OUTPUT		FUSE INPUT
24	TWO-TONE HORNS REAR WINDOW WIPER	XVI 30, T15	15A → L 15
25	INSIDE LIGHTS DIAGNOSIS CONNECTION INSTRUMENT CLUSTER	XXI 1, F13	7.5A → VI 86
26	TAILGATE UNLOCKING DRIVE	T14	1A
27	CONCEALED HEADLIGHT MOTOR	XXIII-XXIV 30a	15A → 30
28	ABS	XV 30, F25	15A → U 15, B+
29	RADIATOR FAN 1	B22	30A → T 25, B+
30	RADIATOR FAN 2	B23	30A → T 24, B+
31	POWER WINDOW REGULATOR	K24	30A → XXV 86
32			
33	CIGAR LIGHTER	D14	25A → X
34	WINDSHIELD WIPERS	XI 15, L24	25A → D 21
35	STOP LIGHT, CRUISE CONTROL	UZ4, D13	7.5A → XXII-XXIV X
36	CONTROL UNIT FAN	C15	5A
37	AIR CONDITIONING SYSTEM	D12	7.5A → L 13
38	FUEL PUMP, HEATER OX. SENSOR	U25	15A → II 86, XXVI 87
39	INSTRUMENT, CONTROL LAMPS KICKDOWN, SOLENOID VALVE SWITCH FOR REAR WINDOW WIPER	D23, D24	5A → S 24, XXVI 86
40	BACKUP LIGHT, MIRROR ADJUSTMENT	XVII/30, P14	7.5A
41	LIGHTS, LIGHT SWITCH BUTTON PANEL RELAY TIMING CONTROL UNIT INSIDE LIGHTS DIAGNOSIS CONNECTION TERM 15	X/X-15a P25	5A → 15
42	REAR WINDOW WIPER	U23	7.5A → D 15
43	TELEPHONE	N24, D25	7.5A → U 14
44	SEAT HEATER	P13	15A → D 15
45	ADD. AC	D22	15A → D 24

I-II REAR WINDOW DEFOGGER

III DAYTIME RUNNING LIGHT

IV FOG LIGHT

2 VERSIONS
- SERIE-ROW
- (M553-USA)

V STARTER

IX ADDITIONAL CLEANING FLUID PUMP

X SUPPLY

XI WIPER INTERMITTENT CONTROL

XII FRESH AIR BLOWER

XIII FLASHER

ONLY 208

XVIII BACKUP LIGHT (M249)

XIX INSIDE LIGHTS

XXI SUPPRESSOR

XXII EZK

I-II REAR WINDOW DEFOGGER

III DAYTIME RUNNING LIGHT

IV FOG LIGHT

2 VERSIONS
- SERIE-RDW
- (M553-USA)

V STARTER

VI FLAP CONTROL

VII HEADLIGHT CLEANERS

VIII FOG LIGHT

IX ADDITIONAL CLEANING FLUID PUMP

X SUPPLY

XI WIPER INTERMITTENT CONTROL

XII FRESH AIR BLOWER

XIII FLASHER

ONLY 208

XIV DEF

XV ABS (M593)

XVI TWO-TONE HORNS

XVII KICKDOWN (M249)

XVIII BACKUP LIGHT (M249)

XIX INSIDE LIGHTS

XXI SUPPRESSOR

XXII EZK

XXIII-XXIV LIGHT COMBINATION RELAY

XXV LH-JETRONIC

XXVI FUEL PUMP

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LEGEND

DESIGNATION	FIELD	SHEET
ABS	DJ71,72	9
AIRBAG	K-N71-74	9
ALARM-PRIMED INDICATOR LAMPS	LK62,63	8
TRAILER COUPLING-POWER CONNECTION	O72	9
STARTER INTERLOCK BACKUP LIGHT	L1, H21, A85	1, 2, 4, 10
ASHTREY LIGHT	GH31	5
OUTSIDE TEMP. SENSOR	G31	5
OUTSIDE MIRROR LEFT	C48, A57	6, 7
OUTSIDE MIRROR RIGHT	C42, A53	6, 7
OUTSIDE TEMP. SENSOR	D21	4
AUTOMATIC-SOLENOID VALVE	A86	10
BATTERY	C82	10
CONTROL SWITCH-AIR CONDITIONING SYSTEM	C031,32	5
LIGHTS BUTTON PANEL	HJ11,12	3
LIGHTS CENTRAL ELECTRIC	L3	1
ACCELERATING SENSOR PORSCHE DIFFERENTIAL LOCK	K73	9
TURN SIGNAL/DIMMER SWITCH	JK2,3	1, 2
FLOOR LAMP LEFT	G1	1, 2
FLOOR LAMP RIGHT	K1	1, 2
BOOSTER	FG63	8
BRAKE FLUID LEVEL CONTROL SWITCH	F21	4
STOP LIGHT SWITCH	C2	1, 2
BRAKE PAD WEAR INDICATOR	D-H79,80	9
STOP LIGHT-TAILGATE	K9	2
CODING ELEMENT	OP84	10
ROOF ANTENNA	B61,62	8
DIAGNOSIS CONNECTION	JK30	4
ALTERNATOR CONTROL	DE81,82	10
SPEED SENDER ABS	E-H79,80	9
SPEED SENDER MOTOR	JK83,84	10
THROTTLE VALVE SWITCH	JK90	10
PRESSURE SWITCH-FRIGEN	L40	5
PRESSURE SWITCH-COOLANT	MN30	4
FUEL INJECTORS	L-N90	10
SUPPRESSOR	J36,37	5
SUPPRESSOR-RADIO	C62	8
SUPPRESSOR-RADIO BERLIN	A62	8
HORNS	CO20	3
FREQUENCY SWITCHES	FG64	8
FRESH AIR BLOWERMOTOR	LM31,32	5
FROST SENSOR AIRBAG LEFT	K71	9
FROST SENSOR AIRBAG RIGHT	N73	9
BLOWER FINAL STAGE	O39,40	5
BLOWER INSIDE SENSOR-AIR CONDITIONING SYSTEM	AB33,34	5
BLOWER MOTOR-ADDITIONAL AIR CONDITIONING SYSTEM	H40	5
BLOWER SWITCH-FRESH AIR	JK31,32	5
BLOWER SWITCH-ADDITIONAL CONDITIONING SYSTEM	G38	5
SPEED WARNING BUZZER	D30	4
TRANSMISSION PROTECTION SWITCH	D85	10

DESIGNATION	FIELD	SHEET
HALL SENDER	L81	10
PARKING BRAKE CONTACT	E21,22	4
GLOVE BOX LAMP	C1	1, 2
TAILGATE UNLOCKING SWITCH LEFT	O11	3
TAILGATE UNLOCKING SWITCH RIGHT	P11	3
TAILGATE LOCK-ALARM SYSTEM	P63	8
TAIL LIGHTS LEFT	OP8-10	1, 2
TAIL LIGHTS RIGHT	OP2-4	1, 2
REAR WINDOW WIPER MOTOR	P18-19	3
REAR WINDOW WIPER SWITCH	B14	3
REAR WINDOW DEFOGGER	P31,32	5
REAR WINDOW DEFOGGER SWITCH	HJ31,32	5
HF SENDER (RDK-TIRE PRESSURE CONTROL)	E-G80	9
HIGH/LOW PRESSURE SWITCH-AIR CONDITIONING SYSTEM	P32	5
HORN-ALARM SYSTEM	OP66	8
HYDRAULIC UNIT ABS	AB73-76	9
PULSE SENDER	G30	4
INFO SWITCH	E30	4
INSIDE TEMP. SENSOR-AIR CONDITIONING SYSTEM	B32,33	5
INSIDE LIGHTS ROOF	LM9	1, 2
INSIDE LIGHTS TAILGATE I	HJ10	1, 2
INSIDE LIGHTS TAILGATE II	HJ9	1, 2
INTENSIVE CLEANING BUTTON	B13	3
CATALYTIC CONVERTER MONITOR	P28-30	4
CONCEALED HEADLIGHT LEFT	A7	1, 2
CONCEALED HEADLIGHT RIGHT	A4	1, 2
CONCEALED HEADLIGHT MOTOR	A5,6	1, 2
KNOCK SENSOR 1	M81	10
KNOCK SENSOR 2	L81	10
LICENSE PLATE LIGHTS	P6,7	1, 2
KICKDOWN SWITCH	BC86,87	10
KICKDOWN SOLENOID VALVE	A886	10
INSTRUMENT CLUSTER	A-C22-30	4
FUEL PUMPS	FG89,90	10
CLUTCH SWITCH	A90	10
COOLING WATER PRESSURE SWITCH	MN30	4
COOLING WATER LEVEL SWITCH	MN29	4
COOLANT FAN 1	P38	5
COOLANT FAN 2	P39	5
COOLANT FAN FINAL STAGE	O39,40	5
AIR FLAP MOTOR	OP36-38	5
OXYGEN SENSOR	O90	10
BULB CONTROL UNIT	NO1	1, 2
SPEAKER	E-H63-68	8
IDLE SPEED POSITIONER	O90	10
STEERING IGNITION LOCK	B14-16	3
HEADLIGHT VERTICAL AIM CONTROL RIGHT	A4	1
HEADLIGHT VERTICAL AIM CONTROL LEFT	A6	1
LIGHT SWITCH	FG2	1, 2
AIR MASS SENSOR	OP85,86	10
SOLENOID CLUTCH AIR CONDITION COMPRESSOR	P33	5
SOLENOID VALVE ABS	C72	9
SOLENOID VALVE ADDITIONAL AIR CONDITIONING SYSTEM	F38	5
SOLENOID VALVES AIR CONDITIONING SYSTEM	B37-40	5

DESIGNATION	FIELD	SHEET
GROUND POINT GP I -BODY FRONT LEFT		
GROUND POINT GP II -BODY FRONT RIGHT		
GROUND POINT GP III -WHEEL HOUSING WALL FRONT RIGHT		
GROUND POINT GP IV -STEERING CONSOLE		
GROUND POINT GP V -FIREWALL		
GROUND POINT GP VI -BODY TAIL		
GROUND POINT GP VII -GROUND STRAP BATTERY		
GROUND POINT GP VIII -MOTOR-POWER		
GROUND POINT GP IX -MOTOR-ELECTRONICS		
GROUND POINT GP X -WHEEL HOUSING LEFT OUTER		
GROUND POINT GP XI -WHEEL HOUSING RIGHT INNER		
GROUND POINT GP XII -WHEEL HOUSING LEFT INNER		
MEMORY SWITCH LEFT MIRROR	A59,60	7
MEMORY SWITCH RIGHT MIRROR	A51,52	7
MICRO SWITCH CENTRAL NOZZLE AIR CONDITIONER	AB37	5
ENGINE ELECTRONICS	L82-84	10
MOTOR POWER WINDOW LEFT DOOR	F11	3
MOTOR POWER WINDOW RIGHT DOOR	N11	3
MOTOR CONCEALED HEADLIGHT	A5,6	1,2
MOTOR SUN ROOF	E11	3
ENGINE COMPARTMENT LAMP	C3	1, 2
FOG LIGHT SWITCH	CO2	1, 2
REAR FOG LIGHT SWITCH	E2	1
OIL PRESSURE SENDER	P27	4
OIL TEMPERATURE SWITCH TORQUE CONVERTER	P35,36	5
OIL LEVEL SWITCH	P26	4
POTENTIOMETER FOR INSTRUMENT LIGHT	E2	1,2
POTENTIOMETER IDLE SPEED CO	OP88	10
POTENTIOMETER HEADLIGHT VERTICAL AIM CONTROL	DE1	1
POTENTIOMETER WIPE/WASH SYSTEM	B16	3
POTENTIOMETER ADDITIONAL AIR CONDITIONER	F37,38	5
PUMP (PORSCHE LOCK DIFFERENTIAL)	B77,78	9
PUMP RELAY (PORSCHE LOCK DIFFERENTIAL)	B79,80	9
RADIO	A-H61-70	8
CONTROL ADDITIONAL AIR CONDITIONING SYSTEM	EF39,40	5
TIRE PRESSURE CONTROL RDK	D-G78,80	9
RELAY ALARM SYSTEM USA	LM62,63	8
RELAY REAR WINDOW WIPER	P17	3
RELAY I-II (REAR WINDOW DEFOGGER)	JK36,37	5
RELAY III (DAYTIME RUNNING LIGHT)	EF8,9	1
RELAY IV (FOG LIGHT)	CO8,9	1, 2
RELAY V (STARTER)	E89,90	10
RELAY VI (FLAP CONTROL)	LM36,37	5
RELAY VII (HEADLIGHT CLEANERS)	HJ18,19	3
RELAY VIII		
RELAY IX (ADDITIONAL CLEANING FLUID PUMP)	GH18,19	3
RELAY X (SUPPLY)	E8, G36	1, 2, 5
RELAY XI (WIPER-INTERVAL)	FG18,19	3
RELAY XII (FRESH AIR BLOWER)	H36,37	5
RELAY XIII (FLASHER)	K8	1, 2
RELAY XIV (DEF)	L36,37	5
RELAY XV (ABS)	M76	9
RELAY XVI (HORNS)	EF18,19	3
RELAY XVII (KICKDOWN)	C89,90	10
RELAY XVIII (BACKUP LIGHT)	KL8	1, 2
RELAY XIX (INSIDE LIGHT)	LM8,9	1, 2
RELAY XX		
RELAY XXI (SUPPRESSOR)	HJ36,37	5
RELAY XXII (EZK)	F89,90	10
RELAY XXIII - XXIV (LIGHT COMBINATION)	F-H8,9	1, 2
RELAY XXV (LH-JETRONIC)	D89,90	10
RELAY XXVI (FUEL PUMP)	FG89,90	10
BACKUP LIGHT SWITCH	PSL1	1, 2

DESIGNATION	FIELD	SHEET
SWITCH FOR INTENSIVE CLEANING	B13	3
SWITCH FOR MIRROR CONTROL	AB46,47, A56,	6, 7
SWITCH FOR ODOMETER RESETTING	L21	4
SWITCHING UNIT 1,2 (CATALYSOR MONITOR)	P28-30	4
SHIFT VALVE RESONANCE FLAP	OP86	10
WINDSHIELD WASHING FLUID PUMP	O11	3
WINDSHIELD WIPER MOTOR	B17,18	3
HEADLIGHT ASSEMBLY LEFT	A8,9	1, 2
HEADLIGHT ASSEMBLY RIGHT	A2,3	1, 2
HEADLIGHT WASHING FLUID PUMP	O11	3
LOCK CYLINDER LEFT	FG11,12	3
LOCK CYLINDER RIGHT	M11,12	3
SIDE TURN SIGNAL LEFT	A10	1
SIDE TURN SIGNAL RIGHT	A1	1
SIDE MARKER LIGHT FRONT	A1, B10	2
SIDE MARKER LIGHT REAR	P1, P10	2
SEAT BELT	OZ2	4
SEAT HEATER COMFORT SEAT	OP41,42	6
SEAT HEATER MEMORY SEAT	H54-57	7
SEAT HEATER SPORT SEAT	EF46	6
SEAT HEATER SWITCH COMFORT SEAT	N42	6
SEAT HEATER SWITCH MEMORY SEAT	L55-57	7
POWER SEAT COMFORT SEAT	J-P44-50	6
POWER SEAT MEMORY SEAT	J-P51-60	7
POWER SEAT SPORT SEAT	EFG47-50	6
LOCK DIFFERENTIAL SOLENOID VALVE	C72	9
LOCK DIFFERENTIAL PORSCHE LOCK DIFFERENTIAL	A-J71-80	9
MIRROR MEMORY SWITCH	A51,A60	7
STARTER	AB83,84	10
DRIVE CRUISE CONTROL CONTROL	AB90	10
DRIVE TAILGATE UNLOCK	O11,12	3
DRIVE CENTRAL LOCKS LEFT DOOR	F11	3
DRIVE CENTRAL LOCKS RIGHT DOOR	MN11	3
CONTROL UNIT ABS / PSD PORSCHE LOCK DIFFERENTIAL	D-J71,72	9
CONTROL UNIT AIRBAG	MN71	9
CONTROL UNIT ALARM SYSTEM	OP64-68	8
CONTROL UNIT EZK	L82-84	10
CONTROL UNIT POWER WINDOW/SUN ROOF	JK14	3
CONTROL UNIT AIR CONDITIONING SYSTEM	AB34-36	5
CONTROL UNIT FRESH AIR REGULATION	MN39,40	5
CONTROL UNIT LH JETRONIC	J87-89	10
CONTROL UNIT RDK (TIRE PRESSURE CONTROL)	K76,77	9
CONTROL UNIT MIRROR	O54-57	7
CONTROL UNIT CENTRAL LOCKS	J-L11,12	3

DESIGN
TANK VE
FUEL LEV
BUTTON
BUTTON
PUSH BU
PUSH BU
PUSH BU
CRUISE C
CRUISE C
TEMPER
TEMPER
TEMPER
TEMPER
THERMOE
THERMO
DOOR CO
DOOR CO
DOOR CO
DOOR CO
DOOR CO
DOOR LOC
DOOR LOC
CHANGED
EVAPOR
DELAYING
RESISTOR
HAZARD
SPRAY JE
WASHING
COOLANT
RESISTAN
RESISTAN
WIPE/W
TOOTHED
TIME REL
CLOCK
CENTRAL
CIGAR LIG
IGNITION
IGNITION
IGNITION
IGNITION
IGNITION
DISTRIBU
DISTRIBU
ADDITIONA
ADDITIONA

F	G	H	J	K	L	M	N	O	P

DESIGNATION	FIELD	SHEET
ROUND POINT GP I -BODY FRONT LEFT		
ROUND POINT GP II -BODY FRONT RIGHT		
ROUND POINT GP III -WHEEL HOUSING WALL FRONT RIGHT		
ROUND POINT GP IV -STEERING CONSOLE		
ROUND POINT GP V -FIREWALL		
ROUND POINT GP VI -BODY TAIL		
ROUND POINT GP VII -GROUND STRAP BATTERY		
ROUND POINT GP VIII -MOTOR-POWER		
ROUND POINT GP IX -MOTOR-ELECTRONICS		
ROUND POINT GP X -WHEEL HOUSING LEFT OUTER		
ROUND POINT GP XI -WHEEL HOUSING RIGHT INNER		
ROUND POINT GP XII -WHEEL HOUSING LEFT INNER		
EMORY SWITCH LEFTMIRROR	A59,60	7
EMORY SWITCH RIGHT MIRROR	A51,52	7
ICRO SWITCH CENTRAL NOZZLE AIR CONDITIONER	AB37	5
NGINE ELECTRONICS	L82-84	10
OTOR POWER WINDOW LEFT DOOR	F11	3
OTOR POWER WINDOW RIGHT DOOR	N11	3
OTOR CONCEALED HEADLIGHT	A5,6	1,2
OTOR SUN ROOF	E11	3
NGINE COMPARTMENT LAMP	C3	1, 2
OG LIGHT SWITCH	C02	1, 2
AR FOG LIGHT SWITCH	E2	1
IL PRESSURE SENDER	P27	4
IL TEMPERATURE SWITCH TORQUE CONVERTER	P35,36	5
IL LEVEL SWITCH	P26	4
OTENTIOMETER FOR INSTRUMENT LIGHT	E2	1,2
OTENTIOMETER IDLE SPEED CO	OP88	10
OTENTIOMETER HEADLIGHT VERTICAL AIM CONTROL	DE1	1
OTENTIOMETER WIPE/WASH SYSTEM	B16	3
OTENTIOMETER ADDITIONAL AIR CONDITIONER	F37,38	5
UMP (PORSCHE LOCK DIFFERENTIAL)	B77,78	9
UMP RELAY (PORSCHE LOCK DIFFERENTIAL)	B79,80	9
ADIO	A-H61-70	8
ONTROL ADDITIONAL AIR CONDITIONING SYSTEM	EF39,40	5
IRE PRESSURE CONTROL RDK	D-G78,80	9
ELAY ALARM SYSTEM USA	LM62,63	8
ELAY REAR WINDOW WIPER	P17	3
ELAY I-II (REAR WINDOW DEFOGGER)	JK36,37	5
ELAY III (DAYTIME RUNNING LIGHT)	EF8,9	1
ELAY IV (FOG LIGHT)	C08,9	1, 2
ELAY V (STARTER)	E89,90	10
ELAY VI (FLAP CONTROL)	LM36,37	5
ELAY VII (HEADLIGHT CLEANERS)	HJ18,19	3
ELAY VIII		
ELAY IX (ADDITIONAL CLEANING FLUID PUMP)	GH18,19	3
ELAY X (SUPPLY)	E8, G36	1, 2, 5
ELAY XI (WIPER-INTERVAL)	FG18,19	3
ELAY XII (FRESH AIR BLOWER)	H36,37	5
ELAY XIII (FLASHER)	K8	1, 2
ELAY XIV (DEF)	L36,37	5
ELAY XV (ABS)	M76	9
ELAY XVI (HORNS)	EF18,19	3
ELAY XVII (KICKDOWN)	C89,90	10
ELAY XVIII (BACKUP LIGHT)	KL8	1, 2
ELAY XIX (INSIDE LIGHT)	LM8,9	1, 2
ELAY XX		
ELAY XXI (SUPPRESSOR)	HJ36,37	5
ELAY XXII (EZK)	F89,90	10
ELAY XXIII - XXIV (LIGHT COMBINATION)	F-H8,9	1, 2
ELAY XXV (LH-JETRONIC)	D89,90	10
ELAY XXVI (FUEL PUMP)	FG89,90	10
ACKUP LIGHT SWITCH	P5,L1	1, 2

DESIGNATION	FIELD	SHEET
SWITCH FOR INTENSIVE CLEANING	B13	3
SWITCH FOR MIRROR CONTROL	AB46,47, A56,	6, 7
SWITCH FOR ODOMETER RESETTING	L21	4
SWITCHING UNIT 1,2 (CATALYSOR MONITOR)	P28-30	4
SHIFT VALVE RESONANCE FLAP	OP86	10
WINDSHIELD WASHING FLUID PUMP	D11	3
WINDSHIELD WIPER MOTOR	B17,18	3
HEADLIGHT ASSEMBLY LEFT	A8,9	1, 2
HEADLIGHT ASSEMBLY RIGHT	A2,3	1, 2
HEADLIGHT WASHING FLUID PUMP	D11	3
LOCK CYLINDER LEFT	FG11,12	3
LOCK CYLINDER RIGHT	M11,12	3
SIDE TURN SIGNAL LEFT	A10	1
SIDE TURN SIGNAL RIGHT	A1	1
SIDE MARKER LIGHTS FRONT	A1, B10	2
SIDE MARKER LIGHTS REAR	P1, P10	2
SEAT BELT	D22	4
SEAT HEATER COMFORT SEAT	OP41,42	6
SEAT HEATER MEMORY SEAT	H54-57	7
SEAT HEATER SPORT SEAT	EF46	6
SEAT HEATER SWITCH COMFORT SEAT	N42	6
SEAT HEATER SWITCH MEMORY SEAT	L55-57	7
POWER SEAT COMFORT SEAT	J-P44-50	6
POWER SEAT MEMORY SEAT	J-P51-60	7
POWER SEAT SPORT SEAT	EFG47-50	6
LOCK DIFFERENTIAL SOLENOID VALVE	C72	9
LOCK DIFFERENTIAL PORSCHE LOCK DIFFERENTIAL	A-J71-80	9
MIRROR MEMORY SWITCH	A51,A60	7
STARTER	AB83,84	10
DRIVE CRUISE CONTROL CONTROL	AB90	10
DRIVE TAILGATE UNLOCK	D11,12	3
DRIVE CENTRAL LOCKS LEFT DOOR	F11	3
DRIVE CENTRAL LOCKS RIGHT DOOR	MN11	3
CONTROL UNIT ABS / PSD PORSCHE LOCK DIFFERENTIAL	D-J71,72	9
CONTROL UNIT AIRBAG	MN71	9
CONTROL UNIT ALARM SYSTEM	OP64-68	8
CONTROL UNIT EZK	L82-84	10
CONTROL UNIT POWER WINDOW/SUN ROOF	JK14	3
CONTROL UNIT AIR CONDITIONING SYSTEM	AB34-36	5
CONTROL UNIT FRESH AIR REGULATION	MN39,40	5
CONTROL UNIT LH JETRONIC	J87-89	10
CONTROL UNIT RDK (TIRE PRESSURE CONTROL)	K76,77	9
CONTROL UNIT MIRROR	D54-57	7
CONTROL UNIT CENTRAL LOCKS	J-L11,12	3

DESIGNATION	FIELD	SHEET
TANK VENTING VALVE	OP86,87	10
FUEL LEVEL SENDER	H30	4
BUTTON PANEL CENTRAL LOCKS	HJ11	3
BUTTON PANEL AIR CONDITIONING SYSTEM (AC SWITCH)	EF31,32	5
PUSH BUTTON POWER WINDOW LEFT	G11	3
PUSH BUTTON POWER WINDOW RIGHT	L11	3
PUSH BUTTON SUN ROOF	E14,15	3
CRUISE CONTROL MONITOR	AB88,89	10
CRUISE CONTROL SWITCH	A87	10
TEMPERATURE SENSOR COOLING WATER	K40	5
TEMPERATURE SENSOR DOUBLE NTC	OP87	10
TEMPERATURE SENSOR CYLINDER HEAD	JK82	10
TEMPERATURE SWITCH INTAKE PIPE	K40	5
THERMOELEMENT I/II - EX CONTROL	O28,29	4
THERMO SWITCH AIR CONDITIONING EVAPORATOR	FG31	5
DOOR CONTACT SWITCH LEFT	M3	1, 2
DOOR CONTACT SWITCH RIGHT	M3,4	1, 2
DOOR CONTACT FOR GLOVE BOX LAMP	C01	1, 2
DOOR CONTACT ENGINE HOOD COOLANT FAN,ALARM SYST.	LM39,40	5
DOOR CONTACT SWITCH TAILGATE	N8	1, 2
DOOR LOCK LIGHT LEFT	H2	1, 2
DOOR LOCK LIGHT RIGHT	J2	1, 2
CHANGEOVER SWITCH MIRROR CONTROL	AB45, A54,55	6, 7
EVAPORATOR SENSOR ADDITIONAL AIR CONDITIONING	H37,38	5
DELAYING RELAY SEAT HEATER	M42	6
RESISTOR INSTRUMENTS	D21	4
HAZARD LIGHT SWITCH	H2	1, 2
SPRAY JETS LEFT,RIGHT	B11,12	3
WASHING FLUID LEVEL SWITCH	MN28,29	4
COOLANT TEMPERATURE SENDER	P26	4
RESISTANCE GROUP BLOWER	KL31,32	5
RESISTANCE GROUP ADDITIONAL CONDITIONING SYSTEM	HJ37,38	5
WIPE/WASH SWITCH	AB18-20	3
TOOTHED BELT TENSION SWITCH	N22	4
TIME RELAY	P23-25	4
CLOCK	F1	1, 2
CENTRAL ELECTRIC		11
CIGAR LIGHTER	GH31	5
IGNITION FINAL STAGE RIGHT	F82	10
IGNITION FINAL STAGE LEFT	F83	10
IGNITION CIRCUIT CONTROL	HJ81	10
IGNITION TRANSFORMER LEFT	G81	10
IGNITION TRANSFORMER RIGHT	F81	10
DISTRIBUTOR LEFT	GH82	10
DISTRIBUTOR RIGHT	GH82,83	10
ADDITIONAL CLEANING FLUID PUMP	CD11	3
ADDITIONAL CONTROL UNIT ALARM SYSTEM	OP64,65	8

M - NUMBERS

M 061	ENGLAND VERSION
M 139	ADJUSTABLE SEAT HEATING SEAT LEFT
M 193	JAPAN VERSION
M 208	TRAILER COUPLING
M 215	SAUDI-ARABIA VERSION
M 221	PSD PORSCHE LOCK DIFFERENTIAL
M 249	AUTOMATIC TRANSMISSION
M 261	OUTSIDE MIRROR FLAT PASSENGER'S SIDE
M 326	RADIO BERLIN
M 340	ADJUSTABLE SEAT HEATING SEAT RIGHT
M 383	SPORT SEAT LEFT
M 387	SPORT SEAT RIGHT
M 454	CRUISE CONTROL
M 479	AUSTRALIAN VERSION
M 481	TRANSMISSION
M 482	RDK - TIRE PRESSURE CONTROL
M 484	USA VERSION
M 513	LUMBAR SUPPORT SEAT RIGHT
M 525	ALARM SYSTEM WITH CONTINUOUS TONE (SWITZERLAND)
M 528	OUTSIDE MIRROR KONVEX PASSENGER'S SIDE
M 533	ALARM SYSTEM WITH INTERVAL TONE
M 537	SEATING POSITION CONTROL COMFORT SEAT LEFT
M 538	SEATING POSITION CONTROL COMFORT SEAT RIGHT
M 553	USA - CANADA VERSION
M 562	AIRBAG
M 570	ADDITIONAL AIR CONDITIONER (INCREASED REFRIGERATING CAPACITY)
M 576	REAR FOG LIGHT
M 586	LUMBAR SUPPORT SEAT LEFT
M 593	ABS-SYSTEM
M 650	ELECTRIC SUN ROOF

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CONSTR. COMPONENTS, PLUG CONNECT., GROUND POINTS

CONSTRUCTION COMPONENTS

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAMM
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT	7cQ		IN DRIVER'S FOOTWELL ON SIDE	DJ 71-72
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT		7cQ	ABOVE CENTRAL ELECTRICS	DJ 71-72
ALARM SYSTEM CONTROL UNIT	7cM	7cP	BEHIND GLOVE COMPARTMENT	DP 64-68
ALRAM SYSTEM RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	LM 62,63
ALARM SYSTEM ADDITIONAL CONTROL UNIT	8dN	8dN	IN CENTRE CONSOLE BELOW RADIO	DP 64,65
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
ACCELERATING SENSOR	10eQ	10eQ	UNDER THE LEFT SEAT	K 73
BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	FG 62,63
RECEIVER FOR RADIO BERLIN	7cL		IN FRONT PASSENGER'S TRAY	C66
SUPPRESSOR FOR RADIO BERLIN	11eK		UNDER THE COVER ON PASSENGER'S SIDE SILL	A62
SUPPRESSOR FOR RADIO	8dO	8dO	IN CENTRE CONSOLE IN FRONT OF RADIO	C 62
SWITCHING UNIT EX (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
EZK CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	L 82-84
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE TOOL KIT COVER	O 17
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
AIR CONDITIONING SYSTEM CONTROL UNIT	8cN-O	8cN-O	IN HEATER BOX	AB 34-36
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39.40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MN 39,40
COOLING WATER PRESSURE SWITCH	5cM	5cP	IN COOLANT HOSE BEFURE EXPANSION TANK	MN 29,30
COOLING WATER LEVEL SWITCH	6cM	6cP	ON EXPANSION TANK	MN 29
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
IDLE SPEED CO ADJUSTMENT POTENIOMETER	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	O 90
LH JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	P 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 35,36
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
CONTROL TIRE PRESSURE CONTROL UNIT	7cP	7cM	ON INTRUMENT PANEL	K 76-78
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 54
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	O 52-57
CRUISE CONTROL CONTROL UNIT	7dN-O	7dN-O	IN CENTRE CONSOLE AT FRONT	A 88,89
FREEZING PROTECTION SWITCH AIR CONDITIONER	7cM	7cM	UNDER THE WINDSHIELD WIPER COVER	FG 31
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
WARNING BUZZER	8cP	8cM	ON STEERING PROTECTIVE TUBE	O 30
WASHING FLUID LEVEL SWITCH	6cL	6cL	ON WINDSHIELD WASHER TANK	M 28
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL-M	ON BLOWER HOUSING	KL 31,32
RESISTANCE GROUP FOR ADD AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
TIME RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	P 23-25
CENTRAL ELECTRIC	7dM	7dP	IN PASSENGER'S FOOTWELL ON FIREWALL	
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIE
T1	2	GLOVE BOX LAMP	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	CD1
T2	3	ENGINE COMPARTMENT LAMP, HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C4
T3	26	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44
T4	26	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	C42
T5	30	INSTRUMENT SCUTTLE	7cQ	7cL	AT SUPPORTING TUBE STEERING CONSOLE	C4-
T6	12	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44
T7	4	TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	P5,0
T8	2	LICENSE PLATE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	N9
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM1
T11	8	B-PILLAR / TAILGATE	13aN	13aO	UNDER THE TAILGATE TRIM PANEL CLOSE TO SUN VISOR	K10
T12	2	SIDE MARKER LIGHT LEFT REAR	18cO		UNDER THE TOOL KIT COVER	O10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	02
T14	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	G7
T15	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	F7
T16	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	E7
T17	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	E7
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	02
T19	26	INSTRUMENT PANEL - / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL ELECTRICS	E13
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	F5
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H4
T22	12	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	C4
T23	21	ABS	7dQ	7dQ	FOOTWELL AT LEFT SIDE PANEL	K7
T24	6	TRAILER COUPLING	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	OP
T25						
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C12
T27						
T28	4	PULSE SENDER	16dO	16dO	UNDER THE SPARE WHEEL COVER	G2
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F3
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O35
T33	6	FRONT END / INSTRUMENT PANEL WIRE HARNESS	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	C2
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G3
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	F3
T36						
T37						
T38						
T39	2	PLUG BRIDGE INSTEAT RADIO BERLIN	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	A
T40						
T41						
T42	6	WH INSTRUMENT PANEL / WH B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E13
T43						
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13aN	13aO	UNDER THE TAILGATE TRIM PANEL CLOSE TO SUN VISOR	06
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	K8
T46	19	DIAGNOSIS CONNECTION	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	J30
T47	8	CODING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N8
T48	3	OX. SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	08
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	M3
T50	6	AUTOM TRANSM., COUPLING TO GEARBOX WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	M2
T51	6	AUTOM TRANSMISSION, COUPLING TO REAR WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC
T52	6	AIRBAG	8dN		IN CENTRE CONSOLE	M7
T53	2	AIRBAG	8dN		IN CENTRE CONSOLE	M7

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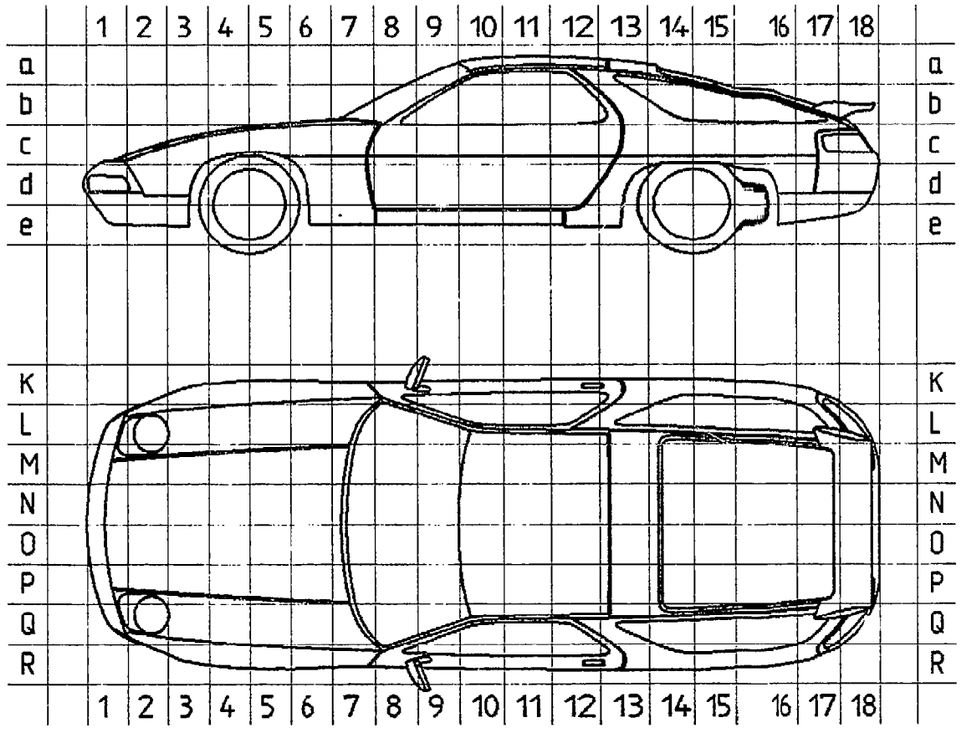
F G H J K L M N O P

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAMM
T1	2	GLOVE BOX LAMP	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C01,P13
T2	3	ENGINE COMPARTMENT LAMP, HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C4,C11
T3	26	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C55-60,D22,G16,P13
T4	26	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	C42,C52-54,,M16
T5	30	INSTRUMENT SCUTTLE	7cQ	7cL	AT SUPPORTING TUBE STEERING CONSOLE	C4-F4,F3-H3,C13-16,K23,H33
T6	12	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C60,F63,G14,H1
T7	4	TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	P5,G29
T8	2	LICENSE PLATE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	N9
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,N31-32
T11	8	B-PILLAR / TAILGATE	13aN	13aO	UNDER THE TAILGATE TRIM PANEL CLOSE TO SUN VISOR	K10,N031
T12	2	SIDE MARKER LIGHT LEFT REAR	18cO		UNDER THE TOOL KIT COVER	O10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	02
T14	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	G78
T15	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	F78
T16	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	E78
T17	3x2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	E78
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	O26,O33,JK39,D83
T19	26	INSTRUMENT PANEL - / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL ELECTRICS	E13,GH28,HJ23,M4
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	FS8-60,HJ46,K43-44
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H42,FS1-53,G63
T22	12	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	C42,C51,G63,J1,L14
T23	21	ABS	7dQ	7dQ	FOOTWELL AT LEFT SIDE PANEL	K74-76,F30
T24	6	TRAILER COUPLING	6fL	6dQ	UNDER THE CENTRAL ELECTRIC	OP74
T25						
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C12
T27						
T28	4	PULSE SENDER	16dO	16dO	UNDER THE SPARE WHEEL COVER	G29
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-34
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O35,D86
T33	6	FRONT END / INSTRUMENT PANEL WIRE HARNESS	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	C2,M38,N69
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	F36
T36						
T37						
T38						
T39	2	PLUG BRIDGE INSTEAT RADIO BERLIN	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	A62-63
T40						
T41						
T42	6	WH INSTRUMENT PANEL / WH B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E13,N63
T43						
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13aN	13aO	UNDER THE TAILGATE TRIM PANEL CLOSE TO SUN VISOR	O63
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	K83-84
T46	19	DIAGNOSIS CONNECTION	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	J30
T47	8	CODING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N84
T48	3	OX. SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	O89
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	M32
T50	6	AUTOM. TRANSM., COUPLING TO GEARBOX WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	M22
T51	6	AUTOM. TRANSMISSION, COUPLING TO REAR WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85,M2
T52	6	AIRBAG	8dN		IN CENTRE CONSOLE	M73
T53	2	AIRBAG	8dN		IN CENTRE CONSOLE	M73

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE
MP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
MP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
MP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
MP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
MP V	FIREWALL	8dM	8dM	ABOVE CENTRAL ELECTRICS
MP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
MP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
MP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
MP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
MP X	WHEEL HOUSING LEFT OUTER	3dO	3dO	BEHIND ABS HYDRAULIC UNIT
MP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
MP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT



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F G H J K L M N O P

Wiring Diagram Type 928 S4/GT Model 91

	Coordinates	
Sheet 1	1 - 10	Lights RoW
Sheet 2	1 - 10	Lights USA
Sheet 3	11 - 20	Body
Sheet 4	21 - 30	Instrument Cluster and Senders
Sheet 5	31 - 40	Engine Cooling, Heater, Air Conditioner
Sheet 6	41 - 50	Outside Mirror, Power Seat
Sheet 7	51 - 60	Seat and Mirror Memory
Sheet 8	61 - 70	Radio, Telephone
Sheet 9	71 - 80	Antilock System, Tire Pressure Control, Airbag, Porsche Lock Differential, Trailor Coupling, Brake Pad Wear Indicator
Sheet 10	81 - 90	Motor, Fuel and Ignition, Cruise Control
Sheet 11	91 - 100	Alarm System, Central Locking System, Inside Lights
Sheet 12	101 - 110	Central Electric
Sheet 13		Constr. Components
Sheet 14		Plug Connections, Ground Points, M-Numbers, Abbreviations

Wiring Diagram Type 928 S4/GT
Model 91

The wiring diagram comprises of 12 individual wiring diagrams, 1 sheet construction components and 1 sheet plug connections, ground points, M-numbers and abbreviations. They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central-electrical system within a dash-dot frame.

This part of the central-electrical system shows all the lines and relays required for the individual wiring diagram.

The ground-connecting points are designated with "MP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Parts 2, is the "module element".

Both parts are identified by the digits 1.....5.

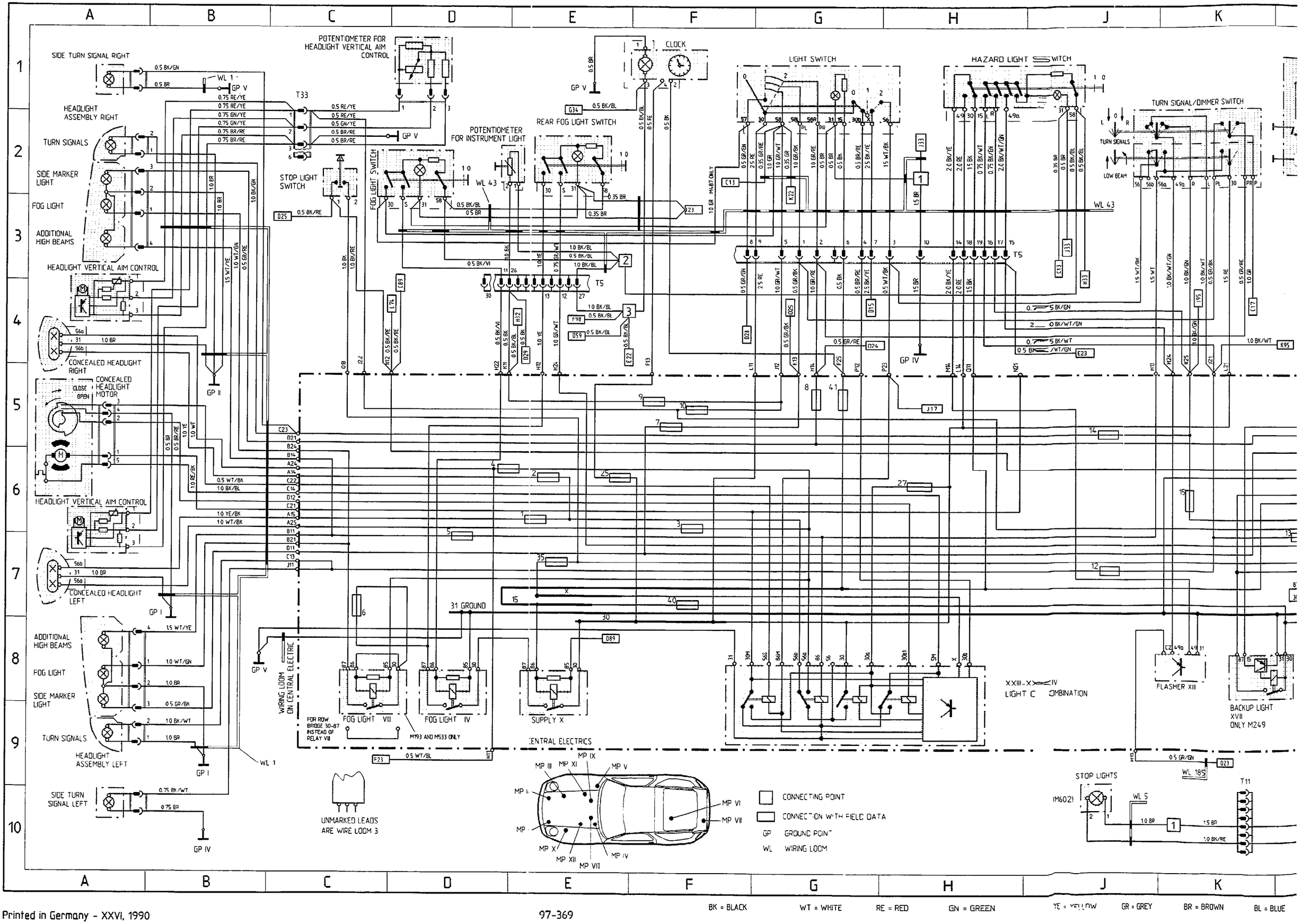
Part 3 is a "coding element".

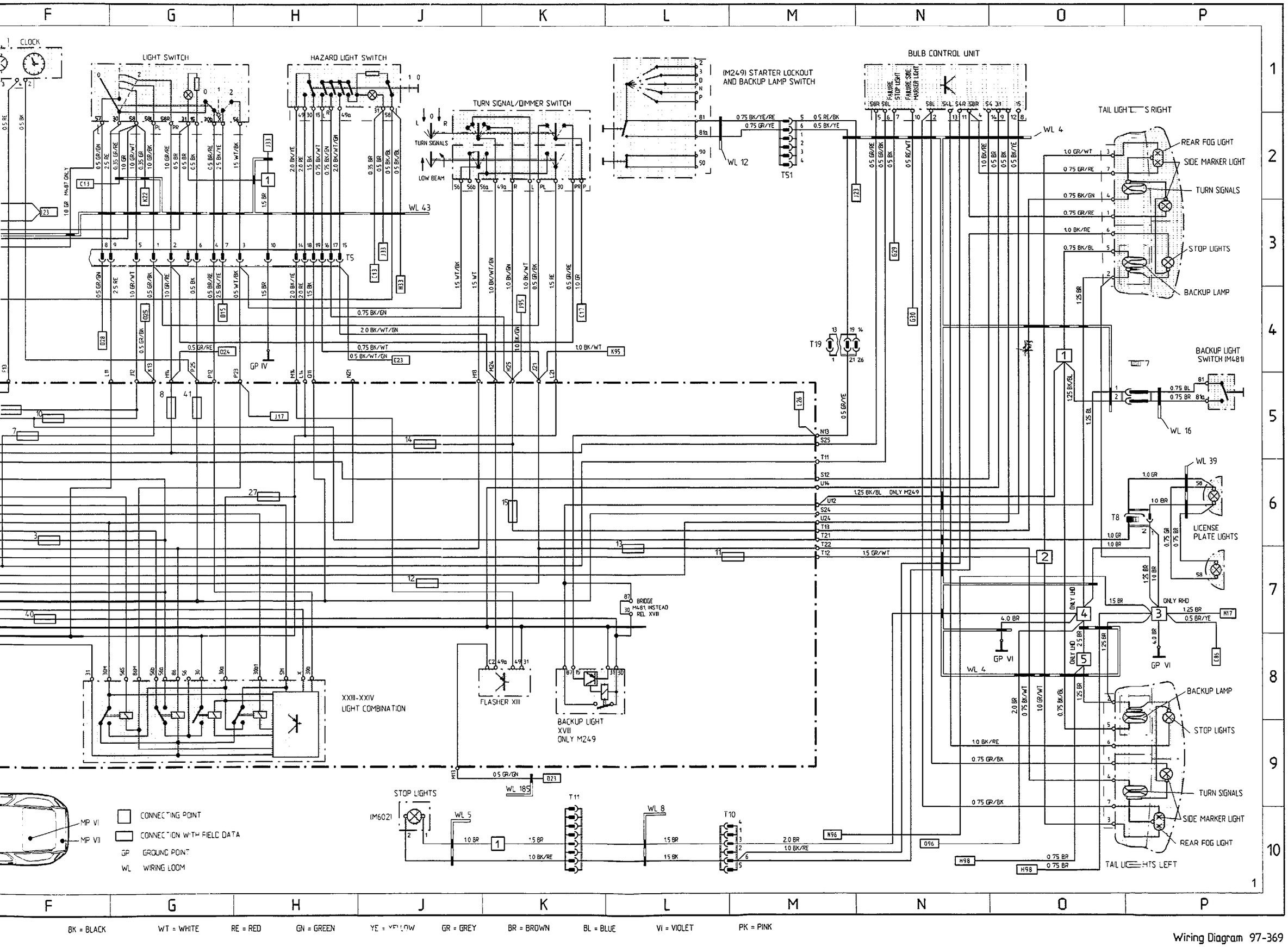
The designations of the plug connections in the wiring diagram for central electrical system refer e.g. from A 11.....15, to the "initial element", from A 21.....25 to module element.

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928 S Model 91 Sheet 1

LIGHTS ROW OUTSIDE

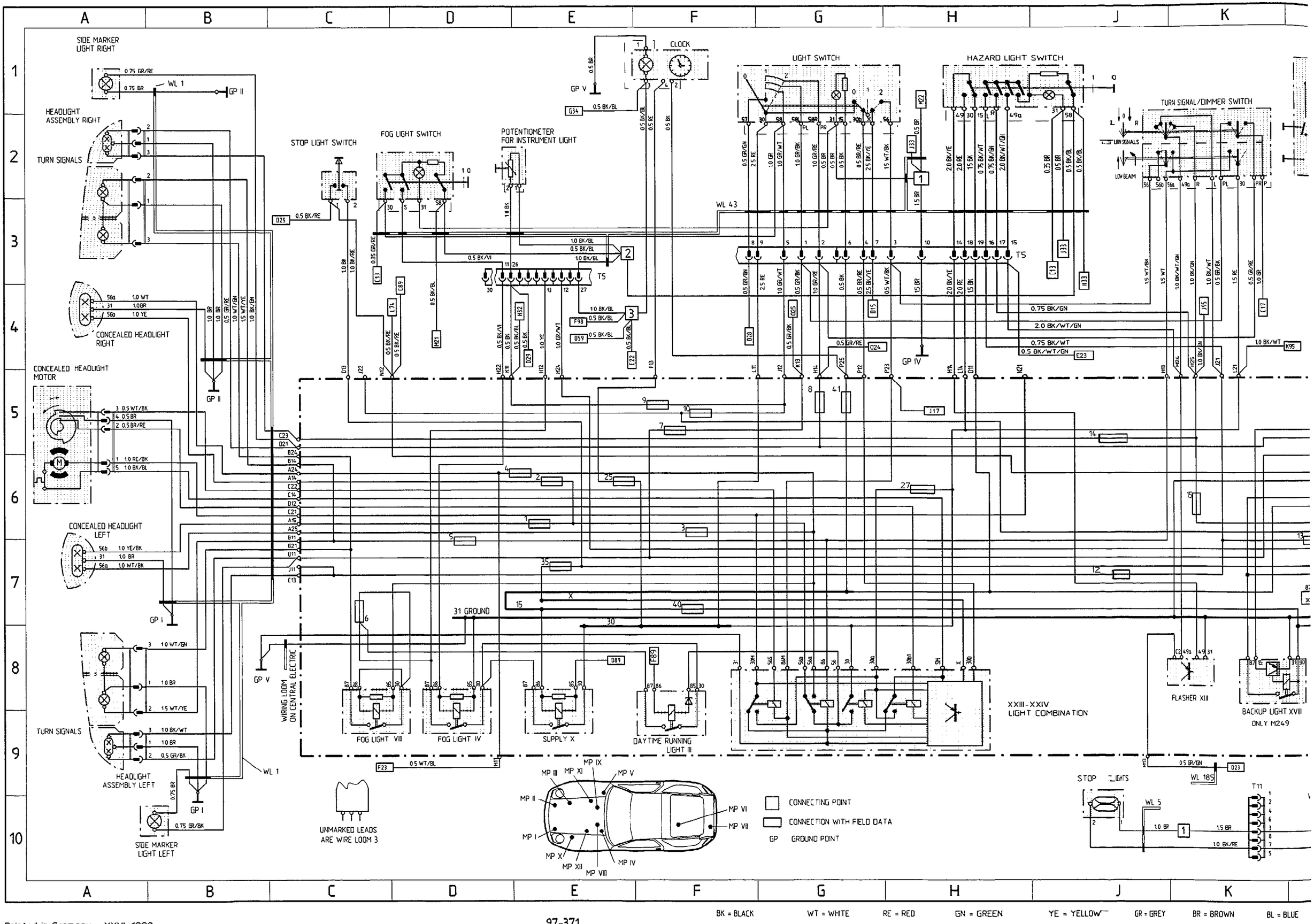




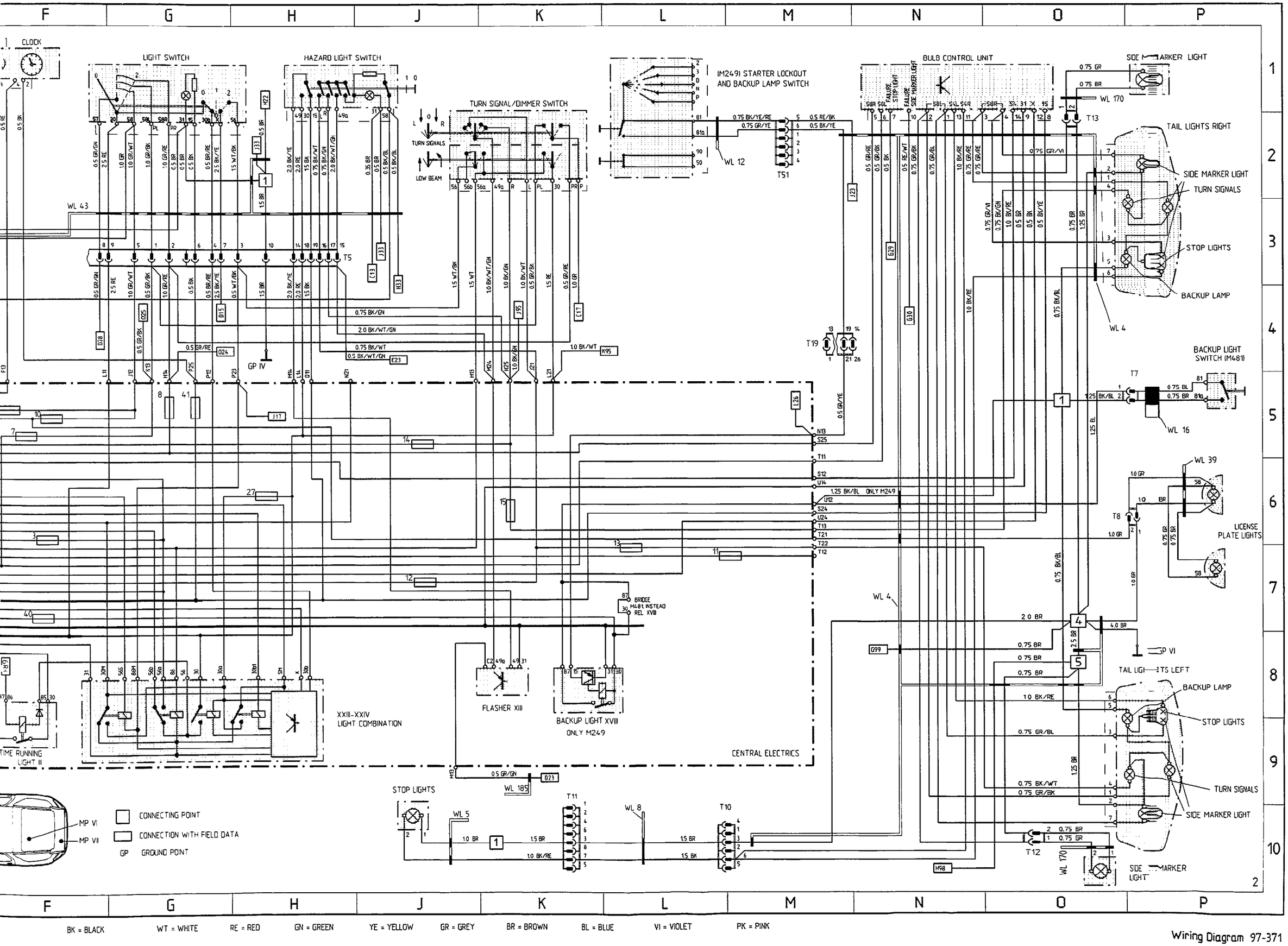
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 91 Sheet 2

LIGHTS USA OUTSIDE



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE



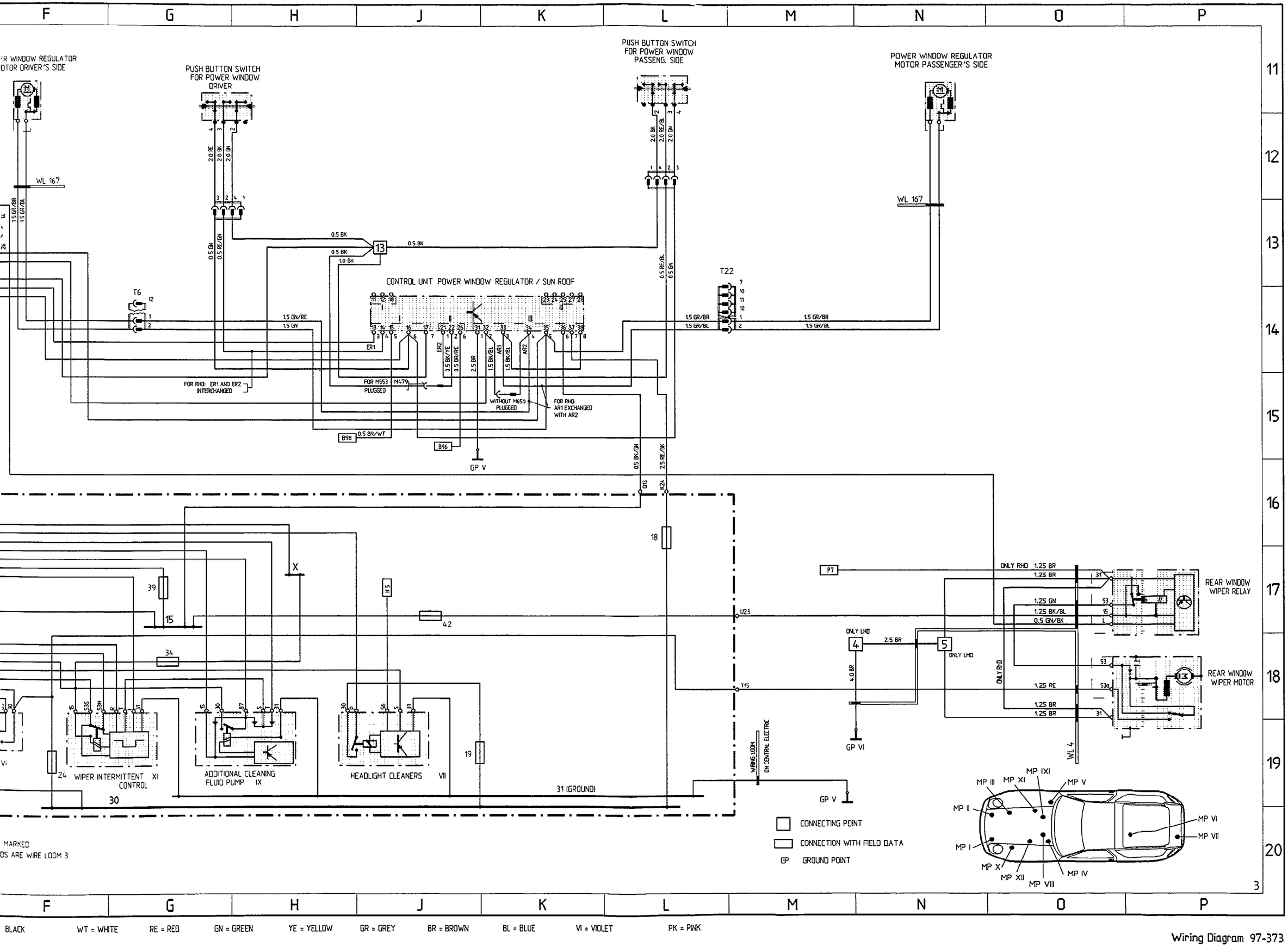
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 91 Sheet 3

BODY

HEADLIGHT WASHING FLUID PUMP
WINDSHIELD WASHING FLUID PUMP
ADDITIONAL CLEANING FLUID PUMP
HEATED SPRAY JET RIGHT
HEATED SPRAY JET LEFT
SWITCH INTENSIVE CLEANING
REAR WINDOW WIPER SWITCH
STEERING IGNITION LOCK
POTENTIOMETER FOR WIPING/WASHING
WINDSHIELD WIPER MOTOR
WIPE/WASH SWITCH
INTERVAL WIPING
TIP SWITCH
WASHING
MOTOR SUN ROOF (M650)
POWER WINDOW REGULATOR MOTOR DRIVER'S SIDE
PUSH BUTTON SWITCH FOR POWER WINDOW DRIVER
PUSH BUTTON SWITCH FOR SUN ROOF (M650)
CONTROL UNIT POWER WINDOW REGULATOR / SUN ROOF
FOR RHD: ER1 AND ER2 INTERCHANGED
WITHOUT M650 PLUGGED
FOR RHD: AR1 EXCHANGED WITH AR2
TWO-TONE HORNS XVI
WIPER INTERMITTENT CONTROL XI
ADDITIONAL CLEANING FLUID PUMP IX
HEADLIGHT CLEANERS VII
TWO-TONE HORN
TWO-TONE HORN
CENTRAL ELECTRICS
31 (GROUND)
NOT MARKED
LEADS ARE WIRE LOOM 3

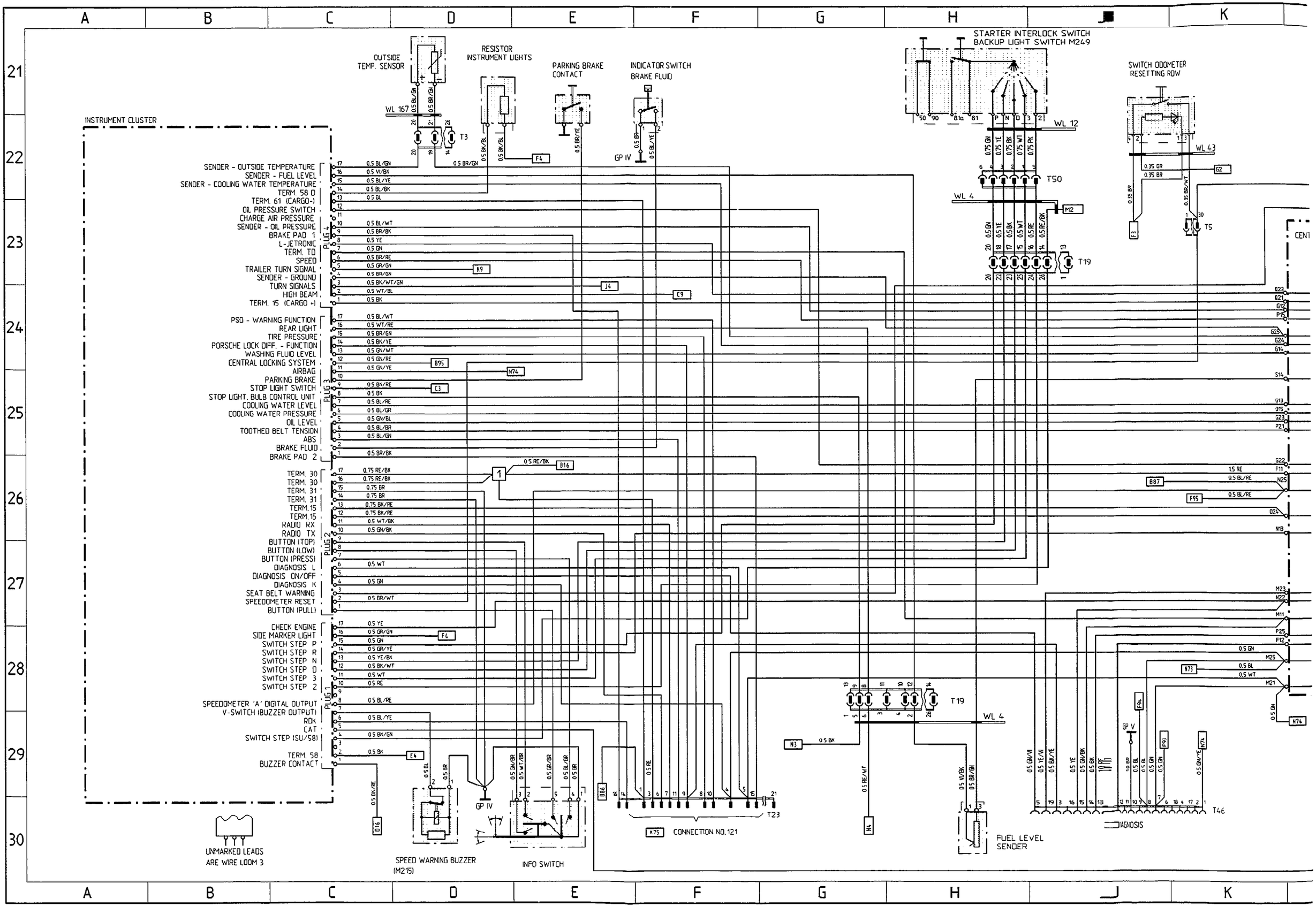
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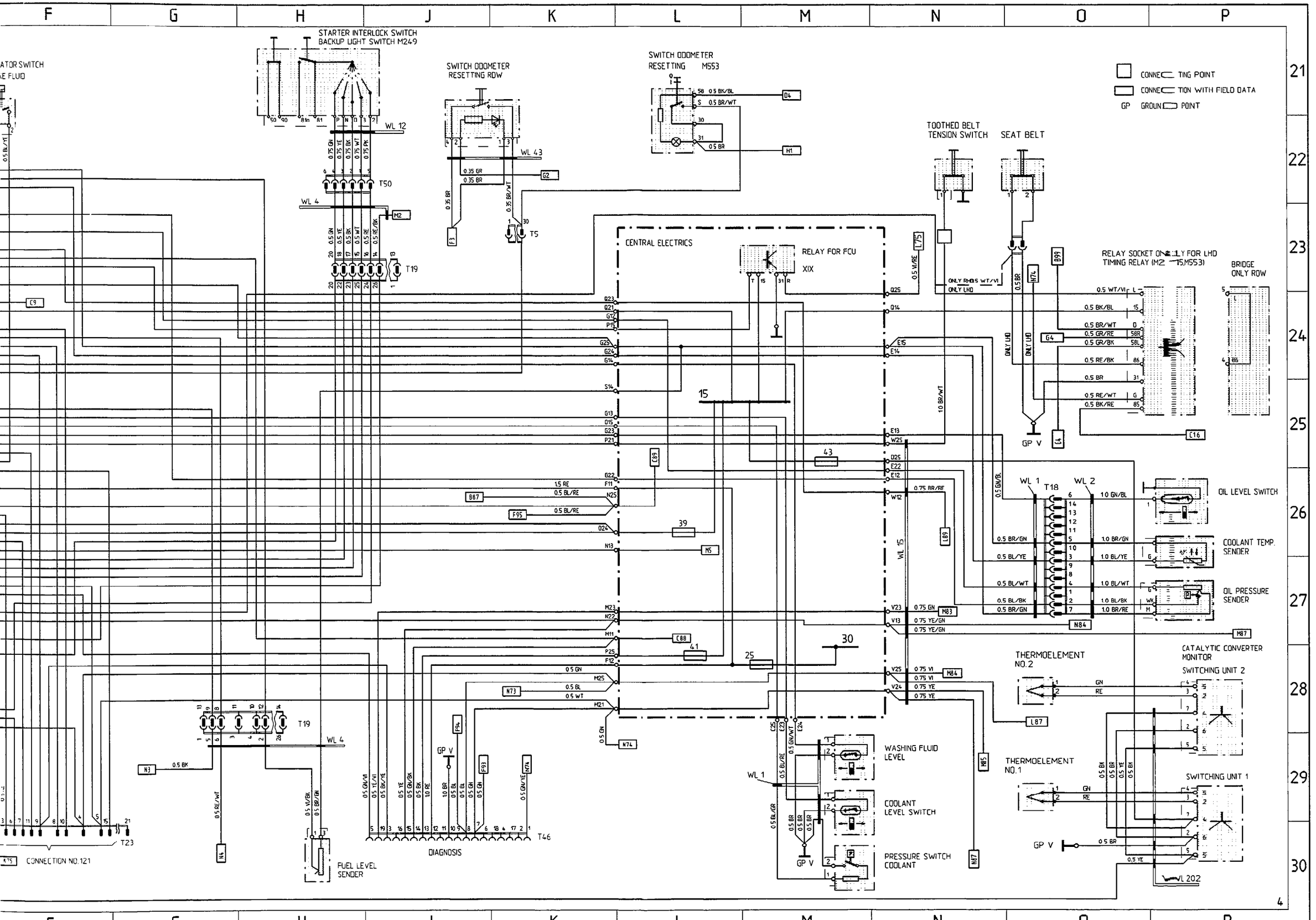
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928 S Model 91 Sheet 4

INSTRUMENT CLUSTER AND SENDERS



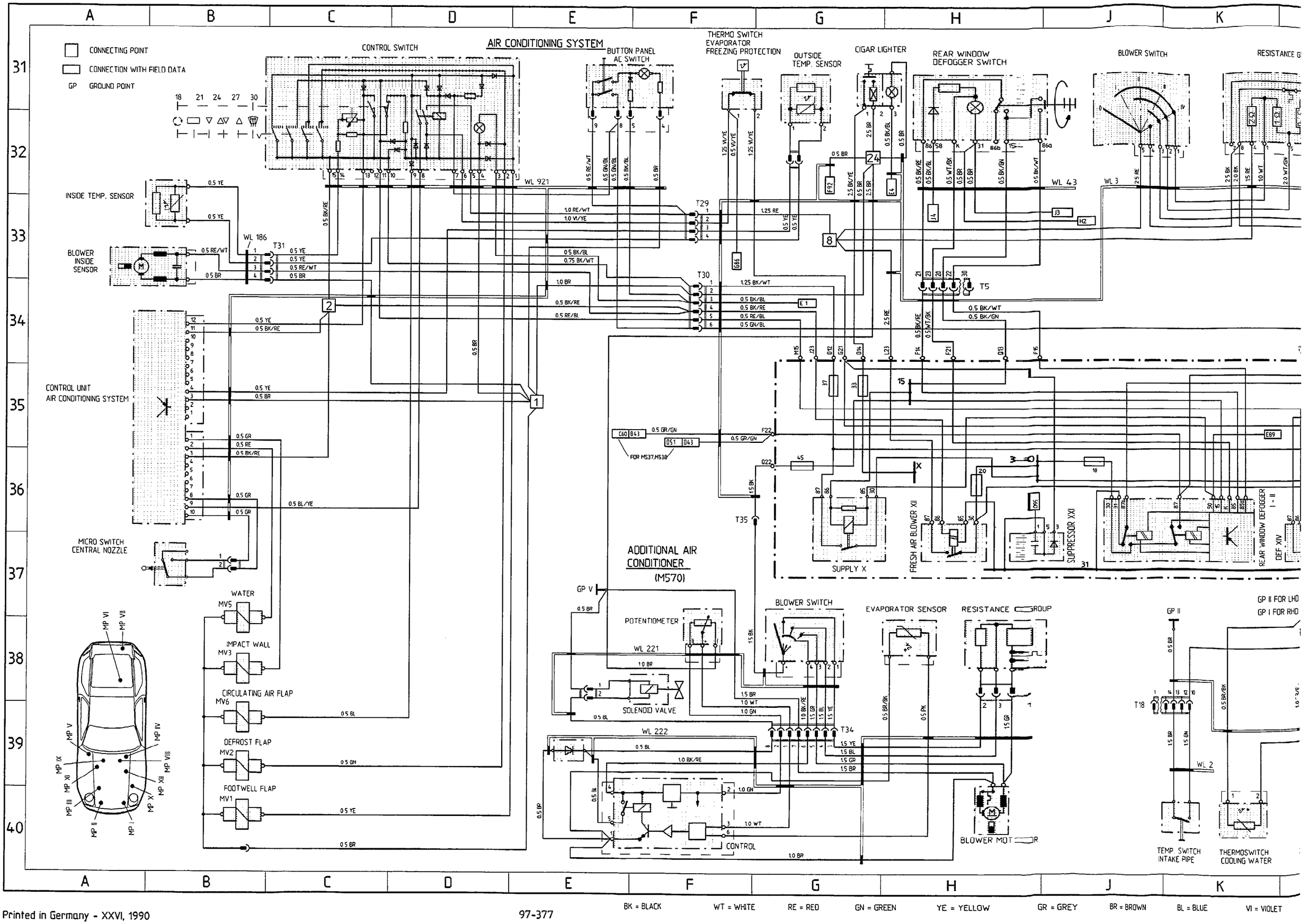
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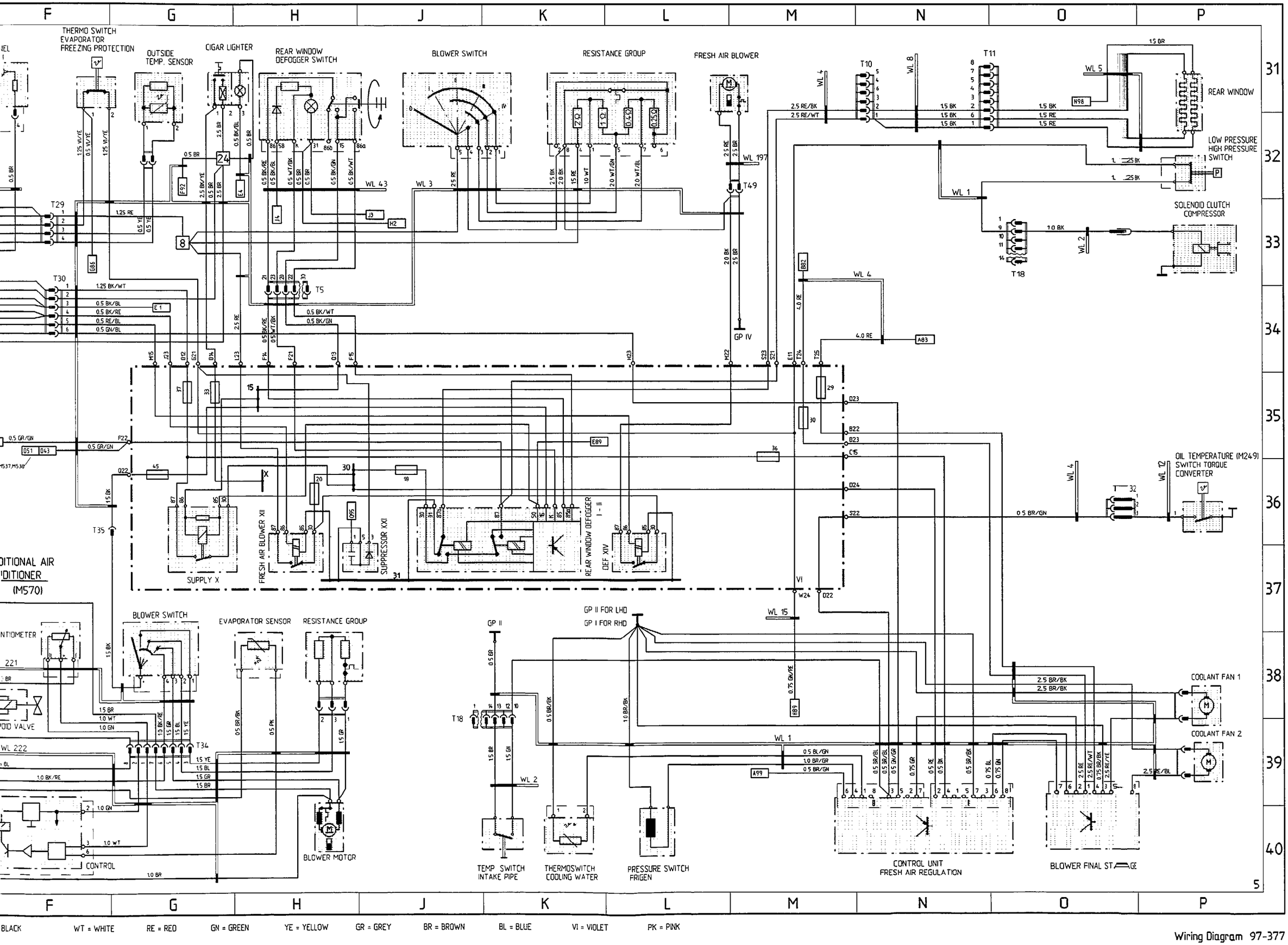
BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 91 Sheet 5

ENGINE COOLING, HEATER, AIR CONDITIONER



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET



BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 91 Sheet 6

OUTSIDE MIRROR, POWER SEAT

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT
WL WIRING LOOM

MIRROR PASSENGER'S SIDE (M261, M528)

TERM 31 CP
WL 167
T4
T22
WL 3
F35
GP V
T6
CHANGEOVER SWITCH
T3
MIRROR SWITCH
VS I
MIRROR DRIVER'S SIDE

CENTRAL ELECTRICS
30
40
23
15
22
44
M12
P14
K25
P13

CONNECTION POWER SEAT RIGHT
T21
WL 227
T20
GP IV

SPORT SEAT (M383, M387)

2-WAY SWITCH
SEAT CUSHION HEIGHT CONTROL REAR
SEAT CUSHION HEIGHT CONTROL FRONT
WIRING LOOM ON SWITCH
CONNECTION POWER SEAT LEFT
SEAT BACKREST CONTROL
SEAT LUMBAR (M586) HEIGHT CONTROL (M513)
SEAT LUMBAR (M586) CURVE CONTROL (M513)
WL 343
NOT APPLICABLE WITH M139 M340, M586, M513
WL 337

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI MP XII

8K = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

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F G H J K L M N O P

41 42 43 44 45 46 47 48 49 50

ADJUSTABLE SEAT HEATING (M139, M340)

CONNECTION POWER SEAT RIGHT

SEAT HEATER AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

DELAYING RELAY

SEAT HEATER SWITCH

BACKREST

SEAT

SIDE ELEMENTS

WIRING LOOM ON SWITCH

WL 337/338/340

WL 227

T21

T20

CENTRAL ELECTRICS

GP V

GP IV

COMFORT SEAT - STANDARD LEFT

PORT SEAT
(1383, M387)

4-WAY SWITCH

4 —WAY SWITCH

2-WAY SWITCH

WIRING LOOM ON SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

SEAT BACKREST CONTROL

WL 343
NOT APPLICABLE WITH M139
M340, M586, M513

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

SEAT LUMBAR (M586) CURVE CONTROL (M513)

CONNECTION POWER SEAT LEFT

WL 337 WITH M139, M340, M513, M586

SEAT CUSHION HEIGHT CONTROL FRONT

SEAT BACK FORWARD CONTROL

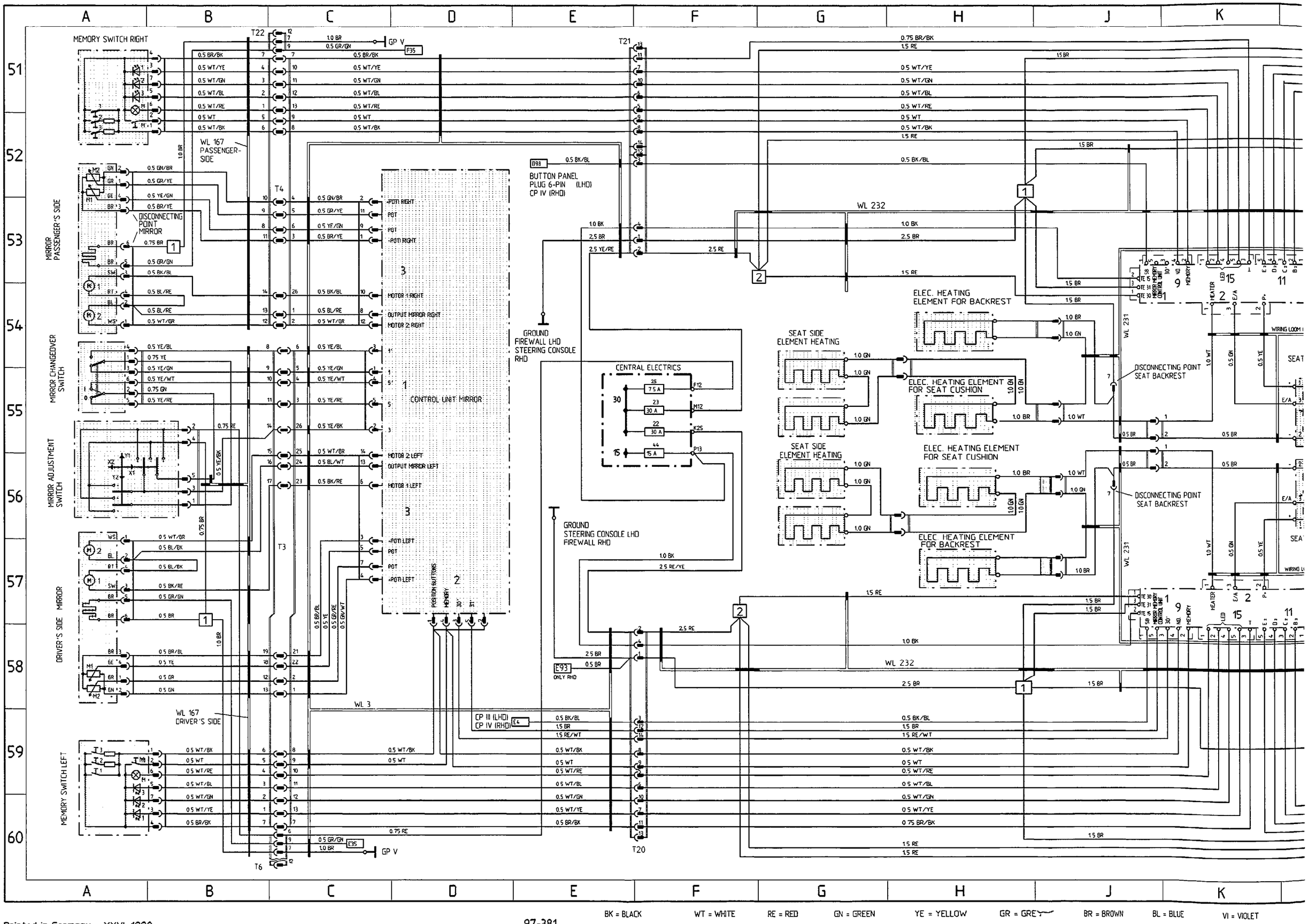
6

F G H J K L M N O P

K = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 91 Sheet 7

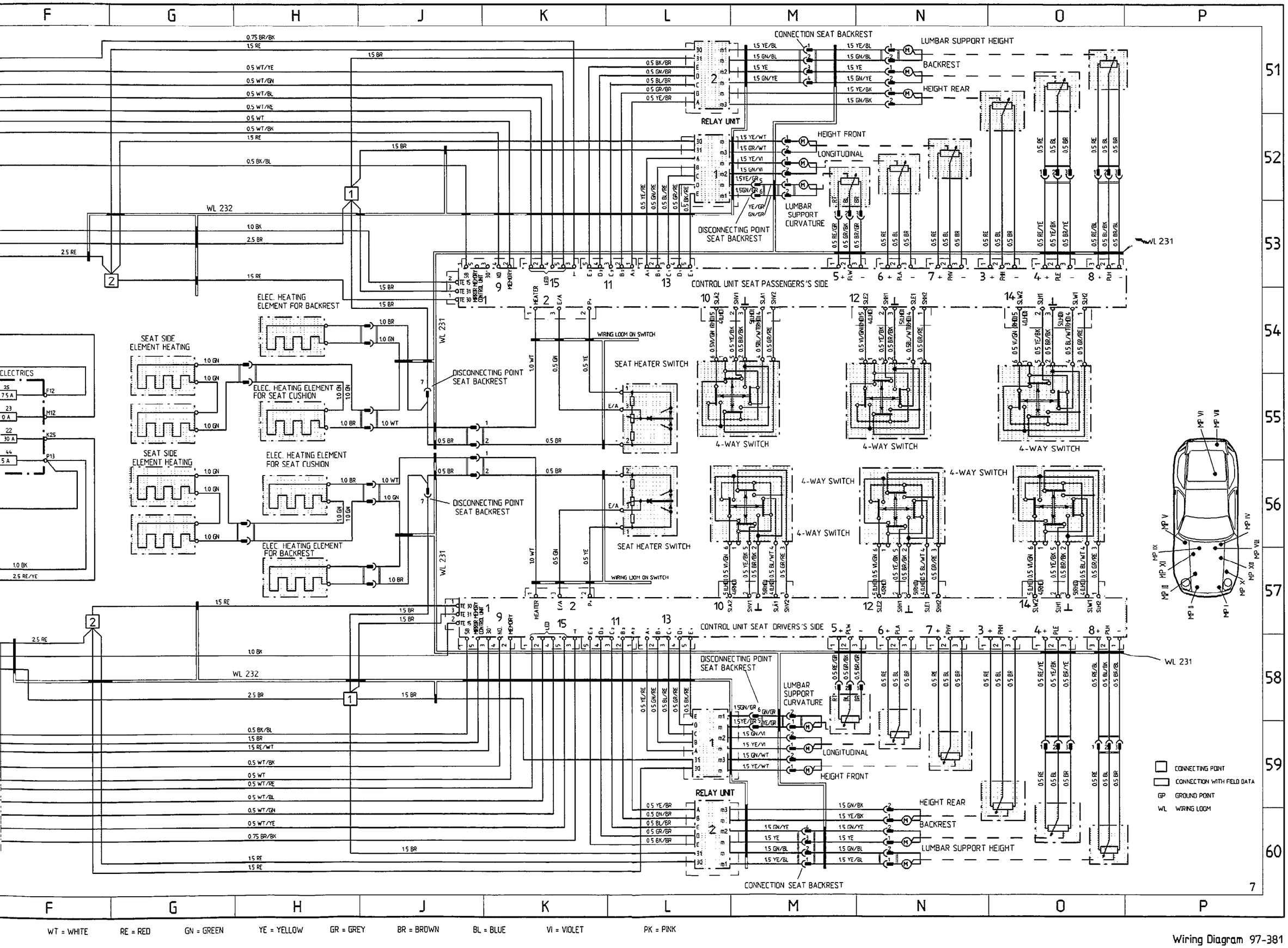
(M537, M538) SEAT AND MIRROR MEMORY



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

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97-381


F
G
H
J
K
L
M
N
O
P
51
52
53
54
55
56
57
58
59
60
CONNECTION SEAT BACKREST
LUMBAR SUPPORT HEIGHT
BACKREST
HEIGHT REAR
HEIGHT FRONT
LONGITUDINAL
LUMBAR SUPPORT CURVATURE
RELAY UNIT
DISCONNECTING POINT SEAT BACKREST
WL 232
WL 231
CONTROL UNIT SEAT PASSENGERS'S SIDE
CONTROL UNIT SEAT DRIVERS'S SIDE
ELEC. HEATING ELEMENT FOR BACKREST
SEAT SIDE ELEMENT HEATING
ELEC. HEATING ELEMENT FOR SEAT CUSHION
WIRING LOOM ON SWITCH
SEAT HEATER SWITCH
4-WAY SWITCH
CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT
WL WIRING LOOM
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

ROOF ANTENNA
NOT ON C-NETWORK
ANTENNA EXTENSION WIRE
SUPPRESSOR
1.0 WT
2.5 RE
2.5 BR
0.5 BR/YE
0.5 BR/YE
1.0 RE
G92
PIN 3 (MUTE) NOT ON CD-PLAYER
RADIO AND CD-PLAYER
ALARM CONTACT IN RADIO SUPPORT FRAME
ALARM CONTACT IN CD-PLAYER
15 BR
2.5 RE/BK
C15
4.0 BR
GP V
T39
WL 3
4.0 RE
4.0 RE
BOOSTER
LEFT
RIGHT
15 BL
15 BR/BK
15 BR/WT
15 BL/WT
T6
T22
WL 167 LEFT
WL 167 RIGHT
FRONT LEFT
HIGH RANGE RADIO SPEAKER
MIDDLE RANGE SPEAKER
15 GN
15 BR
15 YE
15 BR
SEPARATING FILTER DOOR LEFT
WL 4
SEPARATING FILTER DOOR RIGHT
FRONT RIGHT
HIGH RANGE RADIO SPEAKER
MIDDLE RANGE SPEAKER
DEEP RANGE SPEAKER
REAR LEFT
WL 69 LEFT
WL 69 RIGHT
REAR RIGHT
MIDDLE RANGE SPEAKER
HIGH RANGE RADIO SPEAKER
DEEP RANGE SPEAKER
1.5 VI
1.5 BR
1.5 GN
1.5 BR/WT
CONNECTION PLAN BOOSTER
F24
30
BOOSTER 15 A
21
TELEPHONE
TERM. 15
43
N24
0.5 GN
CENTRAL ELECTRICS
SPEAKER PLUG FRONT LEFT WT
SPEAKER PLUG FRONT RIGHT BLACK
SPEAKER PLUG REAR RIGHT RED
SPEAKER PLUG REAR LEFT YELLOW
SPEAKER PLUG DEEP RANGE TUNER LEFT YELLOW
SPEAKER PLUG DEEP RANGE TUNER RIGHT RED
PRE-AMPLIFIER INPUT LF-WIRE
CONNECTION PLUG 6-PIN

TELEPHONE PREPARATION C-NETWORK M 612
(Philips "Porty")

TELEPHONE RECEIVER
NOT CONTAINED IN M612
CONNECTION CABLE TELEPHONE RECEIVER PLATES
WIRE HARNESS FOR TELEPHONE RECEIVER
15-WIRE
TRANSMITTER-RECEIVER C-NETWORK
NOT CONTAINED IN M612
COMBINED RADIO AND TELEPHONE ANTENNA
ANTENNA
RADIO
RADIO
COMBINER
ANTENNA LEAD RADIO CROSS-OVER
RADIO ANTENNA INPUT
WIRING LOOM C-NETWORK SUPPLY
C81 PLUS LEAD FOR TELEPHONE
15 A
NON-CES FUSE IN BATTERY COMPARTMENT
4.0 RE
4.0 BK
GP I
0.5 PK
RADIO MUTE
RADIO PLUG CHAMBER 3 NOT CONNECTED
0.5 YE
0.5 GR
0.5 WT
NOT CURRENTLY CONNECTED
10 RE
10 RE

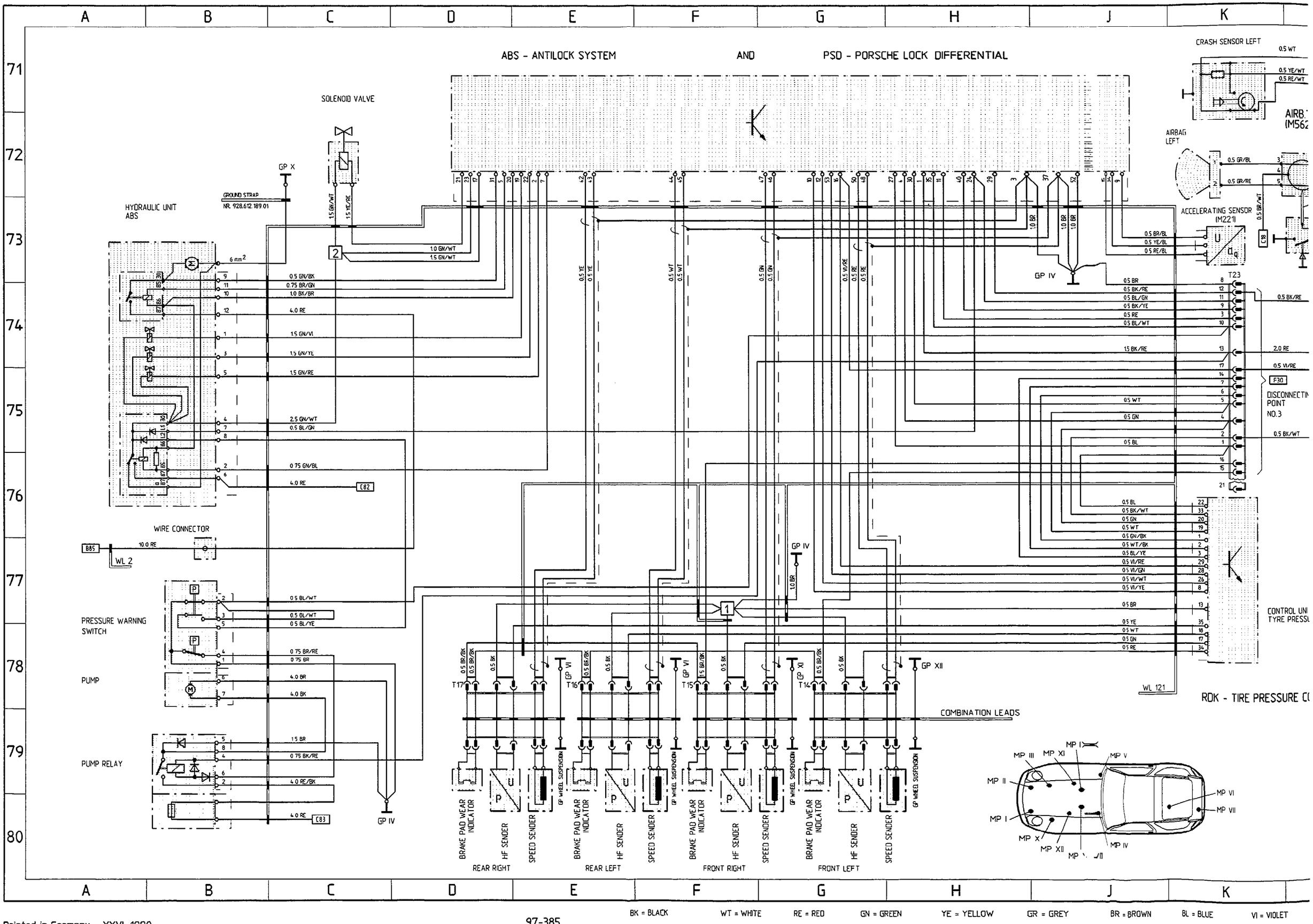
TELEPHONE PREPARATION CELLULAR M 195
(Motorola)

GP I
WIRING LOOM CELLULAR
TRANSMITTER-RECEIVER CELLULAR
ANTENNA CELLULAR
NOT CONTAINED IN M612
0.5 GN/BK
1.0 BR
1.0 BR
TELEPHONE RECEIVER
MULTI-LEAD 8 WIRE
NOT CONTAINED IN M195
BL
BR
GN
WT
NOT CONTAINED IN M195
CONNECTION LOUDSPEAKER (FREE-HANDED SPEAKING)
CONNECTION MICROPHONE (FREE-HANDED SPEAKING)
CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT

8

928 S Model 91 Sheet 9

ABS, TIRE PRESSURE CONTROL, AIRBAG, PORSCHE LOCK DIFFERENTIAL, BRAKE PAD WEAR INDICATOR ,TRAILER COUPLING



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET

R ,TRAILER COUPLING

F G H J K L M N O P

AND PSD - PORSCHE LOCK DIFFERENTIAL

CRASH SENSOR LEFT

AIRBAG (M562)

AIRBAG CONTROL UNIT (M562)

TRAILER COUPLING (M 208)

PLUG SOCKET TRAILER COUPLING

AIRBAG LEFT

ACCELERATING SENSOR (M221)

SLIDING CONTACT UNIT

STEERING WHEEL WITH HORN CONTACT

WITHOUT M562

AIRBAG RIGHT

CRASH SENSOR RIGHT

GP IV

GP V

GP VI

GP XI

GP XII

T23

T52

T53

T24

DISCONNECTING POINT NO.3

F30

F89

GROUND ABS

XV ABS

WIRING LOOM ON CENTRAL ELECTRIC

CONTROL UNIT TYRE PRESSURE CONTROL

ROK - TIRE PRESSURE CONTROL

WL 121

WL 84

WL 3

WL 180

WL 161

WL 4

COMBINATION LEADS

CENTRAL ELECTRICS

SEE SHEET 1 FIELD M5-7 (CONNECTION TO CENTRAL ELECTRIC)

REAR FOG LIGHT

BULB CONTROL UNIT - STOP LIGHTS

TURN SIGNAL REAR RIGHT

TURN SIGNAL REAR LEFT

BULB CONTROL UNIT - SIDE MARKER LIGHT RIGHT

BULB CONTROL UNIT - SIDE MARKER LIGHT LEFT

SPEED SENDER

BRAKE PAD WEAR INDICATOR

HF SENDER

FRONT RIGHT

FRONT LEFT

GP WHEEL SUSPENSION

MP I MP II MP III MP IV MP V MP VI MP VII MP VIII MP IX MP X MP XI MP XII

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

71 72 73 74 75 76 77 78 79 80

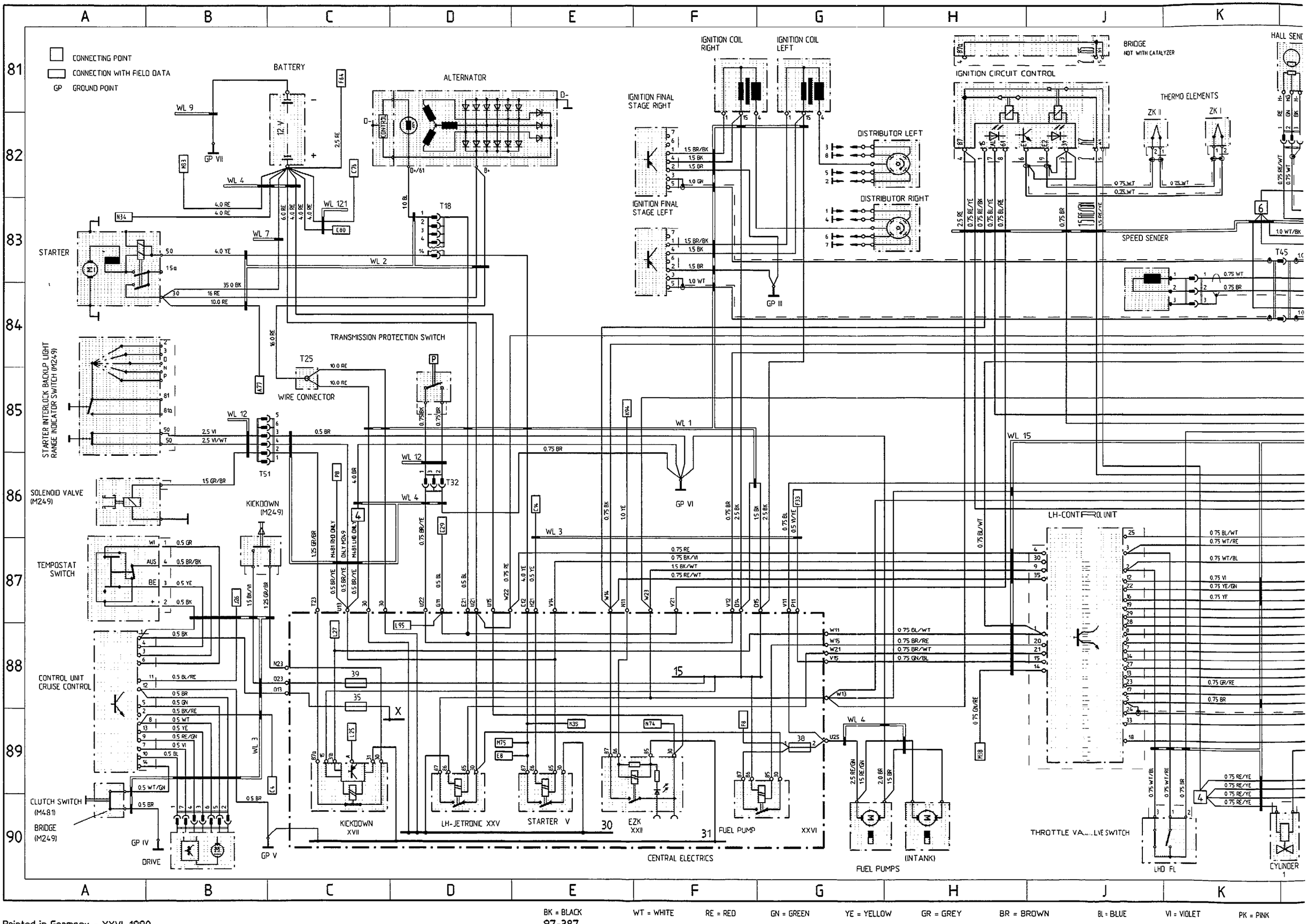
9

F G H J K L M N O P

BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 91 Sheet 10

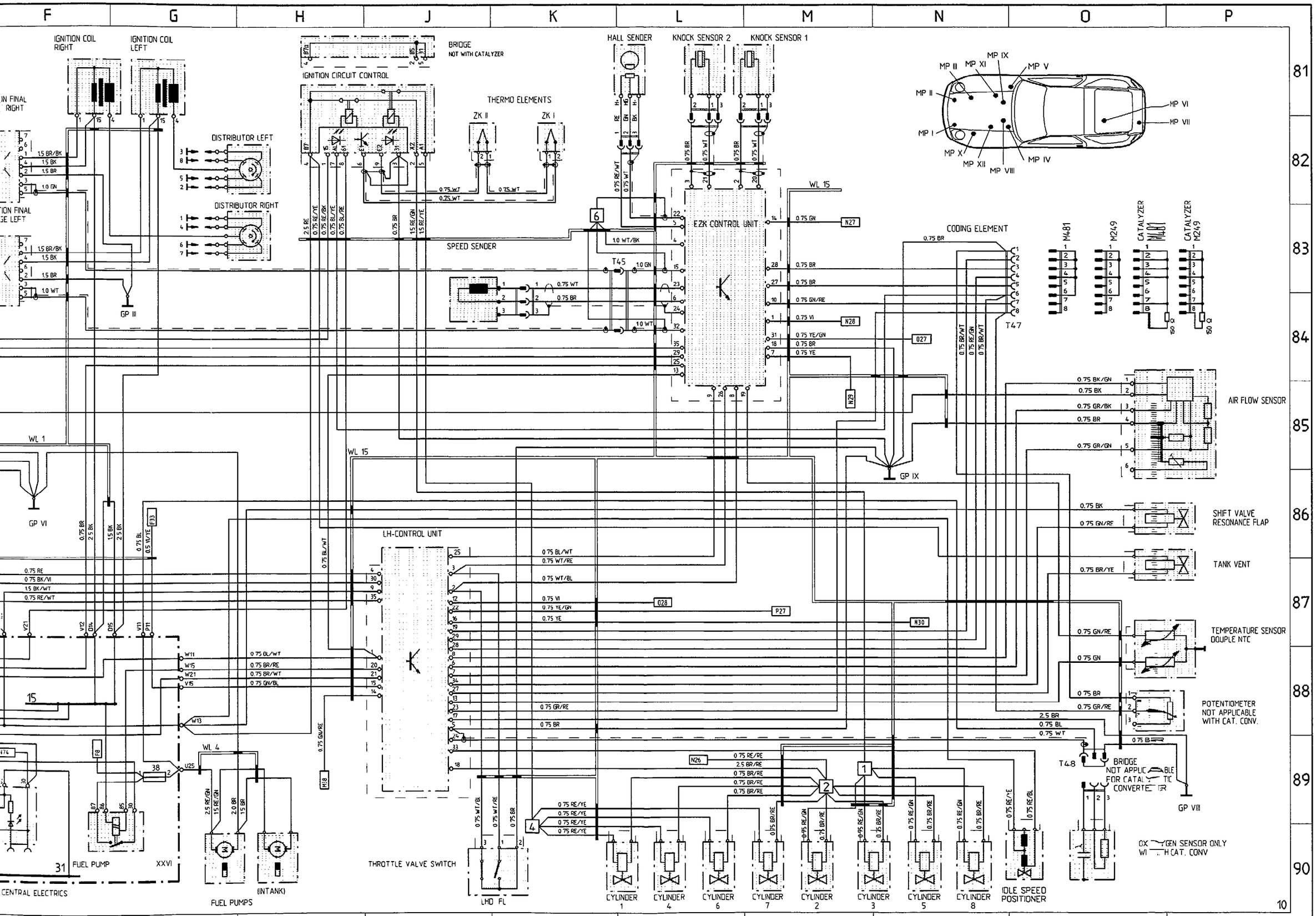
MOTOR, FUEL AND IGNITION, CRUISE CONTROL



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

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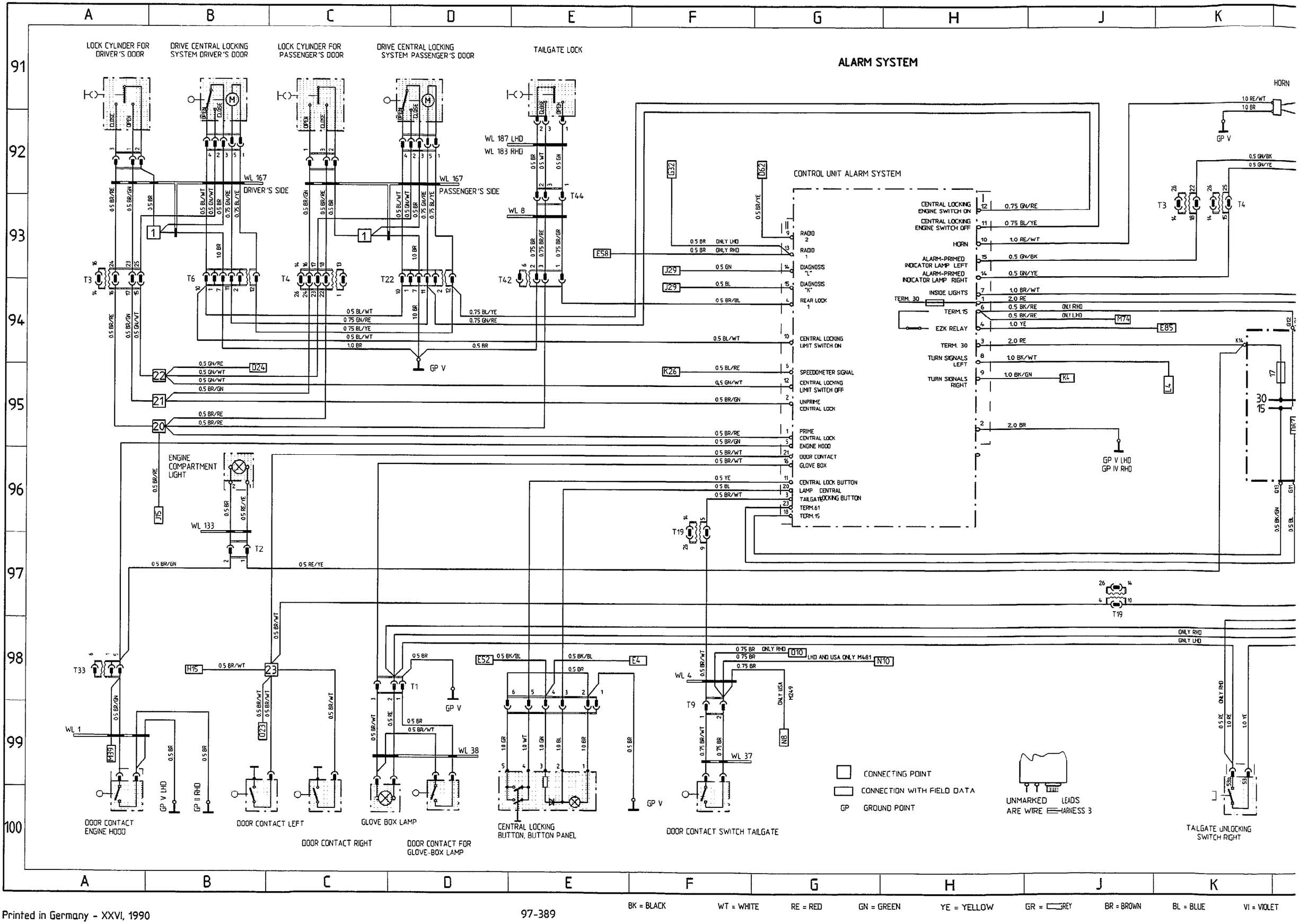
97-387



WH = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 S Model 91 Sheet 11

ALARM SYSTEM, CENTRAL LOCKING SYSTEM INSIDE LIGHTS



F G H J K L M N O P

ALARM SYSTEM

CONTROL UNIT ALARM SYSTEM

G32 D62 0.5 BR/YE

RADIO 2 — 0.5 BR ONLY LHD / 0.5 BR ONLY RHD
RADIO 1
J29 0.5 GN — DIAGNOSIS "L"
J29 0.5 BL — DIAGNOSIS "K"
0.5 BR/BL — REAR LOCK 1
0.5 BL/WT — CENTRAL LOCKING LIMIT SWITCH ON
K26 0.5 BL/RE — SPEEDOMETER SIGNAL
0.5 GN/WT — CENTRAL LOCKING LIMIT SWITCH OFF
0.5 BR/GN — UNPRIME CENTRAL LOCK
0.5 BR/RE — PRIME CENTRAL LOCK
0.5 BR/GN — ENGINE HOOD
0.5 BR/WT — DOOR CONTACT
0.5 BR/WT — GLOVE BOX
0.5 YE — CENTRAL LOCK BUTTON
0.5 BL — LAMP CENTRAL LOCKING BUTTON
0.5 BR/WT — TAILGATE
TERM.61
TERM.15

CENTRAL LOCKING ENGINE SWITCH ON — 12 — 0.75 GN/RE
CENTRAL LOCKING ENGINE SWITCH OFF — 11 — 0.75 BL/YE
HORN — 10 — 1.0 RE/WT
ALARM-PRIMED INDICATOR LAMP LEFT — 15 — 0.5 GN/BK
ALARM-PRIMED INDICATOR LAMP RIGHT — 14 — 0.5 GN/YE
INSIDE LIGHTS — 7 — 1.0 BR/WT
TERM. 30 — 1 — 2.0 RE
TERM.15 — 6 — 0.5 BK/RE ONLY RHD / 0.5 BK/RE ONLY LHD — M74
EZK RELAY — 4 — 1.0 YE — E85
TERM. 30 — 3 — 2.0 RE
TURN SIGNALS LEFT — 8 — 1.0 BK/WT — L4
TURN SIGNALS RIGHT — 9 — 1.0 BK/GN — K4
2 — 2.0 BR — GP V LHD / GP IV RHD

HORN — 1.0 RE/WT, 1.0 BR — GP V

T19 (26/14, 4/10)

T3 (26/22, 14/18) T4 (26/25, 14/15)

0.5 GN/BK, 0.5 GN/YE

WL 167 DRIVER'S SIDE — 1 2

ALARM-PRIMED INDICATOR LAMP. DRIVER'S SIDE
FLOOR LAMP DRIVER'S SIDE
FLOOR LAMP PASSENGER'S SIDE
ALARM-PRIMED INDICATOR LAMP. PASSENGER'S SIDE

WL 167 PASSENGER'S SIDE — 2 1

VS TERM.31 — 1

T6 (12/5/7/1/6/12)

T22 (12/5/7/1/6/12)

DOOR LOCK DRIVER'S SIDE — 0.5 BR/WT
DOOR LOCK LIGHT PASSENGER'S SIDE

GP V — 1.0 BR, 1.0 BR

LIGHTS CENTRAL ELECTRIC — 2 1

0.5 RE/YE — K25
0.75 BR/WT
0.75 BR/WT
0.75 RE — F12
0.75 RE

D12 L21 — K14 — 17 — 30 — 15 — D87

22 — 25 — 26

F11 — H36 — F23 — 0.5 RE/BK

CENTRAL ELECTRICS

D13 G11 F13 D11 S11 T14 F24 S15 U11

0.5 BK/GN, 0.5 BL, 1.0 RE, 1.0 RE, 1.0 YE, 1.0 YE, 1.0 YE, 1.0 RE, 1.0 RE

ONLY RHD M10 — S15 — U11 — N10 ONLY LHD

WL 4 — 0.5 RE, 1.5 BR, 2.0 BR, 0.5 BR/WT — 4 1 3 2 6 5 — T10

WL 8 — 1.5 BK, 1.5 BR, 1.5 BK — 1 2 4 9 3 8 7 5 — T11

D31 1.5 BR — 1

0.5 WT, 0.5 BR

WL 5 — 0.5 GN

INSIDE LIGHTS TAILGATE II
INSIDE LIGHT TAILGATE I
INSIDE LIGHTS ROOF

T9 (1/2) — 0.75 BR/WT, 0.75 BR — WL 37 — GP V

0.75 BR ONLY RHD — D10
0.75 BR — LHD AND USA ONLY M481 — N10
0.75 BR — ONLY USA M249 — N8

DOOR CONTACT SWITCH TAILGATE

ONLY RHD
ONLY LHD

0.5 RE, 1.0 RE, 1.0 YE — ONLY RHD — 53b, 53 — TAILGATE UNLOCKING SWITCH RIGHT

1.0 RE, 1.0 RE, 1.0 YE — ONLY LHD — 53b, 53 — TAILGATE UNLOCKING SWITCH LEFT

1.0 YE, 0.5 BR/WT, 1.0 RE — WL 4 — 2 3 4 1 — TAILGATE UNLOCKING DRIVE

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT

UNMARKED LEADS ARE WIRE HARNESS 3

11

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

CENTRAL ELECTRICS

	FUSE OUTPUT		FUSE INPUT
1	LOW BEAM LEFT	A15	7.5A
2	LOW BEAM RIGHT	A14	7.5A
3	HIGH BEAM LEFT	A25	7.5A
4	HIGH BEAM RIGHT	A24	7.5A
5	ADDITIONAL DRIVING LIGHTS	B14	15A
6	FOG LIGHT	VII 30 (M193 ONLY)	15A
7	SIDE MARKER LIGHT LEFT	T11,D11	5A
8	SIDE MARKER LIGHT RIGHT	S25,D21	5A
9	ASHTRAY- INSTRUMENT- LIGHTS	K11	5A
10	LICENSE PLATE LIGHTS	J22,T21	5A
11	REAR FOG LIGHT	T12	5A
12	TURN SIGNAL FRONT LEFT	J11,C13	5A
13	TURN SIGNAL REAR LEFT	T22	5A
14	TURN SIGNAL FRONT RIGHT	C23	5A
15	TURN SIGNAL REAR RIGHT	T13	5A
16	REAR WINDOW DEFOGGER	I-II 30	25A
17	WARNING FLASHER ENGINE COMPARTMENT LIGHT	K14	15A
18	POWER WINDOW REGULATOR SUN ROOF	K24	25A
19	HEADLIGHT CLEANING SYSTEM	VII 30	25A
20	FRESH AIR BLOWER	XII 30	30A
21	BOOSTER	F24	15A
22	POWER SEAT LEFT LIGHTS CES	K25	30A
23	POWER SEAT RIGHT	M12	30A

	FUSE OUTPUT		FUSE INPUT
24	TWO-TONE HORNS	XVI 30, T15	15A
25	INSIDE LIGHTS DIAGNOSIS CONNECTION INSTRUMENT CLUSTER	XXI 1, F13	7.5A
26	TAILGATE UNLOCKING	T14	1A
27	CONCEALED HEADLIGHT MOTOR	XXIII-XXIV 30a	15A
28	ABS	XV 30	15A
29	RADIATOR FAN 1	B22	30A
30	RADIATOR FAN 2	B23	30A
31			
32			
33	CIGAR LIGHTER	D14	25A
34	WINDSHIELD WIPERS HEATED WASHER JET	XII15, L24	25A
35	STOP LIGHT, CRUISE CONTROL	U24, G13	7.5A
36	CONTROL UNIT FAN	C15	5A
37	AIR CONDITIONING SYSTEM	D12	7.5A
38	FUEL PUMP, HEATER OXYGEN SENSOR	U25	15A
39	INSTRUMENT, CONTROL LAMPS KICKDOWN, SOLENOID VALVE SWITCH FOR REAR WINDOW WIPER	D23, D24	5A
40	BACKUP LIGHT, MIRROR ADJUSTMENT TIRE PRESSURE CONTROL	XVIII30, P14	7.5A
41	LIGHTS, LIGHT SWITCH BUTTON PANEL RELAY TIMING CONTROL UNIT INSIDE LIGHTS DIAGNOSIS CONNECTION TERM 15	P25	5A
42	REAR WINDOW WIPER	U23	7.5A
43	TELEPHONE	N24, D25	7.5A
44	SEAT HEATER	P13	15A
45	ADD. AC	D22	15A

I-II REAR WINDOW DEFOGGER

III DAYTIME RUNNING LIGHT

IV FOG LIGHT

V STARTER

X SUPPLY

XI WIPER INTERMITTENT CONTROL

XII FRESH AIR BLOWER

XIII FLASHER

XIV DEF

XV ABS (M5

XIX FCU

XXI SUPPRESSOR

XXII EZK

XXIII-XXIV LIGHT COMBINATION RELAY

I-II REAR WINDOW DEFOGGER

III DAYTIME RUNNING LIGHT

IV FOG LIGHT

V STARTER

VII HEADLIGHT CLEANING SYSTEM

VIII FOG LIGHT (M193, M553) FOR ROW BRIDGE 30-87

IX ADDITIONAL CLEANING FLUID PUMP

X SUPPLY

XI WIPER INTERMITTENT CONTROL

XII FRESH AIR BLOWER

XIII FLASHER

M208 ONLY

XIV DEF

XV ABS (M593)

XVI TWO-TONE HORNS

XVII KICKDOWN

XVIII BACKUP LIGHT (M249)

XIX FCU

XXI SUPPRESSOR

XXII EZK

XXIII-XXIV LIGHT COMBINATION RELAY

XXV LH-JETRONIC

XXVI FUEL PUMP

GROUND ABS

GROUND LIGHT COMBINATION

CONSTRUCTION COMPONENTS

CONSTRUCTION COMPONENTS

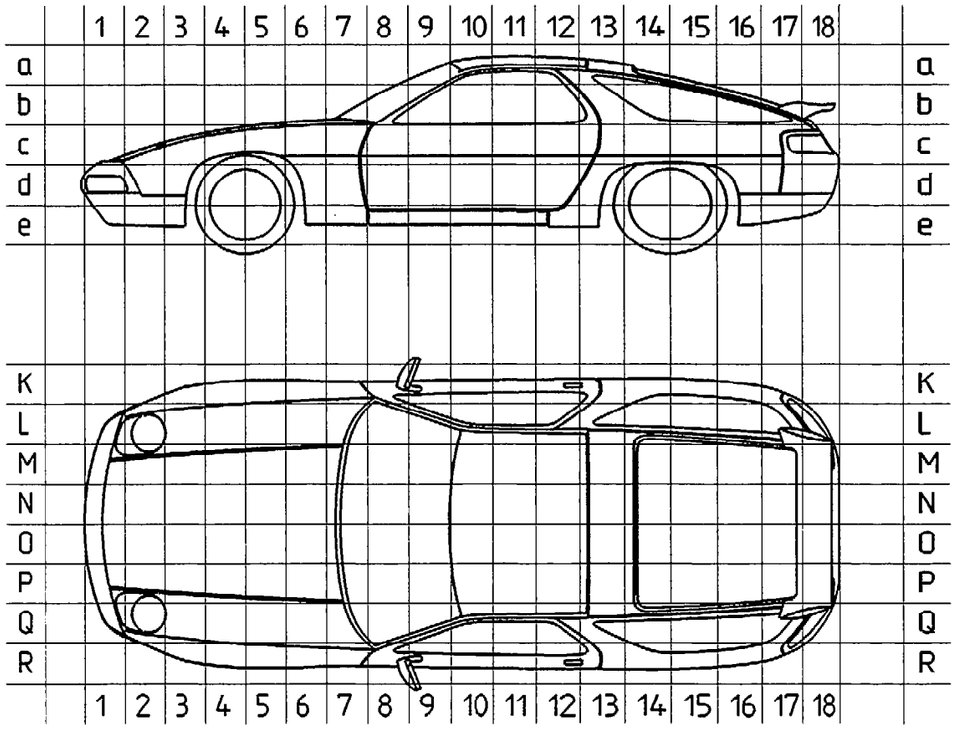
DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAMM
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT	7cQ		IN DRIVER'S FOOTWELL ON SIDE	DJ 71-72
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT		7cQ	ABOVE CENTRAL ELECTRICS	DJ 71-72
ALARM-PRIMED INDICATOR LAMPS				MP 91,92
TRAILER COUPLING				072
STARTER INTERLOCK				L1,2, H21, A85
ASHTRAY LIGHT				GH 31
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
OUTSIDE TEMP. SENSOR				D 21
BATTERY				C 82
LIGHTS CENTRAL ELECTRIC				LM 93
ACCELERATING SENSOR	10eQ	10eQ	UNDER THE LEFT SEAT	K 73
TURN SIGNAL / DIMMER SWITCH				JK 1,2
FLOOR LAMP DRIVER'S SIDE				N 91,92
FLOOR LAMP PASSENGER'S SIDE				O 91,92
BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	BC 64,65
BRAKE PAD WEAR INDICATOR				D-H 79,80
STOP LIGHT TAILGATE				J 9,10
STOP LIGHT SWITCH				C 2,3
CODING ELEMENT				OP 83,84
ROOF ANTENNA				A 61,62
DIAGNOSIS CONNECTION				JK 30
ALTERNATOR				DE 81,82
SPEED SENSOR				E-H 79,80
SPEED SENDER ENGINE				JK 83,84
PRESSURE SWITCH FRIGEN				L 40
THROTTLE VALVE SWITCH	5cM	5cP	IN COOLANT HOSE BEFORE EXPANSION TANK	JK 90
PRESSURE SWITCH COOLANT				MN 30
FUEL INJECTORS				L-N 90
SUPPRESSOR FOR RADIO	8dO	8dO	IN CENTRE CONSOLE IN FRONT OF RADIO	DE 61
SWITCHING UNIT EX (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
EZK CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	L 82-84
TWO-TONE HORNS				CO 20
FREQUENCY SWITCHES				BO 66
FRESH AIR BLOWER ENGINE				LM 31,32
FRONT SENSOR AIRBAG				K 71, N 73,74
BLOWER FINAL STAGE				O 39,40
BLOWER INSIDE				AB 33,34
BLOWER MOTOR SENSOR				H 40
BLOWER SWITCH FRESH AIR				JK 31,32
BLOWER SWITCH ADDITIONAL AIR CONDITIONING SYSTEM				G 37,38
TRANSMISSION PROTECTION SWITCH				D 84,85
HALL SENDER				L 81
PARKING BRAKE CONTACT				E 21,22
GLOVE BOX LAMP				CO 100
TAILGATE UNLOCKING SWITCH				KL 99,100
TAILGATE UNLOCKING DRIVE				M 99,100
TAILGATE LOCK				E 91
REAR WINDOW DEFOGGER				P 31,32
REAR WINDOW WIPER MOTOR				P 18,19
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE TOOL KIT COVER	OP 17
HF SENDER				D-G 79,80
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
HORN ALARM SYSTEM				L 91,92
HYDRAULIC UNIT ABS				AB 73-76
INFO SWITCH				E 30
INSIDE TEMP. SENSOR				B 32,33
INSIDE LIGHTS ROOF				P 99,100
INSIDE LIGHTS TAILGATE I				O 99,100
INSIDE LIGHTS TAILGATE II				N 99,100
LICENSE PLATE LIGHTS				P 6,7
KICKDOWN SOLENOID VALVE				AB 86
KICK-DOWN SWITCH				BC 86,87
CONCEALED HEADLIGHT LEFT				A 7
CONCEALED HEADLIGHT RIGHT				A 4
CONCEALED HEADLIGHT MOTOR				A 5,6
AIR CONDITIONING SYSTEM CONTROL UNIT	8cN-O	8cN-O	IN HEATER BOX	AB 34-36
KNOCK SENSOR				LM 81

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAMM
INSTRUMENT CLUSTER				A-C 22-30
INDICATOR SWITCH BRAKE FLUID				F 21,22
FUEL PUMP				GH 90
CLUTCH SWITCH				A 89,90
RADIATOR FAN				P 38,39
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39,40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MN 39,40
OXYGEN SENSOR				O 90
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
SPEAKER				A-D 66-69
STEERING IGNITION LOCK				B 14-16
HEADLIGHT VERTICAL AIM CONTROL				A4, A 6,7
LH JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
AIR FLOW SENSOR				OP 84,85
SOLENOID CLUTCH COMPRESSOR				P 33
SOLENOID VALVE ABS				C 72
SOLENOID VALVES AIR CONDITIONING				B 37-40
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
MEMORY SWITCH RIGHT				A 51,52
MEMORY SWITCH LEFT				A 59,60
MICRO SWITCH CENTRAL NOZZLE				AB 37
MOTOR POWER WINDOW PASSENGER'S SIDE				N 11
MOTOR POWER WINDOW DRIVER'S SIDE				F 11
MOTOR SUN ROOF				E 11
ENGINE COMPARTMENT LIGHT				B 96
OIL PRESSURE SENDER				P 27
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	P 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 36
POTENTIOMETER INSTRUMENT LIGHT				DE 2
POTENTIOMETER IDLE SPEED CO				OP 88
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL				D 1
POTENTIOMETER FOR WIPING/WASHING				B 16
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM				F 37,38
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
TIRE PRESSURE CONTROL CONTROL UNIT	7cP	7cM	ON INTRUMENT PANEL	K 76-78
BACKUP LIGHT SWITCH				P5, L1,2
SWITCH INTENSIVE CLEANING				B 13
ODOMETER RESET SWITCH				JKL 21,22
SHIFT VALVE RESONANCE FLAP				OP 86
WINDSHIELD WASHING FLUID PUMP				D 11
HEADLIGHT WASHING FLUID PUMP				D 11
LOCK CYLINDER FOR PASSENGER'S DOOR				C 91,92
LOCK CYLINDER FOR DRIVER'S DOOR				A 91,92
SEAT BELT				D 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	D 52-57
MIRROR ADJUSTMENT SWITCH				AB 46,47, A 55,56
DRIVE CENTRAL LOCKING SYSTEM DRIVER'S DOOR				B 91,92
DRIVE CENTRAL LOCKING SYSTEM PASSENGER'S DOOR				D 91,92
DRIVE CRUISE CONTROL				B 90
CONTROL UNIT AIRBAG				MN 71
CONTROL UNIT ALARM SYSTEM	7cM	7cP	BEHIND GLOVE COMPARTMENT	GH 92-96
CONTROL UNIT POWER WINDOWS, SUNROOF				JK 14
CONTROL UNIT CRUISE CONTROL	7dN-O	7dN-O	IN CENTRE CONSOLE AT FRONT	AB 88,89
TANK VENTING VALVE				OP 86,87
FUEL LEVEL SENDER				H 30
BUTTON PANEL AC SWITCH				EF 31,32
PUSH BUTTON SWITCH FOR POWER WINDOW				G 11, L 11
PUSHBUTTON SUNROOF				E 14,15
TEMPERATURE SENSOR DOUPLE NTC				OP 87,88
TEMPERATURE SENSOR COOLING WATER				K 40
TEMPERATURE SWITCH SUCTION TUBE				K 40
TEMPOSTAT SWITCH				A 87
THERMO ELEMENTS CATALYTIC CONVERTER				O 28,29

F	G	H	J	K	L	M	N	O	P

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE	FIELD IN WIRING DIAGRAMM
INSTRUMENT CLUSTER				A-C 22-30
INDICATOR SWITCH BRAKE FLUID				F 21,22
FUEL PUMP				GH 90
CLUTCH SWITCH				A 89,90
RADIATOR FAN				P 38,39
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39,40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MN 39,40
OXYGEN SENSOR				O 90
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
SPEAKER				A-O 66-69
STEERING IGNITION LOCK				B 14-16
HEADLIGHT VERTICAL AIM CONTROL				A4, A 6,7
LH JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
AIR FLOW SENSOR				OP 84,85
SOLENOID CLUTCH COMPRESSOR				P 33
SOLENOID VALVE ABS				C 72
SOLENOID VALVES AIR CONDITIONING				B 37-40
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
MEMORY SWITCH RIGHT				A 51,52
MEMORY SWITCH LEFT				A 59,60
MICRO SWITCH CENTRAL NOZZLE				AB 37
MOTOR POWER WINDOW PASSENGER'S SIDE				N 11
MOTOR POWER WINDOW DRIVER'S SIDE				F 11
MOTOR SUN ROOF				E 11
ENGINE COMPARTMENT LIGHT				B 96
OIL PRESSURE SENDER				P 27
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	P 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 36
POTENTIOMETER INSTRUMENT LIGHT				DE 2
POTENTIOMETER IDLE SPEED CO				OP 88
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL				O 1
POTENTIOMETER FOR WIPING/WASHING				B 16
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM				F 37,38
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
TIRE PRESSURE CONTROL CONTROL UNIT	7cP	7cM	ON INTRUMENT PANEL	K 76-78
BACKUP LIGHT SWITCH				P5, L1,2
SWITCH INTENSIVE CLEANING				B 13
ODOMETER RESET SWITCH				JKL 21,22
SHIFT VALVE RESONANCE FLAP				OP 86
WINDSHIELD WASHING FLUID PUMP				D 11
HEADLIGHT WASHING FLUID PUMP				D 11
LOCK CYLINDER FOR PASSENGER'S DOOR				C 91,92
LOCK CYLINDER FOR DRIVER'S DOOR				A 91,92
SEAT BELT				O 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	O 52-57
MIRROR ADJUSTMENT SWITCH				AB 46,47, A 55,56
DRIVE CENTRAL LOCKING SYSTEM DRIVER'S DOOR				B 91,92
DRIVE CENTRAL LOCKING SYSTEM PASSENGER'S DOOR				D 91,92
DRIVE CRUISE CONTROL				B 90
CONTROL UNIT AIRBAG				MN 71
CONTROL UNIT ALARM SYSTEM	7cM	7cP	BEHIND GLOVE COMPARTMENT	GH 92-96
CONTROL UNIT POWER WINDOWS, SUNROOF				JK 14
CONTROL UNIT CRUISE CONTROL	7dN-O	7dN-O	IN CENTRE CONSOLE AT FRONT	AB 88,89
TANK VENTING VALVE				OP 86,87
FUEL LEVEL SENDER				H 30
BUTTON PANEL AC SWITCH				EF 31,32
PUSH BUTTON SWITCH FOR POWER WINDOW				G 11, L 11
PUSHBUTTON SUNROOF				E 14,15
TEMPERATURE SENSOR DOUPLE NTC				OP 87,88
TEMPERATURE SENSOR COOLING WATER				K 40
TEMPERATURE SWITCH SUCTION TUBE				K 40
TEMPOSTAT SWITCH				A 87
THERMO ELEMENTS CATALYTIC CONVERTER				O 28,29

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE	FIELD IN WIRING DIAGRAMM
THERMO ELEMENTS IGNITION CIRCUIT				JK 82
DOOR CONTACT SWITCH LEFT				BC 99,100
DOOR CONTACT SWITCH RIGHT				C 99,100
DOOR CONTACT FOR GLOVE COMPARTMENT LIGHT				D 99,100
DOOR CONTACT SWITCH TAILGATE				F 99,100
DOOR LOCK LIGHT PASSENGER'S SIDE				P 93
DOOR LOCK LIGHT DRIVER'S SIDE				M 93
EVAPORATOR SENSOR				H 37,38
FREEZING PROTECTION SWITCH AIR CONDITIONING SYSTEM	7cM	7cM	UNDER THE WINDSHIELD WIPER COVER	FG 31
DELAYING RELAY SEAT HEATER				M 42
COOLANT LEVEL SWITCH				M 29,30
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
HAZARD LIGHT SWITCH				HJ 1
WARNING BUZZER	8cP	8cM	ON STEERING PROTECTIVE TUBE	D 29,30
WASHING JETS				B 11,12
WASHING FLUID LEVEL SWITCH	6cL	6cL	ON WINDSHIELD WASHER TANK	MN 28,29
COOLANT TEMP. SENDER				P 26
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL-M	ON BLOWER HOUSING	KL 31,32
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
WIPE/WASH SWITCH				AB 18-20
TOOTHED BELT TENSION SWITCH				N 22
TIME RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	P 23-25
CLOCK				F 1
CENTRAL ELECTRICS	7dM	7dP	IN PASSENGER'S FOOTWELL ON FIREWALL	
CENTRAL LOCK BUTTON				E 99,100
CIGAR LIGHTER				GH 31
IGNITION FINAL STAGE				F 82,83
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82
DISTRIBUTER				GH 82,83
ADDITIONAL CLEANING FLUID PUMP				CD 11



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F	G	H	J	K	L	M	N	O	P

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PLUG CONNECTIONS, GROUND POINTS

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAMM
T1	3	GLOVE BOX LAMP	7cL	7cQ	ABOVE EZK, LH CONTROL UNIT	C098
T2	2	ENGINE COMPARTMENT LIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	B97
T3	26	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C55-60,D22,A93,94,K92,93
T4	26	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	B42,C51-54,C93,94,K92,93
T5	30	INSTRUMENT SCUTTLE	7cQ	7cL	AT SUPPORTING TUBE ON STEERING COLUMN	C3-H3,C13-16,K23,H33
T6	12	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C60,B65,G14,B93,94,N93
T7	2	TRANSMISSION BACKUP LIGHT SWITCH	16dO	16dO	UNDER THE SPARE WHEEL COVER	P5
T8	2	LICENSE PLATE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	F98
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,N31-32,097
T11	8	B-PILLAR / TAILGATE	13aN	13aO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	K10,N031,32,098
T12	2	SIDE MARKER LIGHT LEFT REAR	18cO		UNDER THE TOOL KIT COVER	O10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	O2
T14	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	G78
T15	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	F78
T16	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	EF78
T17	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	DE78
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	O26,27,O33,JK39,O83
T19	26	INSTRUMENT PANEL - / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL ELECTRICS	EF13,GH28,HJ23,M4,F96,97,J97
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	F58-60,HJ46,K43-44
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H42,F51-53
T22	12	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	C42,C51,065,L14,093,94,093
T23	21	ABS	7dQ	7dQ	FOOTWELL AT LEFT SIDE PANEL	K73-76,F30
T24	6	TRAILER COUPLING	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	OP74
T25	1	WIRE CONNECTOR	L4	L4	IN ENGINE COMPARTMENT RIGHT	C85
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C12
T27	2	HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C11
T28						
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-34
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	O36,D86
T33	6	FRONT END / INSTRUMENT PANEL WIRE HARNESS	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	C2,A98
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	F36
T36						
T37						
T38						
T39	2	PLUG BRIDGE INSTEAD RADIO BERLIN	11eK	11eR	UNDER THE BOOSTER COVER ON RIGHT SILL	C63,64
T40						
T41						
T42	6	WH INSTRUMENT PANEL / WH B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E13,E93,94
T43						
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13aN	13aO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	E92
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	KL83,84
T46	19	DIAGNOSIS CONNECTION	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	JK30
T47	8	CODING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N84
T48	3	OXYGEN SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	O89
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	LM32
T50	6	AUTOM. TRANSM., COUPLING TO GEARBOX WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	HJ22
T51	6	AUTOM. TRANSMISSION, COUPLING TO REAR WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85,86,M2
T52	6	AIRBAG	8dN		IN CENTRE CONSOLE	M73
T53	2	AIRBAG	8dN		IN CENTRE CONSOLE	M73

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE
GP I	BODY FRONT LEFT	1cO	1c	IN ENGINE COMPARTMENT AT FRONT END PANEL
GP II	BODY FRONT RIGHT	2cM	2c	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
GP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3c	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
GP IV	STEERING CONSOLE	8cP	8c	ON STEERING CONSOLE, BELOW LEFT
GP V	FIREWALL	8dM	8d	ABOVE CENTRAL ELECTRICS
GP VI	BODY REAR	16dO	16c	UNDER THE SPARE WHEEL COVER
GP VII	GROUND STRAP BATTERY	18dO	18c	UNDER THE TOOL KIT COVER
GP VIII	ENGINE POWER	6cO	6c	ON UPPER CRANKCASE, REAR LEFT
GP IX	ENGINE ELECTRONICS	6cN	6c	ON UPPER CRANKCASE, REAR RIGHT
GP X	WHEEL HOUSING LEFT OUTER	3dQ	3d	BEHIND ABS HYDRAULIC UNIT
GP XI	WHEEL HOUSING RIGHT INNER	5cM	5c	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
GP XII	WHEEL HOUSING LEFT INNER	5cP	5c	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT

ABBREVIATIONS

CODE	MEANING	CODE	MEANING
ABS	ANTILOCK BRAKING SYSTEM	PIN	PIN
AC	AIR CONDITIONING SYSTEM	POT	POTENTIOMETER
DEF	DEFROST	PSD	PORSCHE LIMITED SLIP DIFFERENTIAL
SS	SPEED SENSOR	ROK	TIRE PRESSURE CONTROL
ESO	ENGINE-SPEED SENSOR OUTPUT	ROW	REST OF WORLD
DME	DIGITAL ENGINE ELECTRONICS	RHD	RIGHT-HAND DRIVE
EZK	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	CL	CLOSE
FCU	FREQUENCY CONVERTER UNIT	SA	SAUDI ARABIA
RA	REAR AXLE	CU	CONTROL UNIT
HF	HIGH FREQUENCY	WP	WELD POINT
RL	REAR LEFT	HCS	HEADLIGHT CLEANING SYSTEM
RR	REAR RIGHT	PL	PLUG
IC	INSTRUMENT CLUSTER	DP	DISCONNECTING POINT
TE	TERMINAL	USA	USA
SCS	COMBINED STEERING COLUMN SWITCH	FA	FRONT AXLE
WL	WIRING LOOM	FL	FRONT LEFT
LED	LIGHT-EMITTING DIODE	FR	FRONT RIGHT
LHD	LEFT-HAND DRIVE	CP	CONNECTING POINT
GP	GROUND POINT	WW	WORLDWIDE
LF	LOW FREQUENCY	CES	CENTRAL ELECTRICS
FOG	FOG LIGHT	ADL	ADDITIONAL DRIVING LIGHTS
NO	NUMBER	CLS	CENTRAL LOCKING SYSTEM
RFL	REAR FOG LIGHT		
NTC	NEGATIVE TEMPERATURE COEFFICIENT		
OP	OPEN		

FIELD IN WIRING DIAGRAMM
C098
B97
C44,C55-60,D22,A93,94,K92,93
B42,C51-54,C93,94,K92,93
C3-H3,C13-16,K23,H33
C44,C60,B65,G14,B93,94,N93
P5
P6
F98
LM10,N31-32,097
K10,N031,32,098
010
02
G78
F78
EF78
DE78
026,27,033,JK39,D83
EF13,GH28,HJ23,M4,F96,97,J97
F58-60,HJ46,K43-44
H42,F51-53
C42,C51,D65,L14,093,94,093
K73-76,F30
OP74
C85
C12
C11
F33
F33-34
BC33
036,086
C2,A98
G39
F36
C63,64
E13,E93,94
E92
KL83,84
JK30
N84
089
LM32
HJ22
BC85,86,M2
M73
M73

GROUND POINTS

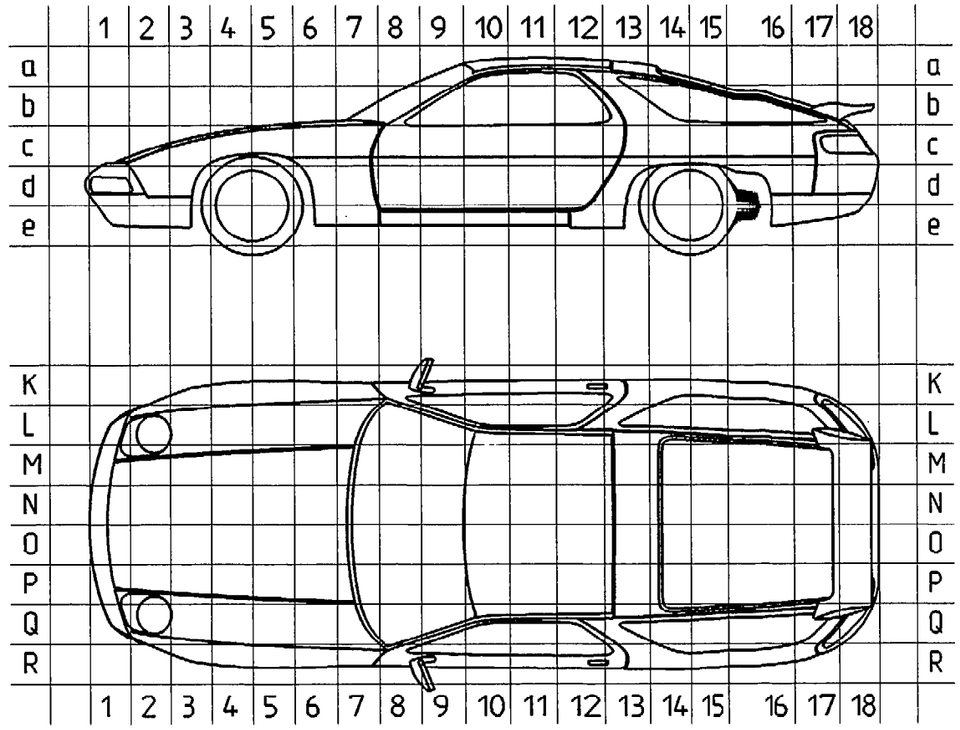
CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE
GP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
GP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
GP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
GP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
GP V	FIREWALL	8dM	8dM	ABOVE CENTRAL ELECTRICS
GP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
GP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
GP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
GP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
GP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
GP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
GP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT

ABBREVIATIONS

CODE	MEANING	CODE	MEANING
ABS	ANTILOCK BRAKING SYSTEM	PIN	PIN
AC	AIR CONDITIONING SYSTEM	POT	POTENTIOMETER
DEF	DEFROST	PSD	PORSCHE LIMITED SLIP DIFFERENTIAL
SS	SPEED SENSOR	ROK	TIRE PRESSURE CONTROL
ESO	ENGINE-SPEED SENSOR OUTPUT	ROW	REST OF WORLD
DME	DIGITAL ENGINE ELECTRONICS	RHD	RIGHT-HAND DRIVE
EZK	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	CL	CLOSE
FCU	FREQUENCY CONVERTER UNIT	SA	SAUDI ARABIA
RA	REAR AXLE	CU	CONTROL UNIT
HF	HIGH FREQUENCY	WP	WELD POINT
RL	REAR LEFT	HCS	HEADLIGHT CLEANING SYSTEM
RR	REAR RIGHT	PL	PLUG
IC	INSTRUMENT CLUSTER	DP	DISCONNECTING POINT
TE	TERMINAL	USA	USA
SCS	COMBINED STEERING COLUMN SWITCH	FA	FRONT AXLE
WL	WIRING LOOM	FL	FRONT LEFT
LED	LIGHT-EMITTING DIODE	FR	FRONT RIGHT
LHD	LEFT-HAND DRIVE	CP	CONNECTING POINT
GP	GROUND POINT	WW	WORLDWIDE
LF	LOW FREQUENCY	CES	CENTRAL ELECTRICS
FOG	FOG LIGHT	AOL	ADDITIONAL DRIVING LIGHTS
NO	NUMBER	CLS	CENTRAL LOCKING SYSTEM
RFL	REAR FOG LIGHT		
NTC	NEGATIVE TEMPERATURE COEFFICIENT		
OP	OPEN		

M - NUMBERS

M 061	ENGLAND VERSION
M 139	ADJUSTABLE SEAT HEATING SEAT LEFT
M 193	JAPAN VERSION
M 208	TRAILER COUPLING
M 215	SAUDI-ARABIA VERSION
M 249	AUTOMATIC TRANSMISSION
M 261	OUTSIDE MIRROR FLAT PASSENGER'S SIDE
M 340	ADJUSTABLE SEAT HEATING SEAT RIGHT
M 383	SPORT SEAT LEFT
M 387	SPORT SEAT RIGHT
M 479	AUSTRALIAN VERSION
M 481	TRANSMISSION
M 484	USA VERSION
M 513	LUMBAR SUPPORT SEAT RIGHT
M 525	ALARM SYSTEM WITH CONTINUOUS TONE (SWITZERLAND)
M 528	OUTSIDE MIRROR KONVEX PASSENGER'S SIDE
M 537	SEATING POSITION CONTROL COMFORT SEAT LEFT
M 538	SEATING POSITION CONTROL COMFORT SEAT RIGHT
M 553	USA - CANADA VERSION
M 562	AIRBAG
M 570	ADD. AIR CONDITIONER (INCREASED COOLING CAPACITY)
M 576	REAR FOG LIGHT
M 586	LUMBAR SUPPORT SEAT LEFT
M 602	HIGH MOUNTED STOP LIGHT
M 650	ELECTRIC SUN ROOF



14

Modifications in wiring diagram 928 S4/GT, Model 91

Sheet 13

On LHD vehicles, the control unit of the cruise control is fitted below the footrest.

The alarm control unit is fitted below the right-hand seat.

Please alter the circuit diagrams accordingly.

Printed in Germany – XXVIII, 1992

Wiring Diagram Type 928 GTS
Model 93 / 2

	Coordinates	
Sheet 1	1 - 10	Lights RoW
Sheet 2	1 - 10	Lights USA
Sheet 3	11 - 20	Body
Sheet 4	21 - 30	Instrument Cluster and Sensor
Sheet 5	31 - 40	Engine Cooling, Heater, Air Conditioner
Sheet 6	41 - 50	Outside Mirror, Power Seat
Sheet 7	51 - 60	Seat and Mirror Memory
Sheet 8	61 - 70	Radio, Telephone
Sheet 9	71 - 80	Antilock System, Tire Pressure Control, Airbag, Porsche Lock Differential, Trailor Coupling, Brake Pad Wear Indicator
Sheet 10	81 - 90	Motor, Fuel and Ignition, Cruise Control
Sheet 11	91 - 100	Alarm System, Central Locking System, Inside Lights
Sheet 12	101 - 110	Central Electric
Sheet 13		Constr. Components
Sheet 14		Plug Connections, Ground Points, M-Numbers, Abbreviations

From V.I.N. WPO AA2 92 PS8 20 001

Modifications in wiring diagram 928 GTS, model 92, 93

Sheet 1, F 4/5

The connector designation on cable 0.5 RE/BK is incorrect.
The correct designation is F 11.

Please alter the wiring diagram accordingly.

Printed in Germany – XXXII, 1993

Wiring Diagram Type 928 GTS
Model 93 / 2

The wiring diagram comprises of 12 individual wiring diagrams, 1 sheet construction components and 1 sheet plug connections, ground points, M-numbers and abbreviations. They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central-electrical system within a dash-dot frame.

This part of the central-electrical system shows all the lines and relays required for the individual wiring diagram.

The ground-connecting points are designated with "GP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Parts 2, is the "module element".

Both parts are identified by the digits 1.....5.

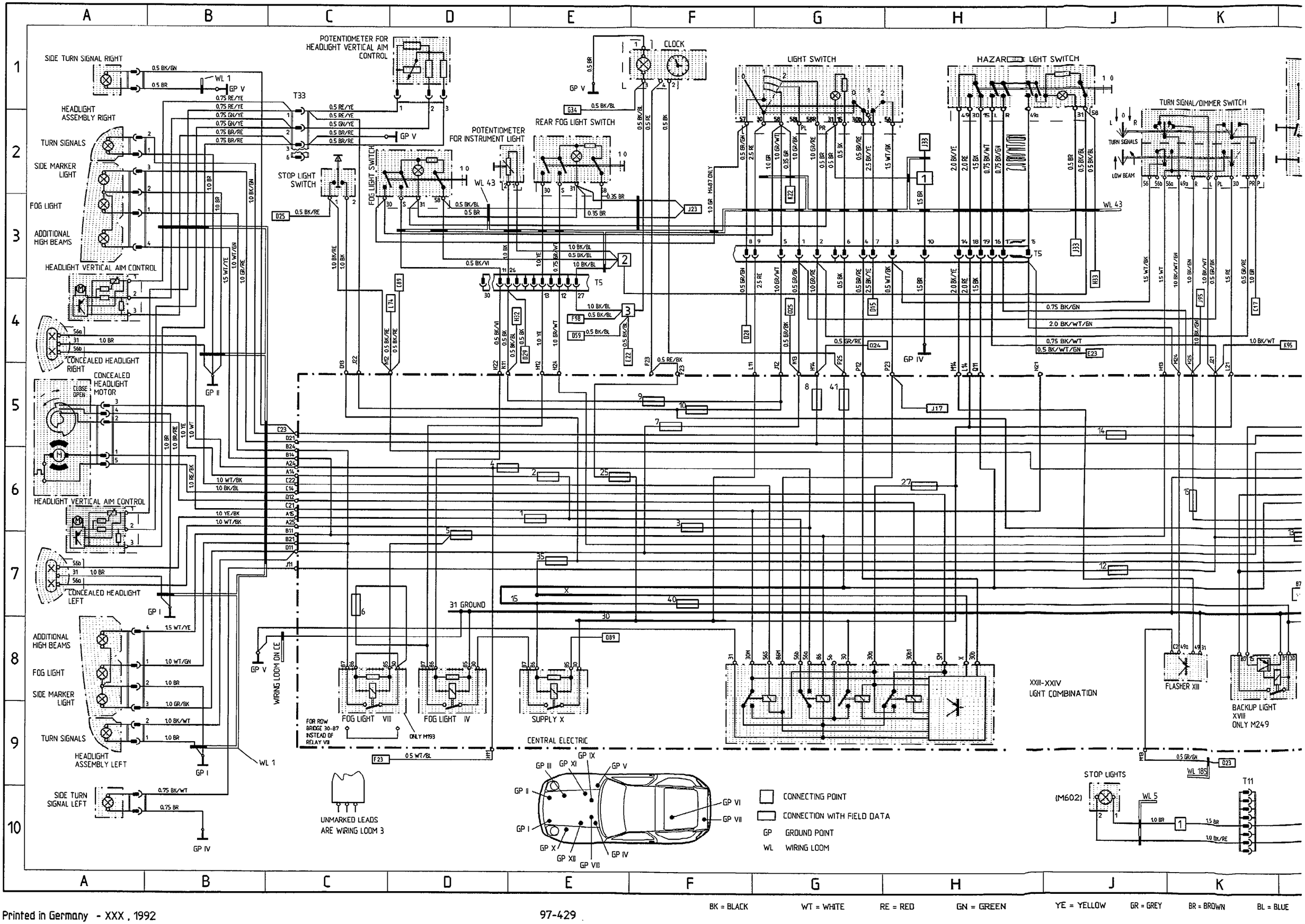
Part 3 is a "coding element".

The designations of the plug connections in the wiring diagram for central electrical system refer e.g. from A 11.....15, to the "initial element", from A 21.....25 to module element.

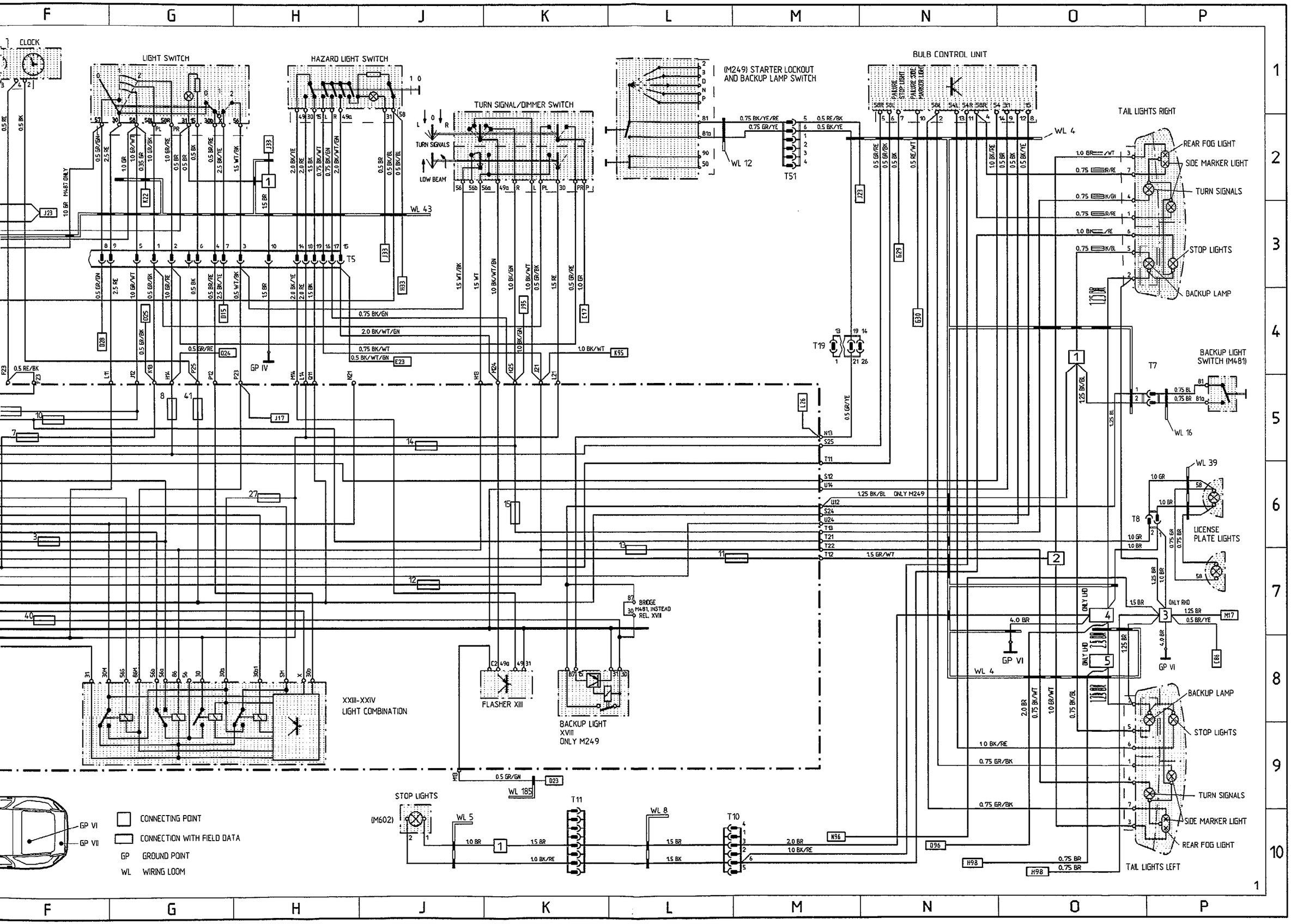
Printed in Germany - XXX, 1992

928 GTS MODEL 93/2 SHEET 1

LIGHTS ROW OUTSIDE



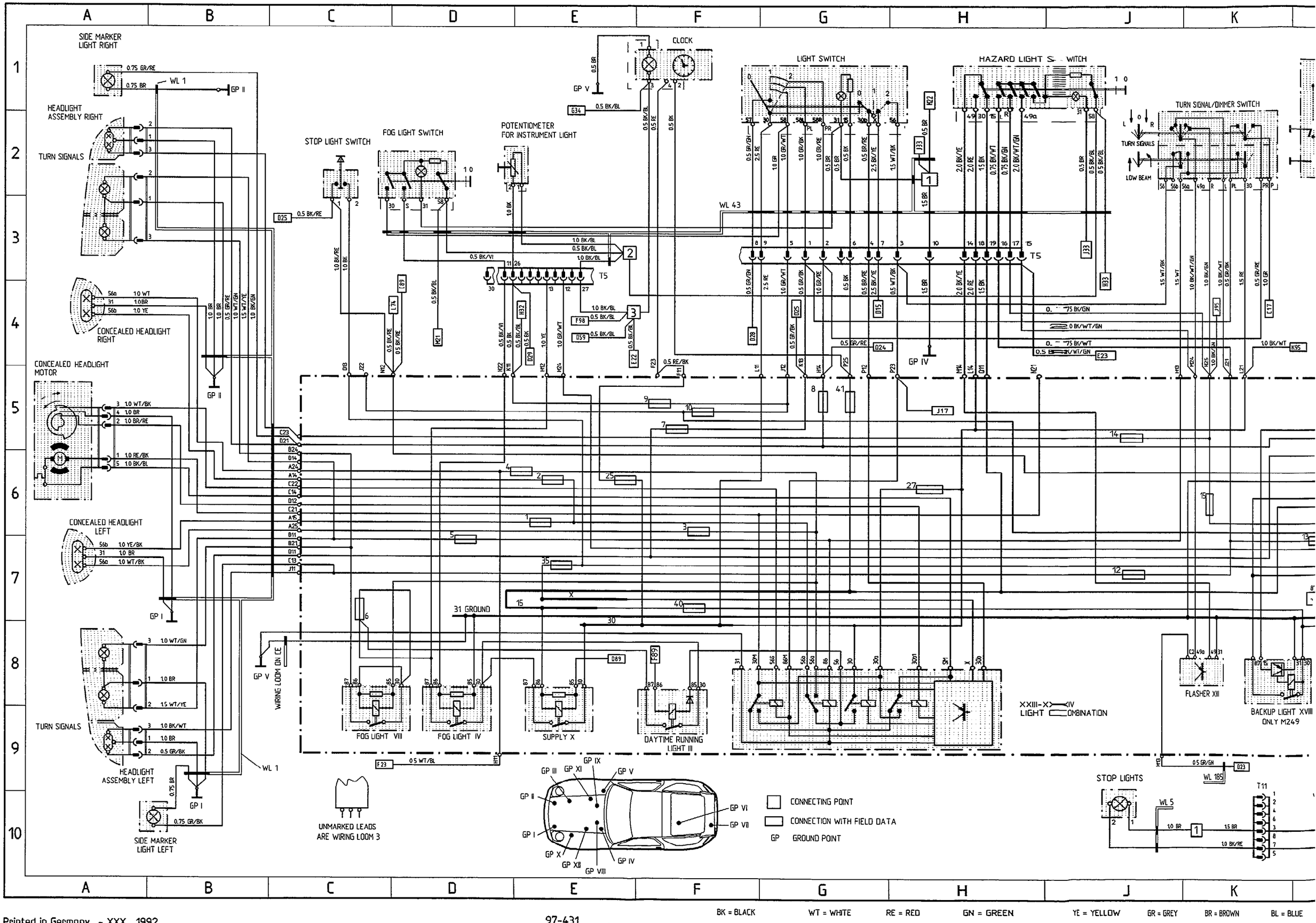
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE



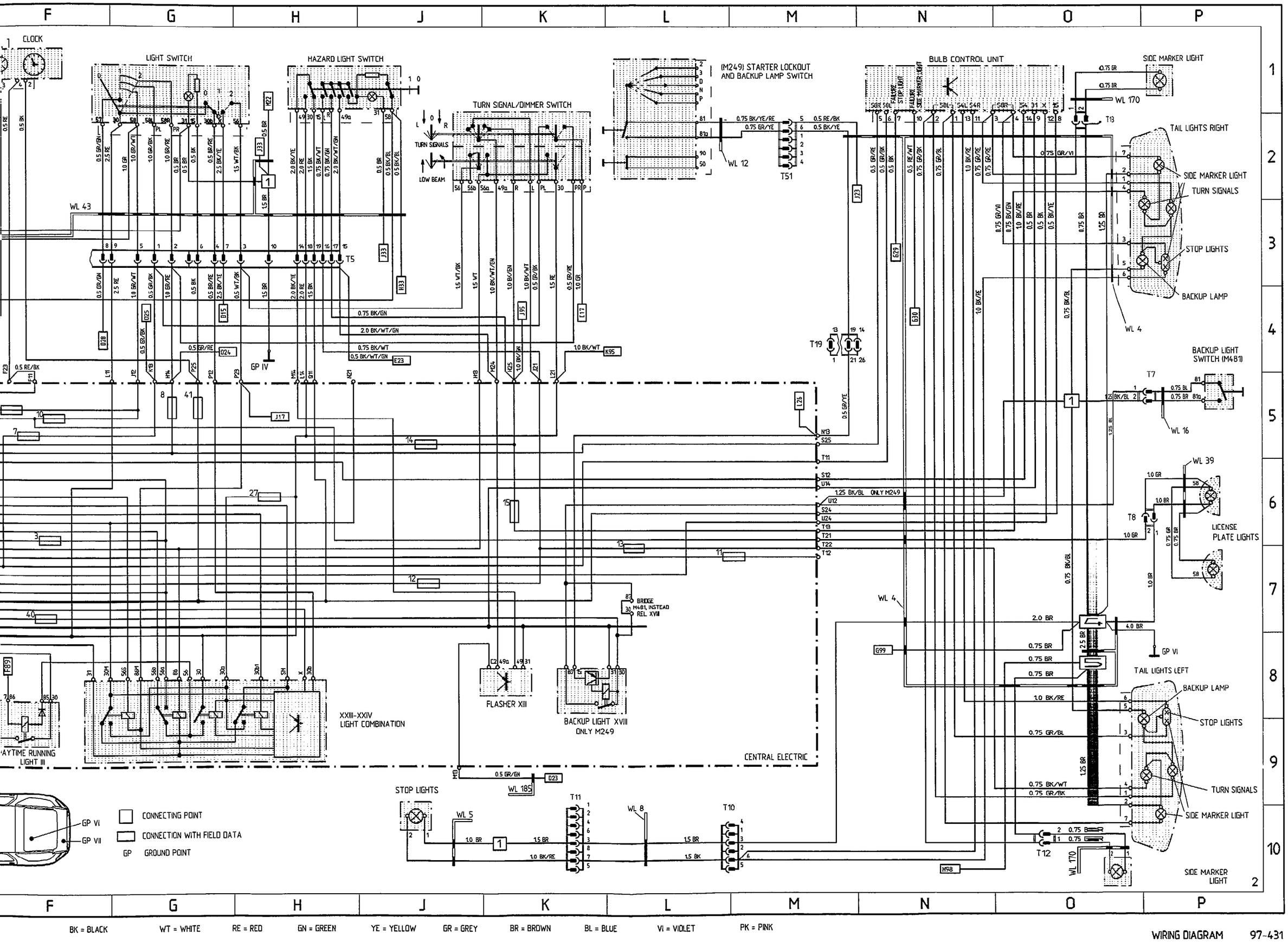
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93/2 SHEET 2

LIGHTS USA OUTSIDE



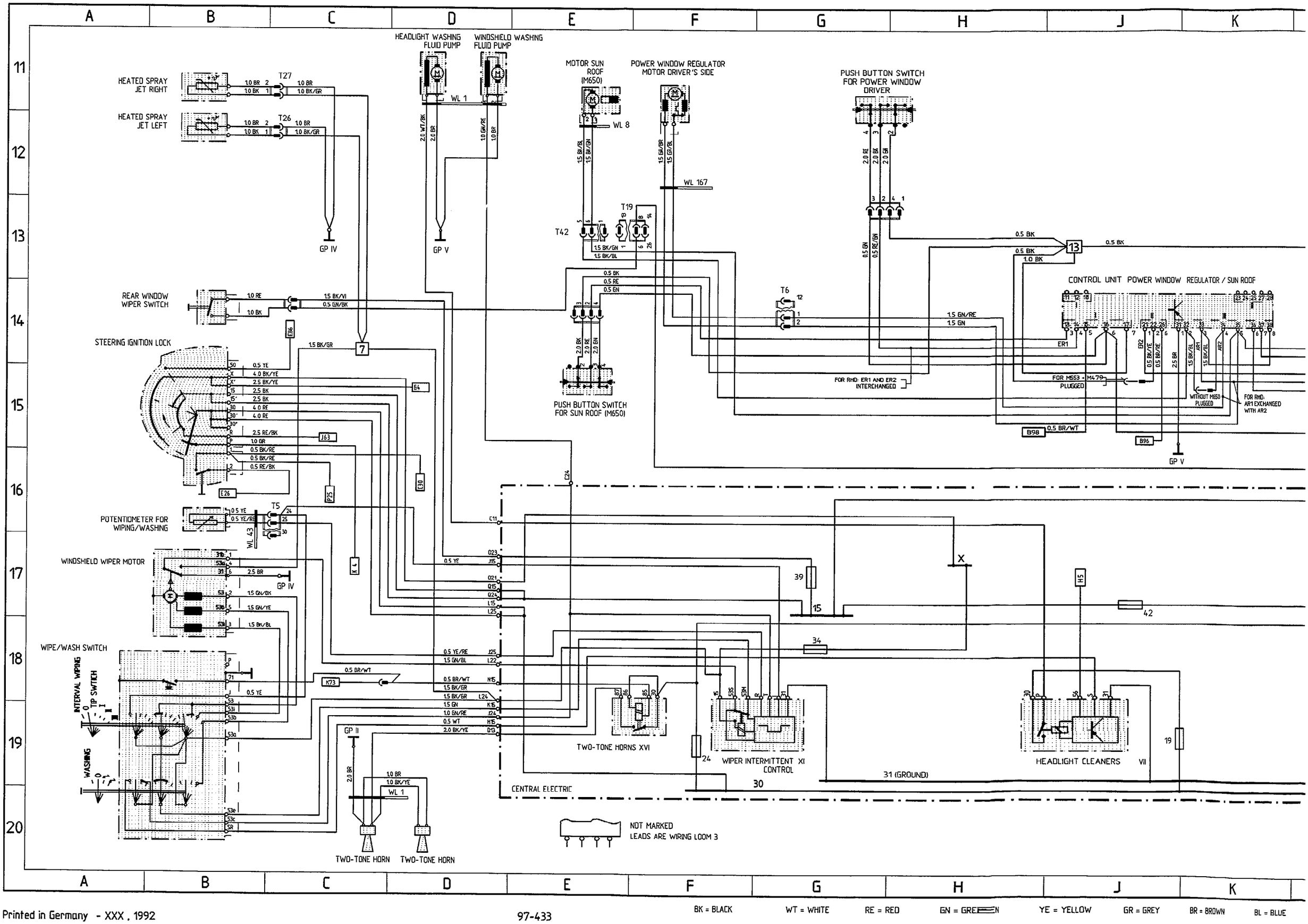
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93/2 SHEET 3

BODY



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

11 12 13 14 15 16 17 18 19 20

'ER WINDOW REGULATOR
MOTOR DRIVER'S SIDE

PUSH BUTTON SWITCH
FOR POWER WINDOW
DRIVER

PUSH BUTTON SWITCH
FOR POWER WINDOW
PASSENG. SIDE

POWER WINDOW REGULATOR
MOTOR PASSENGER'S SIDE

WL 167

2.0 BK
2.0 RE/BL
2.0 GN

2.0 RE
2.0 BK
2.0 GN

0.5 GN
0.5 RE/GN

0.5 BK
0.5 BK
1.0 BK
0.5 BK

13

0.5 RE/BL
0.5 GN

T22

T6

1.5 GN/RE
1.5 GN

1.5 GR/BR
1.5 GR/BL

1.5 GR/BR
1.5 GR/BL

CONTROL UNIT POWER WINDOW REGULATOR / SUN ROOF

ER1
ER2
AR1
AR2

0.5 BK/YE
0.5 BR/RE
2.5 BR
1.5 BK/BL
1.5 BK/BL

FOR RHD: ER1 AND ER2
INTERCHANGED

FOR M553 + M479
PLUGGED

WITHOUT M650
PLUGGED

FOR RHD:
AR1 EXCHANGED
WITH AR2

B98 0.5 BR/WT

B96

GP V

0.5 BK/GN
0.5 BR/BK

18

X

39

15

34

42

H5

U23

T16

P7

ONLY RHD 1.25 BR
1.25 BR

1.25 GN
1.25 BK/BL
0.5 GN/BK

REAR WINDOW
WIPER RELAY

ONLY LHD

4

2.5 BR

5

ONLY LHD

ONLY RHD

4.0 BR

53
15
L

53
53a

1.25 RE/BR
1.25 BR
1.25 BR

REAR WINDOW
WIPER MOTOR

31

GP VI

WL 4

WIRING LOOM ON ICE

GP V

19

24

WIPER INTERMITTENT XI
CONTROL

HEADLIGHT CLEANERS VII

31 (GROUND)

30

GP III GP XI GP IX GP V
GP II
GP VI
GP VII
GP I
GP X GP XII GP IV
GP V III

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

T MARKED
DS ARE WIRING LOOM 3

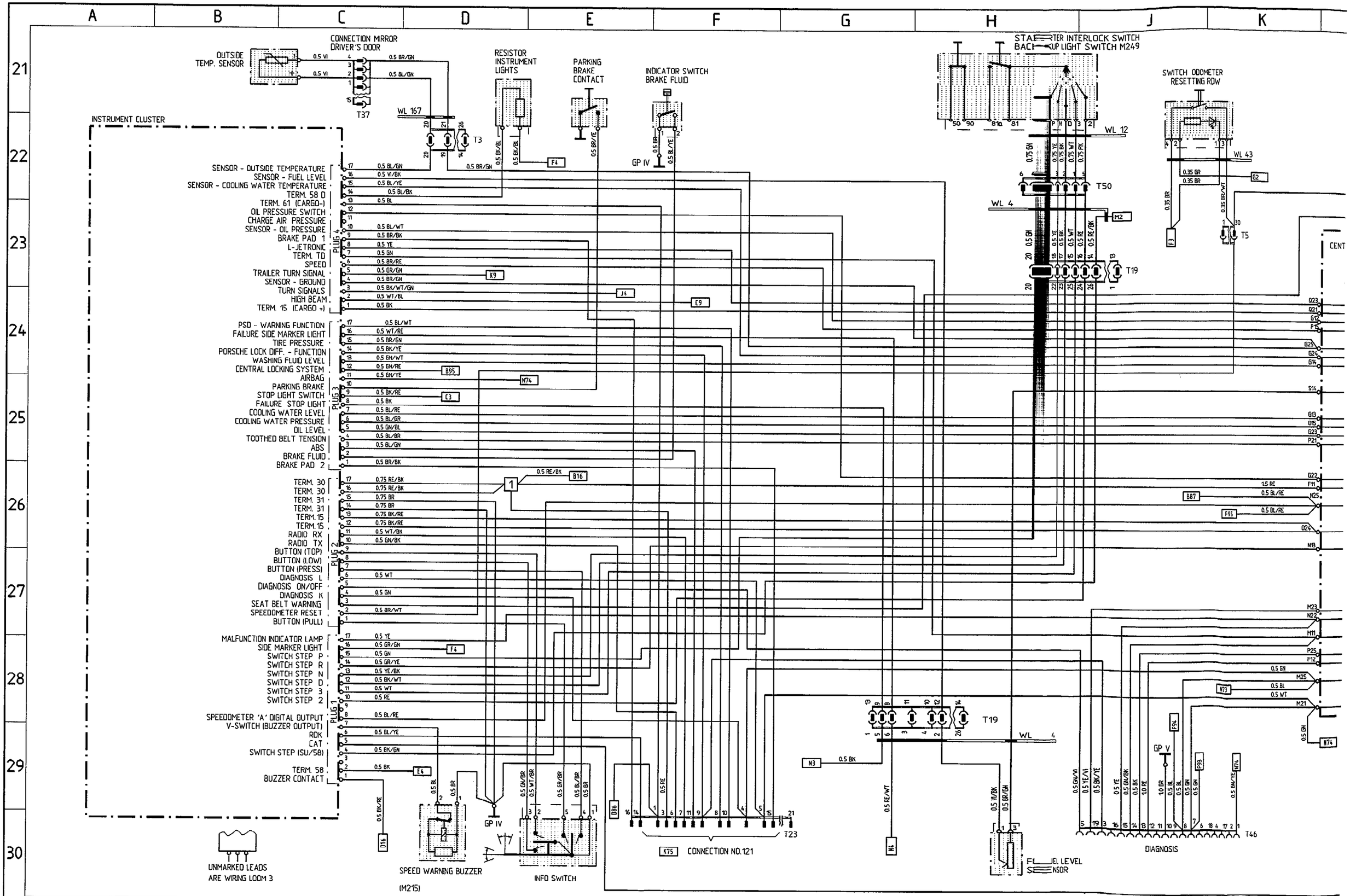
3

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93/2 SHEET 4

INSTRUMENT CLUSTER AND SENSOR



Printed in Germany - XXX . 1992

97-435

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

21 22 23 24 25 26 27 28 29 30

STARTER INTERLOCK SWITCH
BACKUP LIGHT SWITCH M249

SWITCH ODOMETER RESETTING RDW

SWITCH ODOMETER RESETTING M553

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT

TOOTHED BELT TENSION SWITCH

SEAT BELT

CENTRAL ELECTRIC

RELAY FOR FCU
XIX

RELAY SOCKET ONLY FOR LHD
TIMING RELAY (M215,M553)

ONLY RHDS WT/VI
ONLY LHD

GP V

OIL LEVEL SWITCH

COOLANT TEMP. SENSOR

OIL PRESSURE SENSOR

THERMOELEMENT NO.2

CATALYTIC CONVERTER MONITOR
SWITCHING UNIT 2

THERMOELEMENT NO.1

SWITCHING UNIT 1

WASHING FLUID LEVEL

COOLANT LEVEL SWITCH

PRESSURE SWITCH COOLANT

DIAGNOSIS

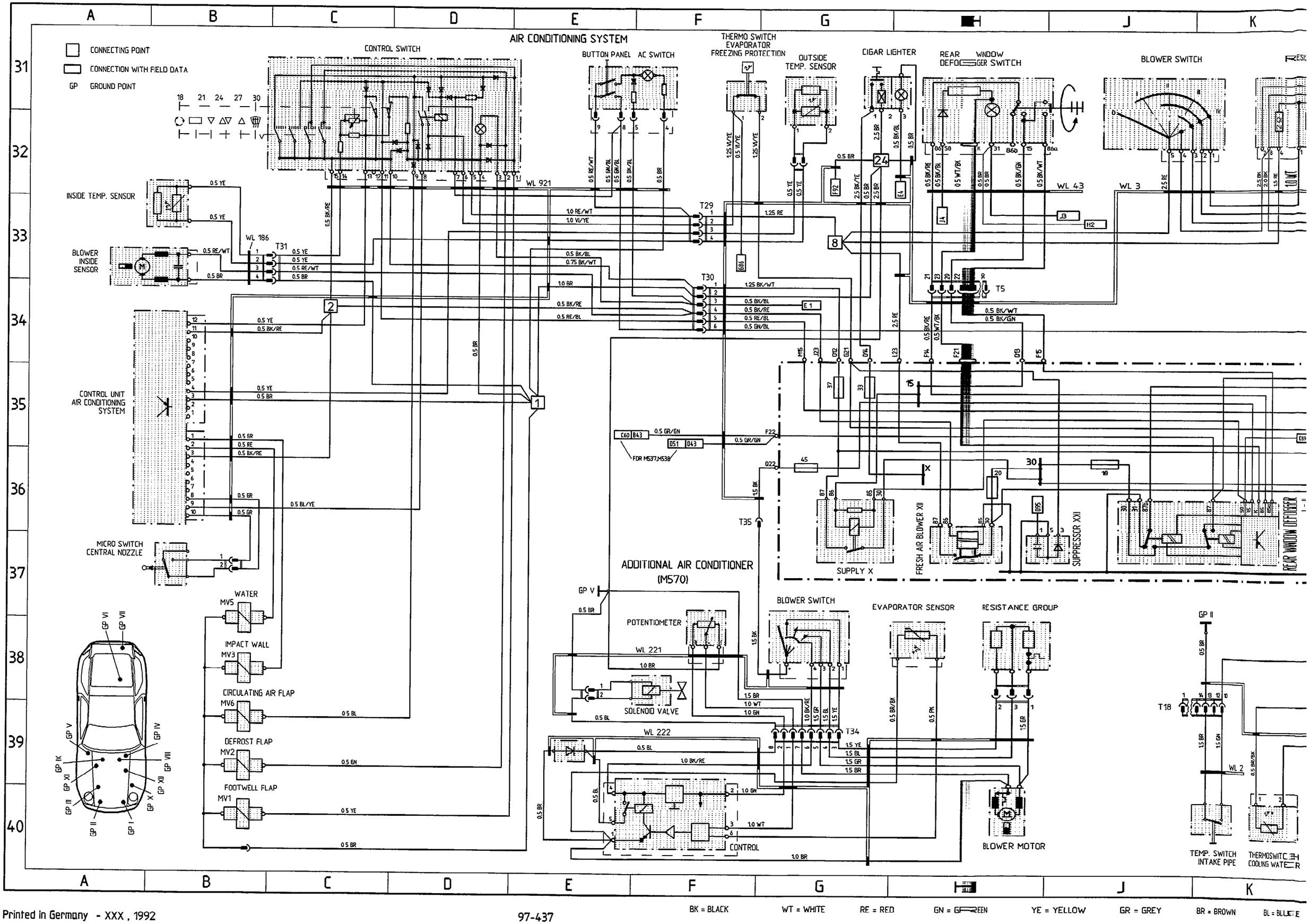
FUEL LEVEL SENSOR

CONNECTION NO.121

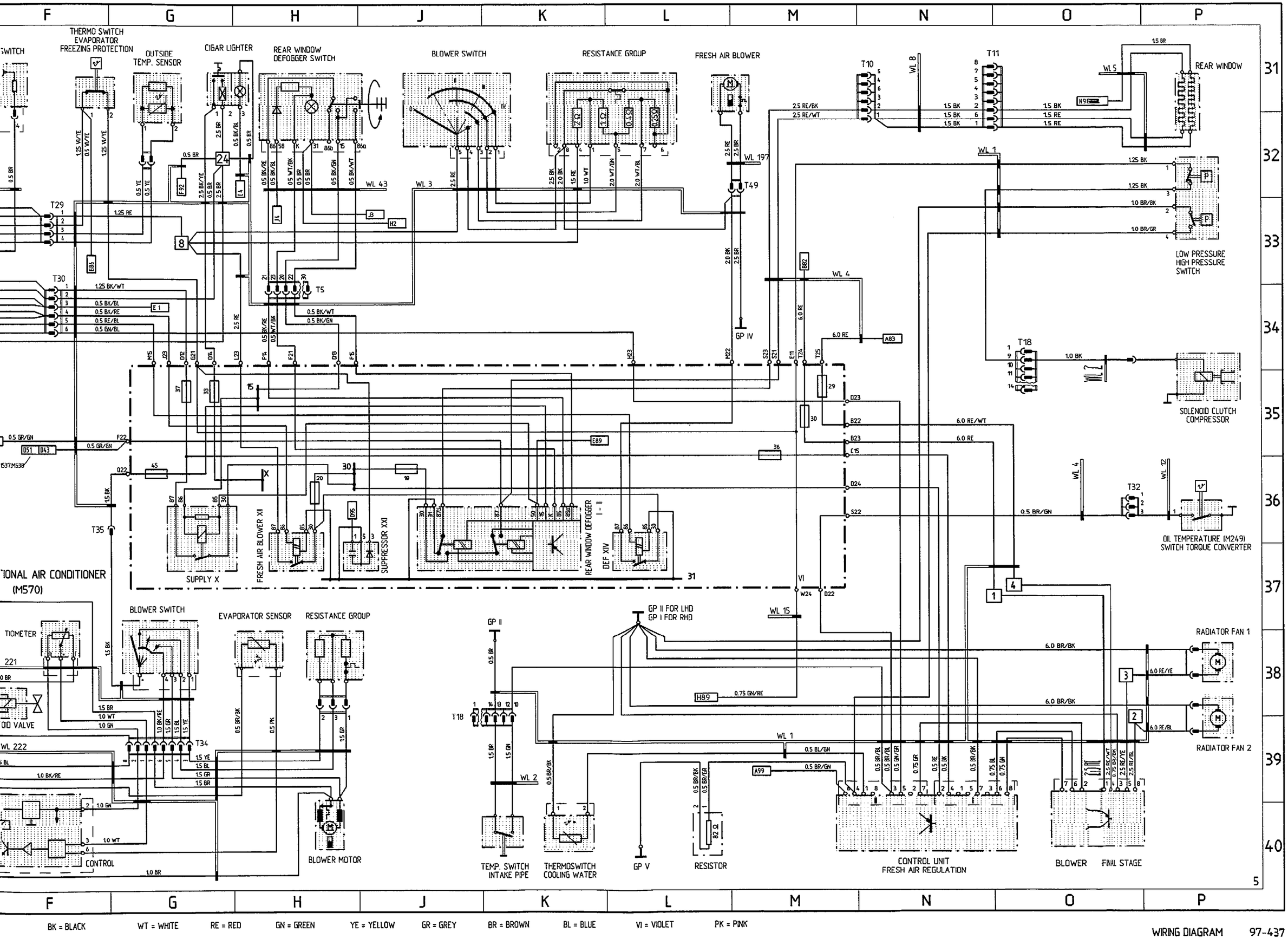
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93/2 SHEET 5

ENGINE COOLING, HEATER, AIR CONDITIONER



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 9372 SHEET 6

OUTSIDE MIRROR, POWER SEAT

MIRROR PASSENGER'S SIDE (M261, M528)

CONNECTION MIRROR

T36

T4

T22

WL 167

WL 3

F35

CE 31 CP

T6

GP V

GP IV

CHANGEOVER SWITCH

T3

CP I

MIRROR SWITCH

GP I GP II GP III GP IV GP V GP VI GP VII GP VIII GP IX GP X GP XI GP XII

D21 OUTSIDE TEMP. SENSOR

T37

DISCONNECTING POINT MIRROR

MIRROR DRIVER'S SIDE

CENTRAL ELECTRIC

30 15 23 40 22 44 M12 P14 X25 P13

CONNECTION POWER SEAT RIGHT

T21

WL 227

T20

SPORT SEAT
(M383, M387)

2-WAY SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

SEAT CUSHION HEIGHT CONTROL FRONT

WL ON SWITCH

WL 227

SEAT BACKREST CONTROL

CONNECTION POWER SEAT LEFT

SEAT CUSHION HEIGHT CONTROL REAR

WL 343
NOT APPLICABLE WITH M13. 9
M340, M586, M513

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

SEAT LUMBAR (M586) CURVE CONTROL (M513)

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

41 42 43 44 45 46 47 48 49 50

ADJUSTABLE SEAT HEATING (M139, M34)

COMFORT SEAT - STANDARD LEFT

PORT SEAT
(383, M387)

CONNECTION POWER SEAT RIGHT

SEAT HEATER AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

DELAYING RELAY

SEAT HEATER SWITCH

BACKREST

SEAT

SIDE ELEMENTS

CENTRAL ELECTRIC

WL ON SWITCH

WL 337/338/340

WL 227

T21

T20

GP V

GP IV

4-WAY SWITCH

4—WAY SWITCH

2-WAY SWITCH

SEAT BACKREST CONTROL

CONNECTION POWER SEAT LEFT

SEAT CUSHION HEIGHT CONTROL REAR

SEAT CUSHION HEIGHT CONTROL FRONT

SEAT BACK FORWARD CONTROL

SEAT LUMBAR (MS86) HEIGHT CONTROL (MS13)

SEAT LUMBAR (MS86) CURVE CONTROL (MS13)

WL 343
NOT APPLICABLE WITH M139 M340, MS86, MS13

WL 337 WITH M139, M340, MS13, MS86

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

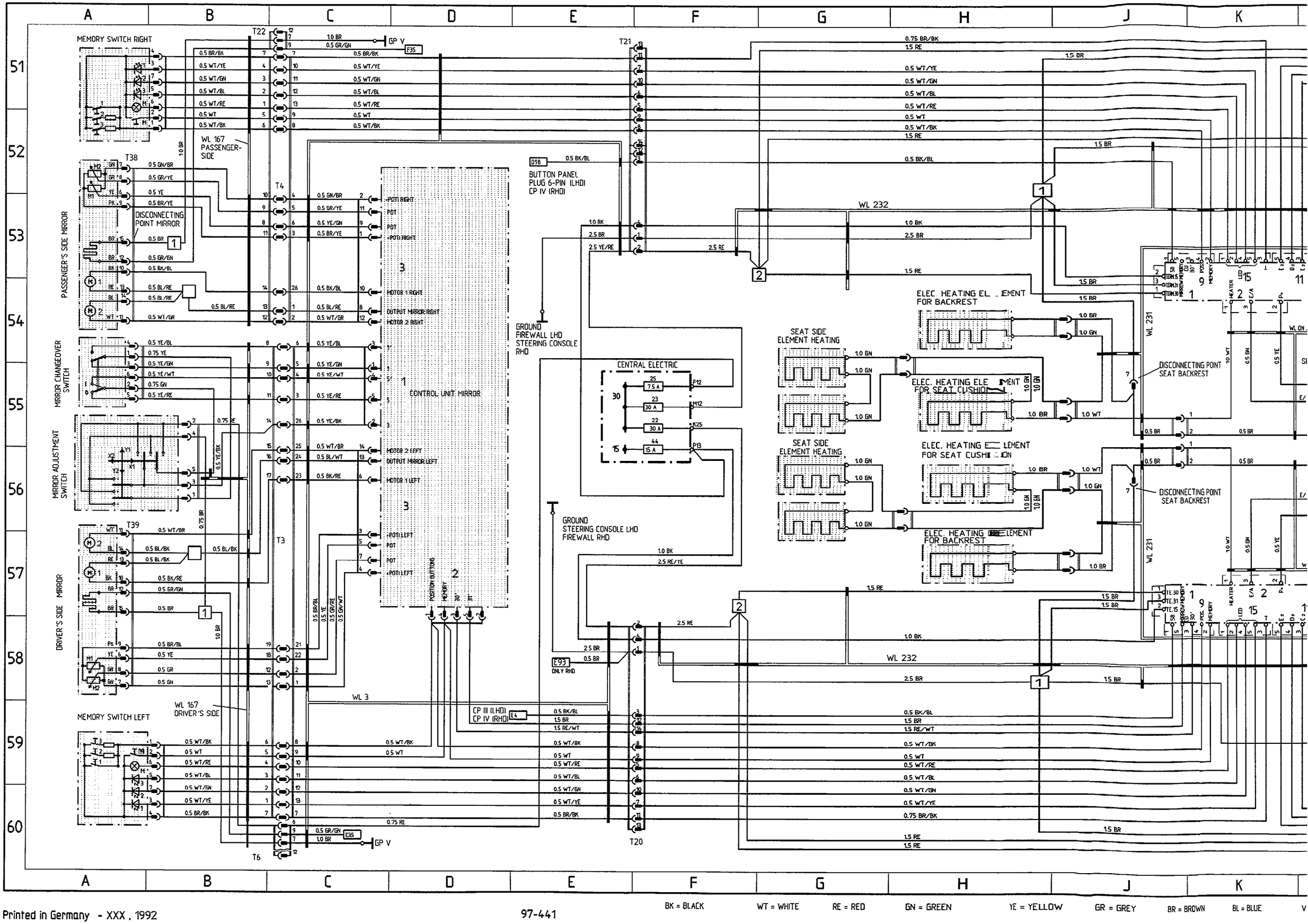
WL WIRING LOOM

6

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93/2 SHEET 7

(M537, M538) SEAT AND MIRROR MEMORY



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97-441

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

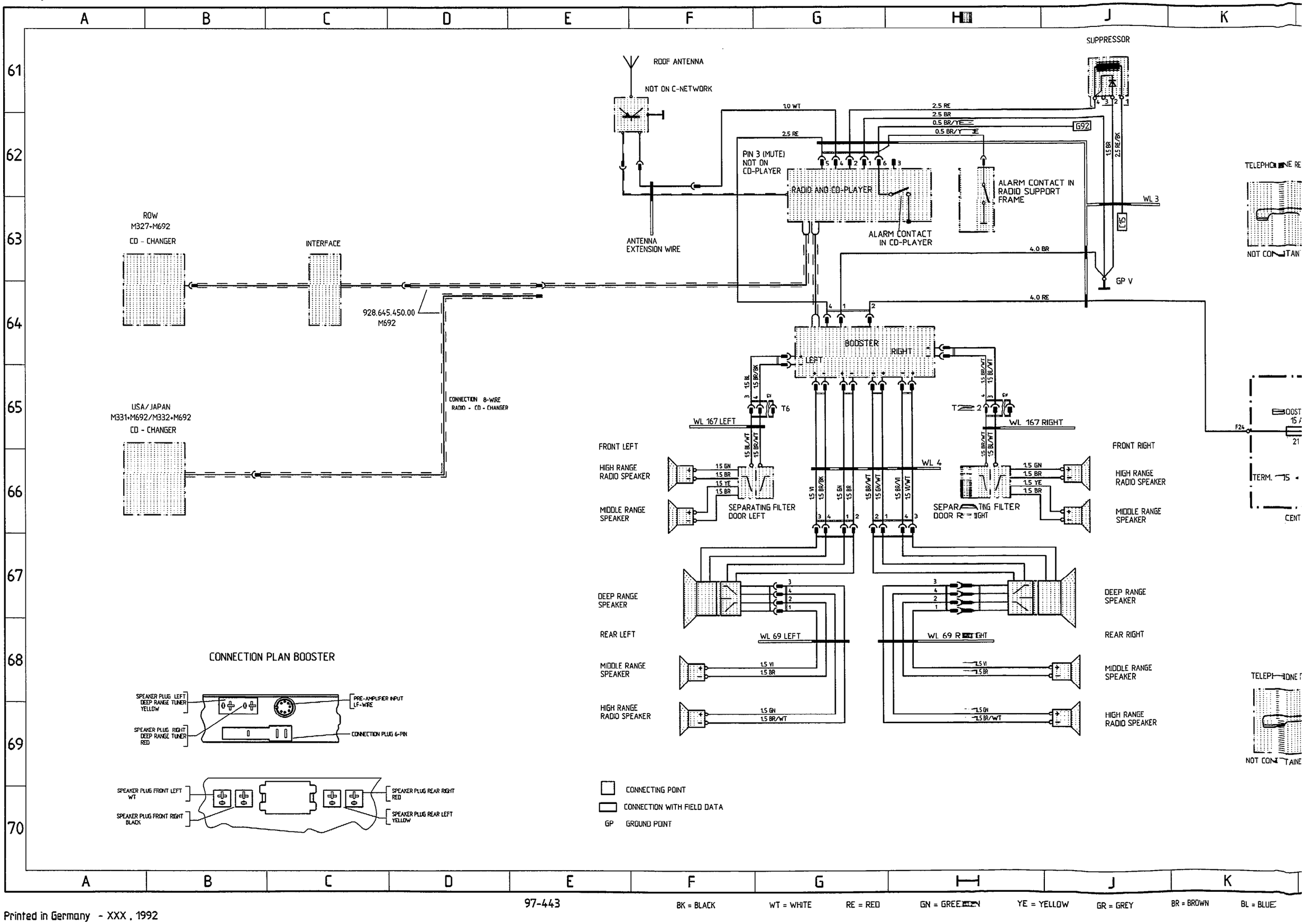
51 52 53 54 55 56 57 58 59 60

CONNECTION SEAT BACKREST
LUMBAR SUPPORT HEIGHT
BACKREST
HEIGHT REAR
HEIGHT FRONT
LONGITUDINAL
LUMBAR SUPPORT CURVATURE
RELAY UNIT
DISCONNECTING POINT SEAT BACKREST
CONTROL UNIT SEAT PASSENGERS'S SIDE
CONTROL UNIT SEAT DRIVERS'S SIDE
WL 231
WL 232
SEAT HEATER SWITCH
WL ON SWITCH
4-WAY SWITCH
SEAT SIDE ELEMENT HEATING
ELEC. HEATING ELEMENT FOR BACKREST
ELEC. HEATING ELEMENT FOR SEAT CUSHION
ELECTRIC
CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT
WL WIRING LOOM

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 9372 SHEET 8

RADIO, TELEPHONE



97-443

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

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F G H J K L M N O P

61 62 63 64 65 66 67 68 69 70

ROOF ANTENNA

NOT ON C-NETWORK

NNA
NSION WIRE

SUPPRESSOR

1.0 WT
2.5 RE
2.5 BR
0.5 BR/YE
0.5 BR/YE
2.5 RE
G92
15 BR
2.5 RE/BK
WL 3
C15
GP V
4.0 BR
4.0 RE

PIN 3 (MUTE)
NOT ON
CD-PLAYER
RADIO AND CD-PLAYER
ALARM CONTACT IN
RADIO SUPPORT
FRAME
ALARM CONTACT
IN CD-PLAYER

BOOSTER
LEFT
RIGHT

T6
T22
WL 167 LEFT
WL 167 RIGHT
WL 4
WL 69 LEFT
WL 69 RIGHT

SEPARATING FILTER
DOOR LEFT
SEPARATING FILTER
DOOR RIGHT

FRONT RIGHT
HIGH RANGE
RADIO SPEAKER
MIDDLE RANGE
SPEAKER
DEEP RANGE
SPEAKER
REAR RIGHT
MIDDLE RANGE
SPEAKER
HIGH RANGE
RADIO SPEAKER

ICTING POINT
CTION WITH FIELD DATA
D POINT

TELEPHONE PREPARATION C-NETWORK M 612
(Philips "Porty")

TELEPHONE RECEIVER
NOT CONTAINED IN M612
CONNECTION CABLE
TELEPHONE RECEIVER PLATES
WIRING LOOM FOR
TELEPHONE RECEIVER
15-WIRE
TRANSMITTER-RECEIVER
C-NETWORK
NOT CONTAINED IN M612
COMBINED RADIO AND
TELEPHONE ANTENNA
ANTENNA
RADIO
COMBINER
ANTENNA LEAD
RADIO CROSS-OVER
WIRING LOOM
C-NETWORK SUPPLY
4.0 RE
C81 PLUS LEAD
FOR TELEPHONE
15 A
NON-CES FUSE
IN BATTERY COMPARTMENT
4.0 BK
GP I
0.5 PK
RADIO MUTE
RADIO PLUG CHAMBER 3
NOT CONNECTED
RADIO ANTENNA INPUT
0.5 YE
0.5 GR
0.5 WT
NOT CURRENTLY CONNECTED

30
BOOSTER
15 A
F24
21
TELEPHONE
TERM.15
43
N24
0.5 GN
CENTRAL ELECTRIC

1.0 RE
1.0 RE

TELEPHONE PREPARATION CELLULAR M 195
(Motorola)

GP I
WIRING LOOM
CELLULAR
TRANSMITTER-RECEIVER
CELLULAR
ANTENNA CELLULAR
NOT CONTAINED IN M612
0.5 GN/BK
1.0 BR
1.0 BR
TELEPHONE RECEIVR
MULTI-LEAD
8 WIRE
BL
BR
GN
WT
NOT CONTAINED IN M95
NOT CONTAINED IN M195
CONNECTION LOUDSPEAKER
(FREE-HANDED SPEAKING)
CONNECTION MICROPHONE
(FREE-HANDED SPEAKING)

8

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE = VIOLET PK = PINK

928 GTS MODEL 9372 SHEET 9

ABS, TIRE PRESSURE CONTROL, AIRBAG, PORSCHE LOCK DIFFERENTIAL, BRAKE PAD WEAR INDICATOR, TRAILER COUPLING

ABS - ANTILOCK SYSTEM AND PSD - PORSCHE LOCK DIFFERENTIAL

SOLENOID VALVE

GP X

GROUND STRAP
NO. 928.612.189.01

HYDRAULIC UNIT ABS

1.5 GN/WT
1.5 YE/RE

1.0 GN/WT
1.5 GN/WT

6 mm²

0.5 GN/BK
0.75 BR/GN
1.0 BK/BR
4.0 RE
1.5 GR/VI
1.5 GN/YE
1.5 GN/RE
2.5 GN/WT
0.5 BL/GN
0.75 GN/BL
4.0 RE

WIRE CONNECTOR
B85
10.0 RE
WL 2

PRESSURE WARNING SWITCH
0.5 BL/WT
0.5 BL/WT
0.5 BL/YE

PUMP
0.75 BR/RE
0.75 BR
4.0 BR
4.0 BK

PUMP RELAY
1.5 BR
0.75 BK/RE
4.0 RE/BK
4.0 RE

C82
C83
GP VI

AIRBAG DRIVER'S SIDE
0.5 GR/BL
0.5 GR/RE
0.5 BR/WT
C18

ACCELERATING SENSOR (M221)
0.5 BR/BL
0.5 YE/BL
0.5 RE/BL

0.75 BR
0.75 BR
0.75 BR
0.75 BR
1.0 BR
1.0 BR
1.0 BR

LH: GP IV
RH: GP V

T23
0.5 BR
0.5 BK/RE
0.5 BL/GN
0.5 BK/YE
0.5 RE
0.5 BL/WT
1.5 BK/RE
0.5 VI/RE
0.5 WT
0.5 GN
0.5 BL
0.5 BK/WT
0.5 GN
0.5 WT
0.5 GN/BK
0.5 WT/BK
0.5 BL/YE
0.5 VI/RE
0.5 VI/GN
0.5 VI/WT
0.5 VI/YE
0.5 BR
0.5 YE
0.5 WT
0.5 GN
0.5 RE

0.5 BK/RE
2.0 RE
0.5 VI/RE
F30
DISCONNECTING POINT NO. 3
0.5 BK/WT

LHD: GP IV
RHD: GP V

CONTROL UNI
TYRE PRESSI

RDK - TIRE PRESSURE C

WL 121

BRAKE PAD WEAR INDICATOR
HF SENSOR
ENGINE SPEED SENSOR
GP WHEEL SUSPENSION

REAR RIGHT
REAR LEFT
FRONT RIGHT
FRONT LEFT

GP I
GP II
GP III
GP IV
GP V
GP VI
GP VII
GP VIII
GP IX
GP X
GP XI
GP XII

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

AND PSD - PORSCHE LOCK DIFFERENTIAL

AIRBAG

AIRBAG DRIVER'S SIDE

SHORT-CIRCUITING BRACKET

SLIDING CONTACT UNIT

STEERING WHEEL WITH HORN CONTACT

ACCELERATING SENSOR (M221)

AIRBAG CONTROL UNIT

AIRBAG PASSENGER'S SIDE ONLY LHD

CRASH SENSOR RIGHT

CRASH SENSOR LEFT

WL 8 LHD
WL 3 RHD

WL 3

T52

T53

T23

GP V

TRAILER COUPLING (M 208)

PLUG SOCKET TRAILER COUPLING

WL 180

WL 161

T24

DISCONNECTING POINT NO.3

F30

F89

GROUND ABS

XV ABS

WARN LOCK ON EE

CONTROL UNIT TYRE PRESSURE CONTROL

RDK - TIRE PRESSURE CONTROL

WL 121

CENTRAL ELECTRIC

SEE SHEET 1 FIELD M5-7 (CONNECTION TO CENTRAL ELECTRIC)

T12 REAR FOG LIGHT

S12 BULB CONTROL UNIT - STOP LIGHTS

T13 TURN SIGNAL REAR RIGHT

T22 TURN SIGNAL REAR LEFT

S25 BULB CONTROL UNIT - SIDE MARKER LIGHT RIGHT

T11 BULB CONTROL UNIT - SIDE MARKER LIGHT LEFT

WL 4

LHD: GP IV
RHD: GP V

LHD: GP VI
RHD: GP IV

ENGINE SPEED SENSOR

GP WHEEL SUSPENSION

BRAKE PAD WEAR INDICATOR

HF SENSOR

FRONT RIGHT

FRONT LEFT

GP I GP II GP III GP IV GP V GP VI GP VII GP VIII GP IX GP X GP XI GP XII

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93/2 SHEET 10

MOTOR, FUEL AND IGNITION, CRUISE CONTROL

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT

BATTERY
12 V
WL 9
GP VII
WL 4
WL 121
WL 7
WL 2
L64
L76
K83
C80
2.5 RE
4.0 RE
6.0 RE
1.0 BK

GENERATOR
D-
D+/61
B+
CONTROL

STARTER
N34
50
15a
30
4.0 YE
35.0 BK
16 RE
10.0 RE

T18
T25
10.0 RE
WIRE CONNECTOR
K77
16.0 RE

TRANSMISSION PROTECTION SWITCH

STARTER INTERLOCK BACKUP LIGHT RANGE INDICATOR SWITCH (M249)
P R N D 3 2
81 81a 50 50
2.5 VI 2.5 VI/WT

WL 12
T51
0.5 BR
WL 1
WL 3
WL 4
WL 15
T32
0.75 BR

SOLENOID VALVE (M249)
1.5 GR/BR

KICKDOWN (M249)
F9
4.0 BR
1.25 GR/BR
M48 RHD ONLY
M48 LHD ONLY
ONLY M249
0.5 BR/YE

CRUISE CONTROL SWITCH
WI
AUS
BE
0.5 GR
0.5 BR/BK
0.5 YE
0.5 BK
L26
1.5 BK/VI
1.25 GR/BR

CONTROL UNIT CRUISE CONTROL
0.5 BK
0.5 BL/RE
0.75 BR
0.75 GN
0.5 BK/RE
0.75 WT
0.75 YE
0.75 RE/GN
0.75 VI
0.75 BL
T23
L27
N23
Q23
Q13
E4

CLUTCH SWITCH
(M48)
BRIDGE
(M249)
0.5 WT/GN
0.5 BR
GP IV
DRIVE
GP V

KICKDOWN XVII
MULTIPORT FUEL INJECTION XXV
STARTER V
DI XXII
FUEL PUMP XXVI
CENTRAL ELECTRIC
30
31
X
39
35
15
38
K35
W74
F8
E8
125
87a 87 86 85 30

0.75 BK
0.75 BR
0.5 BR/YE
0.75 RE
0.75 BK/VI
1.5 BK/WT
0.75 RE/WT
0.5 BL
0.5 YE
4.0 YE
0.75 BK
1.0 YE
1.5 BK
2.5 BK
0.75 BL
0.5 WT/YE
0.5 BL/WT
0.75 BL/WT
0.75 BR/RE
0.75 BR/WT
0.75 GN/BL
0.75 GR/RE
0.75 GN/RE

RIGHT IGNITION COIL
LEFT IGNITION COIL
RIGHT IGNITION FINAL STAGE
LEFT IGNITION FINAL STAGE
1.5 BR/BK
1.5 BK
1.5 BR
1.0 GN
1.0 WT
GP III

LEFT IGNITION DISTRIBUTOR
RIGHT IGNITION DISTRIBUTOR

BRIDGE
NOT WITH CATALYZER

IGNITION CIRCUIT CONTROL MODUL
THERMO ELEMENTS
IGNITION CIRCUIT II
IGNITION CIRCUIT I
0.75 WT
0.75 BR
0.75 BR/BK
0.75 BL/YE
0.75 BL/RE
0.75 RE/GN
1.5 RE/YE
2.5 RE

ENGINE SPEED SENSOR

GP VI

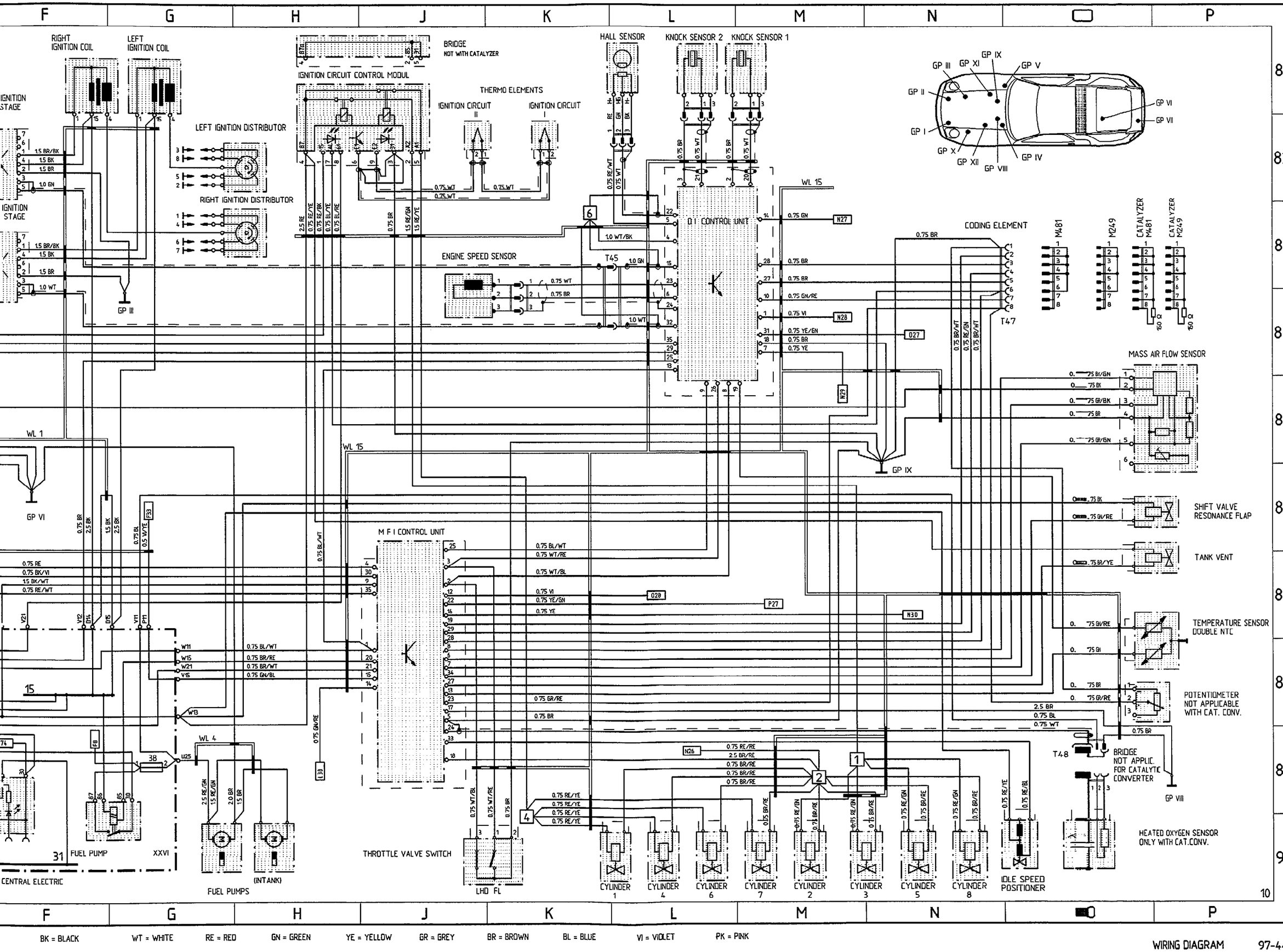
M F I CONTROL UNIT

THROTTLE VALVE SWITCH
LHD FL
0.75 RE/YE

FUEL PUMPS
(INTANK)
2.5 RE/GN
1.5 RE/GN
2.0 BR
1.5 BR

BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE

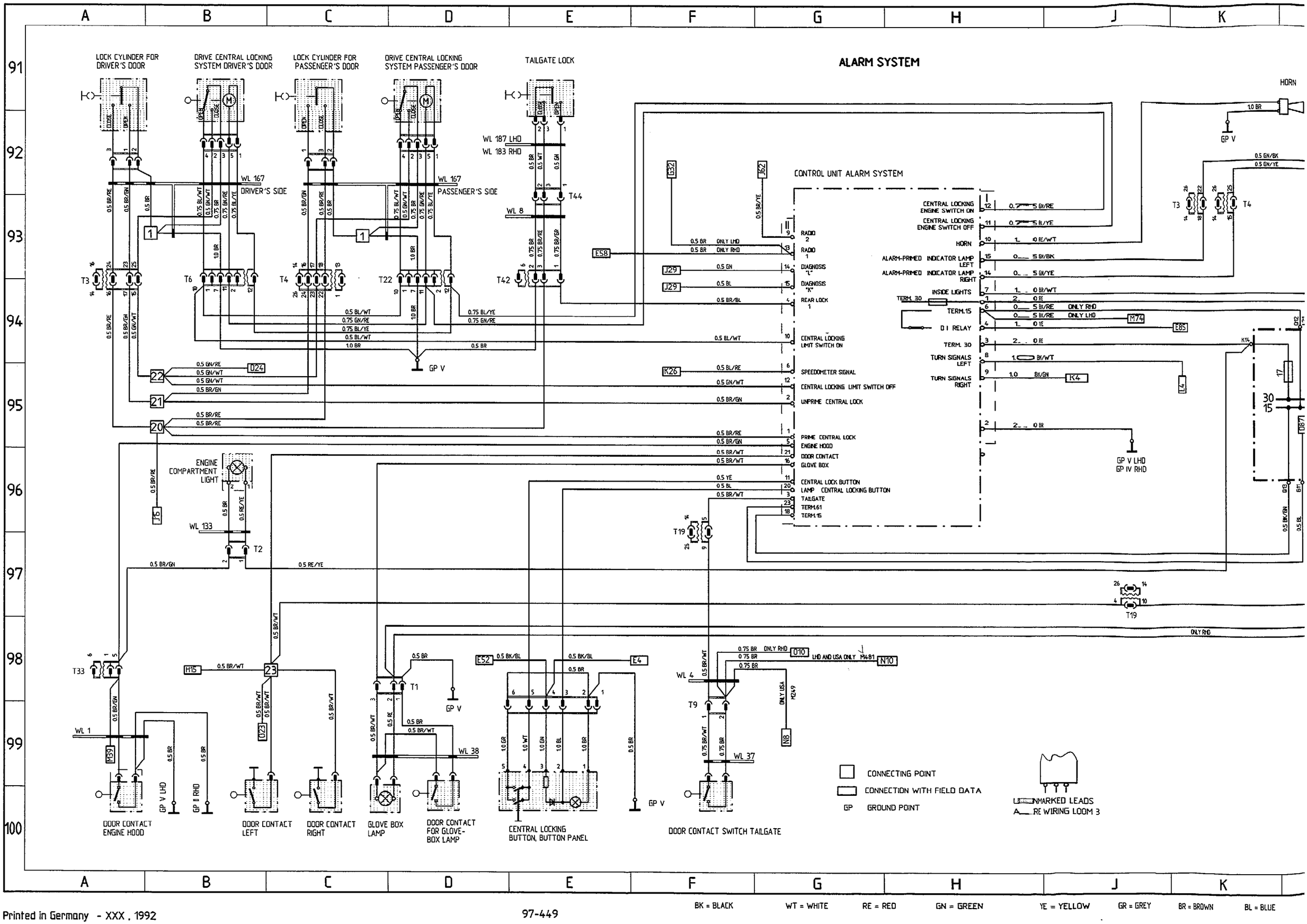
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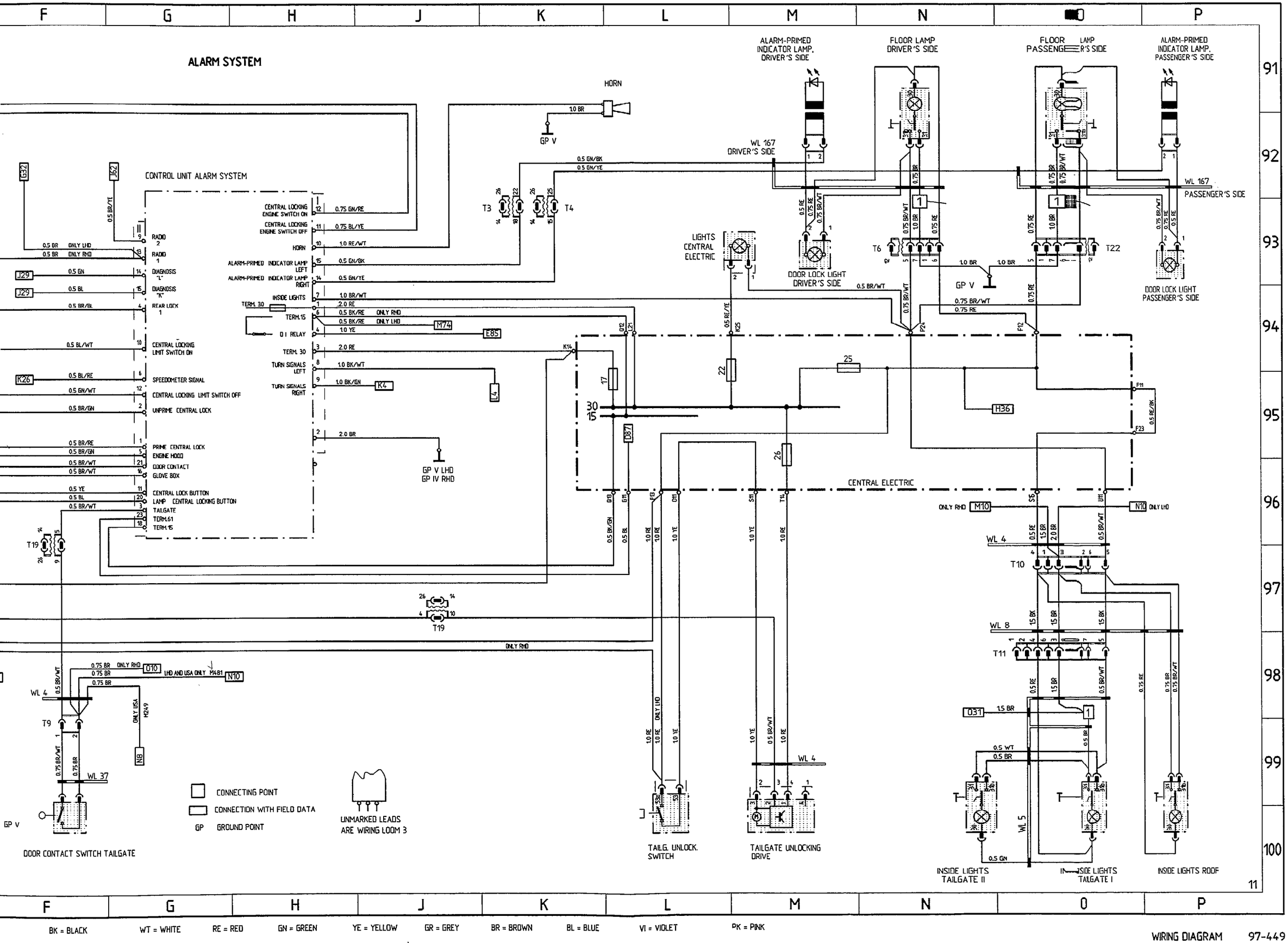
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 9372 SHEET 11

ALARM SYSTEM, CENTRAL LOCKING SYSTEM, INSIDE LIGHTS



ALARM SYSTEM



F	G	H	J	K	L	M	N	O	P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93/2 SHEET 12

CENTRAL ELECTRIC

	FUSE OUTPUT		FUSE INPUT
1	LOW BEAM LEFT	A15	7.5A → XXII-XXIV 56b
2	LOW BEAM RIGHT	A14	7.5A → XXII-XXIV 56b
3	HIGH BEAM LEFT	A25	7.5A → XXII-XXIV 56a, VII 85
4	HIGH BEAM RIGHT	A24	7.5A → XXII-XXIV 56a, VII 85
5	ADDITIONAL DRIVING LIGHTS	B14	15A → H 13, XXII-XXIV 86
6	FOG LIGHT	VII 30 (ONLY M193)	15A → III 87, IV 87
7	SIDE MARKER LIGHT LEFT	T11, D11	5A → K 13
8	SIDE MARKER LIGHT RIGHT	S25, D21	5A → H 14
9	ASHTRAY- INSTRUMENT-LIGHTS	K11	5A
10	LICENSE PLATE LIGHTS	J22, T21	5A → J 12
11	REAR FOG LIGHT	T12	5A → H 24
12	TURN SIGNAL FRONT LEFT	J11, C13	5A → J 21
13	TURN SIGNAL REAR LEFT	T22	5A
14	TURN SIGNAL FRONT RIGHT	C23	5A → H 25
15	TURN SIGNAL REAR RIGHT	T13	5A
16	REAR WINDOW DEFOGGER	I-II 30	25A → 30
17	WARNING FLASHER ENGINE COMPARTMENT LIGHT	K14	15A → 30
18	POWER WINDOW REGULATOR SUN ROOF	K24	25A → X 30
19	HEADLIGHT CLEANING SYSTEM	VII 30	25A → V 30
20	FRESH AIR BLOWER	XII 30	30A → L 15
21	BOOSTER GLOVE BOX LAMP	F24	15A
22	POWER SEAT LEFT LIGHTS CE	K25	30A
23	POWER SEAT RIGHT	M12	30A → 24

	FUSE OUTPUT		FUSE INPUT
24	TWO-TONE HORNS	XVI 30, T15	15A → L 25, XXIII-XXIV 30
25	INSIDE LIGHTS DIAGNOSTIC CONNECTOR INSTRUMENT CLUSTER	XXI 1, F13	7.5A → D 24
26	TAILGATE UNLOCKING	T14	1A
27	CONCEALED HEADLIGHT MOTOR	XXIII-XXIV 30a	15A → 30
28	ABS	XV 30	15A → U 15, (B+)
29	RADIATOR FAN 1	B22	30A → T 25, (B+)
30	RADIATOR FAN 2	B23	30A → T 24, (B+)
31			
32			
33	CIGAR LIGHTER	D14	25A → X
34	WINDSHIELD WIPERS HEATED SPRAY JET	X15, L24	25A → D 21
35	STOP LIGHT, CRUISE CONTROL	U24, D13	7.5A → XXIII-XXIV X
36	CONTROL UNIT FAN	C15	5A
37	AIR CONDITIONING SYSTEM	D12	7.5A → L 13
38	FUEL PUMP, HEATER HEADED OXYGEN SENSOR	U25	15A → III 86, XXVI 87
39	INSTRUMENT, CONTROL LAMPS KICKDOWN, SOLENOID VALVE SWITCH FOR REAR WINDOW WIPER	D23, D24	5A → S 24, XXVI 86
40	BACKUP LIGHT, MIRROR ADJUSTMENT TIRE PRESSURE CONTROL	XVIII30, P14	7.5A
41	LIGHTS, LIGHT SWITCH BUTTON PANEL RELAY TIMING CONTROL UNIT INSIDE LIGHTS DIAGNOSTIC CONNECTOR TERM.15	P25	5A → 15
42	REAR WINDOW WIPER	U23	7.5A → D 15
43	TELEPHONE	M24, D25	7.5A → D 14
44	SEAT HEATER	P13	15A → D 15
45	ADDL AC	D22	15A → D 24

I-II REAR WINDOW DEFOGGER

III DAYTIME RUNNING LIGHT

IV FOG LIGHT

V STARTER

X SUPPLY

XI WIPER INTERMITTENT CONTROL

XII FRESH AIR BLOWER

XIII FLASHER

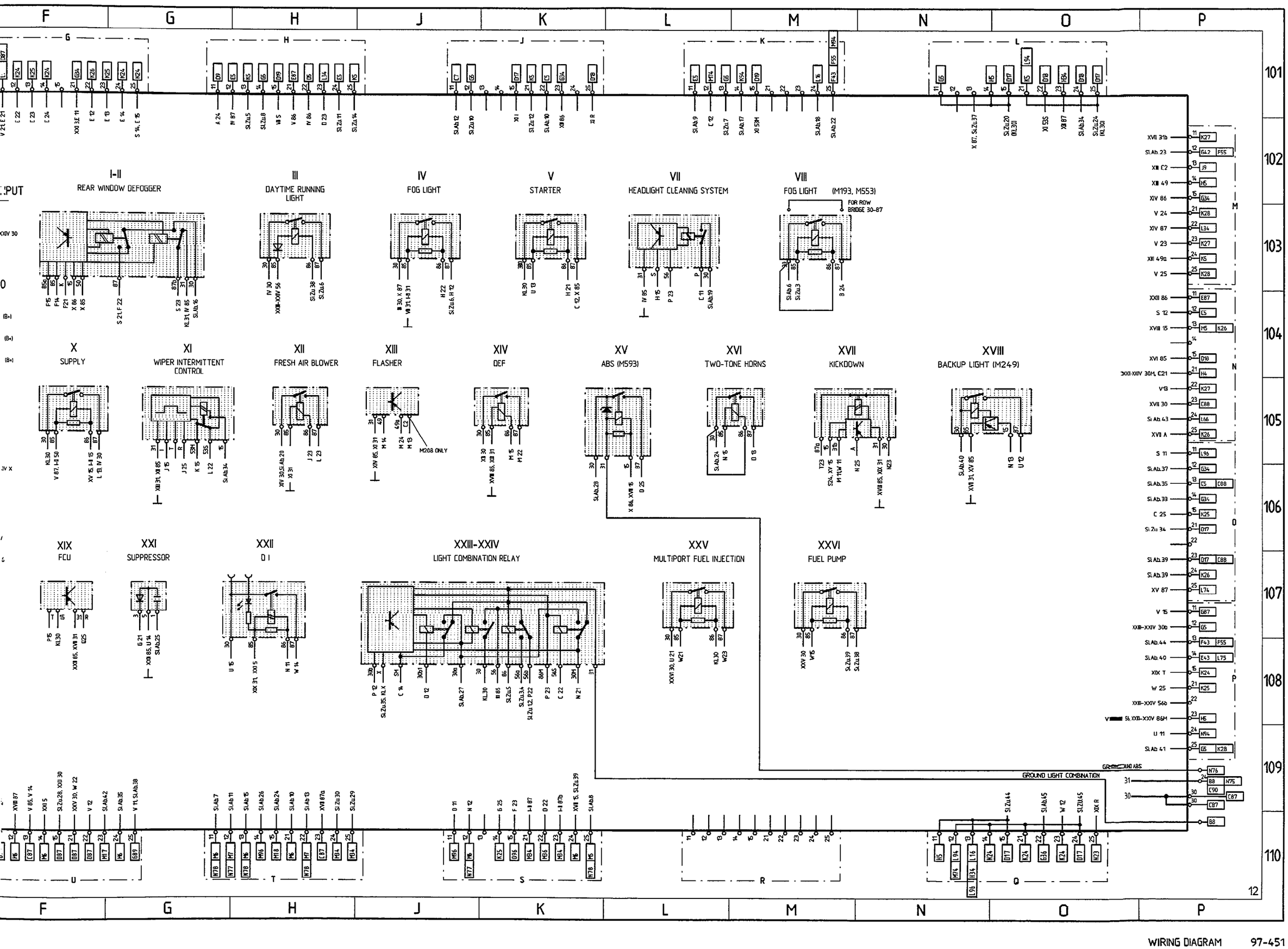
XIV DEF

XIX FCU

XXI SUPPRESSOR

XXII D I

XXIII-XXIV LIGHT COMBINATION RELAY


F
G
H
J
K
L
M
N
O
P
101
102
103
104
105
106
107
108
109
110
12
I-II
REAR WINDOW DEFOGGER
III
DAYTIME RUNNING LIGHT
IV
FOG LIGHT
V
STARTER
VII
HEADLIGHT CLEANING SYSTEM
VIII
FOG LIGHT (M193, M553)
FOR ROW BRIDGE 30-87
X
SUPPLY
XI
WIPER INTERMITTENT CONTROL
XII
FRESH AIR BLOWER
XIII
FLASHER
M208 ONLY
XIV
DEF
XV
ABS (M593)
XVI
TWO-TONE HORNS
XVII
KICKDOWN
XVIII
BACKUP LIGHT (M249)
XIX
FCU
XXI
SUPPRESSOR
XXII
DI
XXIII-XXIV
LIGHT COMBINATION RELAY
XXV
MULTIPORT FUEL INJECTION
XXVI
FUEL PUMP
GROUND LIGHT COMBINATION
GROUND ABS

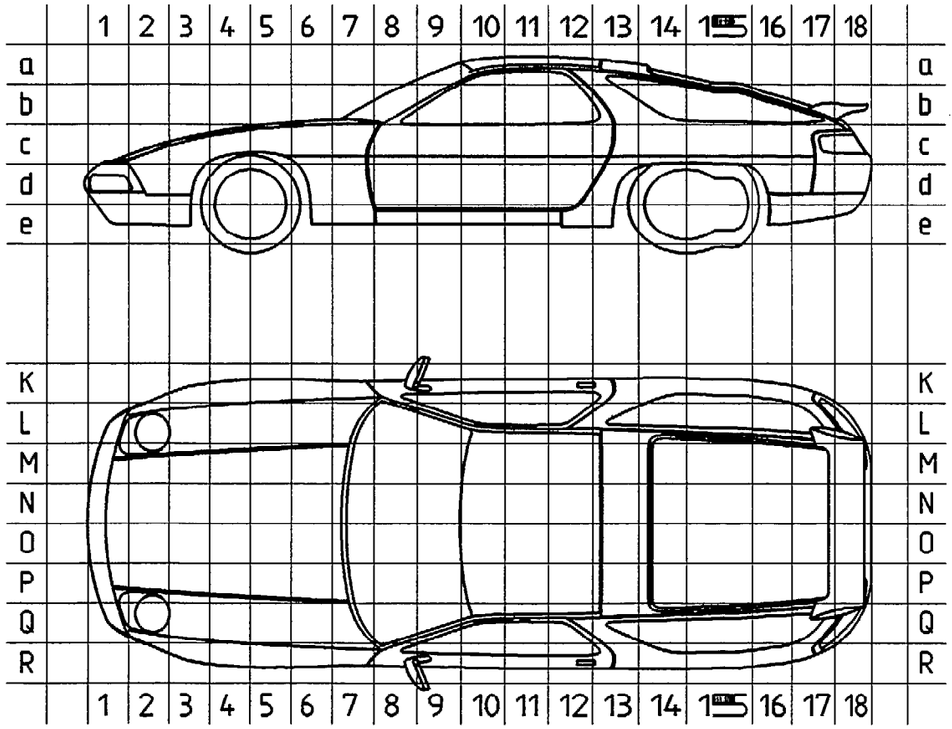
CONSTRUCTION COMPONENTS

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE	FIELD IN WIRING DIAGRAM
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT	7cQ		IN DRIVER'S FOOTWELL ON SIDE	DJ 71-72
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT		7cQ	ABOVE CENTRAL ELECTRIC	DJ 71-72
ACCELERATING SENSOR	10eQ	10eQ	UNDER THE LEFT SEAT	K 73
AIR CONDITIONING SYSTEM CONTROL UNIT	8cN-O	8cN-O	IN HEATER BOX	AB 34-36
ALARM-PRIMED INDICATOR LAMPS				MP 91,92
ASHTRAY LIGHT				GH 31
BACKUP LIGHT SWITCH				P5, L1,2
BATTERY				C 82
BLOWER FINAL STAGE				O 39,40
BLOWER INSIDE SENSOR				AB 33,34
BLOWER MOTOR				H 40
BLOWER SWITCH FRESH AIR				JK 31,32
BLOWER SWITCH ADDITIONAL AIR CONDITIONING SYSTEM				G 37,38
BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	GH 64.65
BRAKE PAD WEAR INDICATOR				D-H 79,80
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
BUTTON PANEL AC SWITCH				EF 31,32
CENTRAL ELECTRIC	7dM	7dP	IN PASSENGER'S FOOTWELL ON FIREWALL	
CENTRAL LOCK BUTTON				E 99,100
CIGAR LIGHTER				GH 31
CLOCK				F 1
CLUTCH SWITCH				A 89,90
CODING ELEMENT				OP 83,84
CONCEALED HEADLIGHT LEFT				A 7
CONCEALED HEADLIGHT RIGHT				A 4
CONCEALED HEADLIGHT MOTOR				A 5.6
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
CONTROL UNIT AIRBAG				M-O 71
CONTROL UNIT ALARM SYSTEM	7cM	7cP	UNDER THE PASSEGER SEAT	GH 92-96
CONTROL UNIT POWER WINDOWS, SUNROOF				JK 14
CONTROL UNIT CRUISE CONTROL	6dQ		IN DRIVER'S FOOTWELL BELOW THE FOOT REST	AB 88,89
CONTROL UNIT CRUISE CONTROL		7dN-O	IN CENTRE CONSOLE AT FRONT	AB 88,89
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39,40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MN 39,40
COOLANT LEVEL SWITCH				M 29,30
COOLANT TEMP. SENSOR				P 26
CRUISE CONTROL SWITCH				A 87
DELAYING RELAY SEAT HEATER				M 42
DIAGNOSTIC CONNECTOR				JK 30
D I CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	L 82-84
DISTRIBUTER				GH 82,83
DOOR CONTACT SWITCH LEFT				BC 99,100
DOOR CONTACT SWITCH RIGHT				C 99,100
DOOR CONTACT FOR GLOVE COMPARTMENT LIGHT				D 99,100
DOOR CONTACT SWITCH TAILGATE				F 99,100
DOOR LOCK LIGHT PASSENGER'S SIDE				P 93
DOOR LOCK LIGHT DRIVER'S SIDE				M 93
DRIVE CENTRAL LOCKING SYSTEM DRIVER'S DOOR				B 91,92
DRIVE CENTRAL LOCKING SYSTEM PASSENGER'S DOOR				D 91,92
DRIVE CRUISE CONTROL				B 90
ENGINE COMPARTMENT LIGHT				B 96
ENGINE SPEED SENSOR				JK 83,84
EVAPORATOR SENSOR				H 37,38
FLOOR LAMP DRIVER'S SIDE				N 91,92
FLOOR LAMP PASSENGER'S SIDE				O 91,92
FREEZING PROTECTION SWITCH AIR CONDITIONING SYSTEM	7cM	7cM	UNDER THE WINDSHIELD WIPER COVER	FG 31
FREQUENCY SWITCHES				FG 66, H66
FRESH AIR BLOWER ENGINE				LM 31,32
FRONT SENSOR AIRBAG				OP 73.74
FUEL INJECTORS				L-N 90
FUEL LEVEL SENSOR				H 30
FUEL PUMP				GH 90
GENERATOR				DE 81,82
GLOVE BOX LAMP				CD 100
HALL SENSOR				L 81
HAZARD LIGHT SWITCH				HJ 1
HEADLIGHT WASHING FLUID PUMP				D 11
HEADLIGHT VERTICAL AIM CONTROL				A4, A 6,7
HEATED OXYGEN SENSOR				O 90

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE	FIELD IN WIRING DIAGRAM
HF SENSOR				D-G 79,80
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
HORN ALARM SYSTEM				L 91,92
HYDRAULIC UNIT ABS				AB 73-76
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82
IGNITION FINAL STAGE				F 82,83
INDICATOR SWITCH BRAKE FLUID				F 21,22
INFO SWITCH				E 30
INSIDE TEMP. SENSOR				B 32,33
INSIDE LIGHTS ROOF				P 99,100
INSIDE LIGHTS TAILGATE I				O 99,100
INSIDE LIGHTS TAILGATE II				N 99,100
INSTRUMENT CLUSTER				A-C 22-30
KICKDOWN SOLENOID VALVE				AB 86
KICK-DOWN SWITCH				BC 86,87
KNOCK SENSOR				LM 81
LICENSE PLATE LIGHTS				P 6,7
LIGHTS CENTRAL ELECTRIC				LM 93
LOCK CYLINDER FOR PASSENGER'S DOOR				C 91,92
LOCK CYLINDER FOR DRIVER'S DOOR				A 91,92
MASS AIR FLOW SENSOR				OP 84,85
MEMORY SWITCH RIGHT				A 51,52
MEMORY SWITCH LEFT				A 59,60
M F I JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
MICRO SWITCH CENTRAL NOZZLE				AB 37
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	D 52-57
MIRROR ADJUSTMENT SWITCH				AB 46,47, A 55,56
MOTOR POWER WINDOW PASSENGER'S SIDE				N 11
MOTOR POWER WINDOW DRIVER'S SIDE				F 11
MOTOR SUN ROOF				E 11
ODOMETER RESET SWITCH				JKL 21,22
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	P 26
OIL PRESSURE SENSOR				P 27
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 36
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
OUTSIDE TEMP. SENSOR				D 21
PARKING BRAKE CONTACT				E 21,22
POTENTIOMETER INSTRUMENT LIGHT				DE 2
POTENTIOMETER IDLE SPEED CO				OP 88
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL				D 1
POTENTIOMETER FOR WIPING/WASHING				B 16
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM				F 37,38
PRESSURE SWITCH COOLANT				MN 30
PRESSURE SWITCH FRIGEN				L 40
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
PUSH BUTTON SWITCH FOR POWER WINDOW				G 11, L 11
PUSH BUTTON SUN ROOF				E 14,15
RADIATOR FAN				P 38,39
REAR WINDOW DEFOGGER				P 31,32
REAR WINDOW WIPER MOTOR				P 18,19
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE TOOL KIT COVER	OP 17
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL-M	ON BLOWER HOUSING	KL 31,32
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
ROOF ANTENNA				EF 61,62
SEAT BELT				O 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
SHIFT VALVE RESONANCE FLAP				OP 86
SOLENOID CLUTCH COMPRESSOR				P 33
SOLENOID VALVE ABS				C 72
SOLENOID VALVES AIR CONDITIONING				B 37-40
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
SPEAKER				F-J 66-69
SPEED SENSOR				E-H 79,80
STEERING IGNITION LOCK				B 14-16
STARTER INTERLOCK				L1,2, H21, A85

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
HF SENSOR				D-G 79,80
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
HORN ALARM SYSTEM				L 91,92
HYDRAULIC UNIT ABS				AB 73-76
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82
IGNITION FINAL STAGE				F 82,83
INDICATOR SWITCH BRAKE FLUID				F 21,22
INFO SWITCH				E 30
INSIDE TEMP. SENSOR				B 32,33
INSIDE LIGHTS ROOF				P 99,100
INSIDE LIGHTS TAILGATE I				O 99,100
INSIDE LIGHTS TAILGATE II				N 99,100
INSTRUMENT CLUSTER				A-C 22-30
KICKDOWN SOLENOID VALVE				AB 86
KICK-DOWN SWITCH				BC 86,87
KNOCK SENSOR				LM 81
LICENSE PLATE LIGHTS				P 6,7
LIGHTS CENTRAL ELECTRIC				LM 93
LOCK CYLINDER FOR PASSENGER'S DOOR				C 91,92
LOCK CYLINDER FOR DRIVER'S DOOR				A 91,92
MASS AIR FLOW SENSOR				OP 84,85
MEMORY SWITCH RIGHT				A 51,52
MEMORY SWITCH LEFT				A 59,60
M F I JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
MICRO SWITCH CENTRAL NOZZLE				AB 37
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	D 52-57
MIRROR ADJUSTMENT SWITCH				AB 46,47, A 55,56
MOTOR POWER WINDOW PASSENGER'S SIDE				N 11
MOTOR POWER WINDOW DRIVER'S SIDE				F 11
MOTOR SUN ROOF				E 11
ODOMETER RESET SWITCH				JKL 21,22
OIL LEVEL SWITCH	3eN-Q	3eN-Q	ON OIL PAN, FRONT	P 26
OIL PRESSURE SENSOR				P 27
OIL TEMPERATURE SWITCH (M249)	13eQ	13eQ	ON TORQUE CONVERTER LEFT SIDE	P 36
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
OUTSIDE TEMP. SENSOR				D 21
PARKING BRAKE CONTACT				E 21,22
POTENTIOMETER INSTRUMENT LIGHT				DE 2
POTENTIOMETER IDLE SPEED CO				OP 88
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL				D 1
POTENTIOMETER FOR WIPING/WASHING				B 16
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM				F 37,38
PRESSURE SWITCH COOLANT				MN 30
PRESSURE SWITCH FRIGEN				L 40
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16d0	16d0	UNDER THE SPARE WHEEL COVER	B 79,80
PUSH BUTTON SWITCH FOR POWER WINDOW				G 11, L 11
PUSH BUTTON SUN ROOF				E 14,15
RADIATOR FAN				P 38,39
REAR WINDOW DEFOGGER				P 31,32
REAR WINDOW WIPER MOTOR				P 18,19
REAR WINDOW WIPER RELAY	18c0	18c0	UNDER THE TOOL KIT COVER	OP 17
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL-M	ON BLOWER HOUSING	KL 31,32
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12d0	12d0	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
ROOF ANTENNA				EF 61,62
SEAT BELT				O 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
SHIFT VALVE RESONANCE FLAP				OP 86
SOLENOID CLUTCH COMPRESSOR				P 33
SOLENOID VALVE ABS				C 72
SOLENOID VALVES AIR CONDITIONING				B 37-40
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
SPEAKER				F-J 66-69
SPEED SENSOR				E-H 79,80
STEERING IGNITION LOCK				B 14-16
STARTER INTERLOCK				L12, H21, A85

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
STOP LIGHT TAILGATE				J 9,10
STOP LIGHT SWITCH				C 2,3
SUPPRESSOR FOR RADIO	8d0	8d0	IN CENTRE CONSOLE IN FRONT OF RADIO	DE 61
SWITCHING UNIT EX (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
TAILGATE LOCK				E 91
TAILGATE UNLOCKING SWITCH				KL 99,100
TAILGATE UNLOCKING DRIVE				M 99,100
TANK VENTING VALVE				OP 86,87
TEMPERATURE SENSOR DOUBLE NTC				OP 87,88
TEMPERATURE SENSOR COOLING WATER				K 40
TEMPERATURE SWITCH SUCTION TUBE				K 40
THERMO ELEMENTS CATALYTIC CONVERTER				O 28,29
THERMO ELEMENTS IGNITION CIRCUIT				JK 82
THROTTLE VALVE SWITCH	5cM	5cP	IN COOLANT HOSE BEFORE EXPANSION TANK	JK 90
TIME RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	P 23-25
TIRE PRESSURE CONTROL CONTROL UNIT	7cP	7cM	ON INTRUMENT PANEL	K 76-78
TOOTHED BELT TENSION SWITCH				N 22
TRAILER COUPLING				075
TRANSMISSION PROTECTION SWITCH				D 84,85
TURN SIGNAL / DIMMER SWITCH				JK 1,2
TWO-TONE HORNS				CD 20
WARNING BUZZER	8cP	8cM	ON STEERING PROTECTIVE TUBE	D 29,30
WASHING JETS				B 11,12
WASHING FLUID LEVEL SWITCH	6cL	6cL	ON WINDSHIELD WASHER TANK	MN 28,29
WINDSHIELD WASHING FLUID PUMP				D 11
WIPE/WASH SWITCH				AB 18-20



13

928 GTS MODEL 93/2 SHEET 14

PLUG CONNECTIONS, GROUND POINTS

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
T1	3	GLOVE BOX LAMP	7cL	7cQ	ABOVE DI MFI CONTROL UNIT	CD98
T2	2	ENGINE COMPARTMENT LIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	B97
T3	26	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C55-60,D22,A93,94,K92,93
T4	26	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	B42,C51-54,C93,94,K92,93
T5	30	INSTRUMENT SCUTTLE	7cQ	7cL	AT SUPPORTING TUBE ON STEERING COLUMN	C3-H3, K23,H33
T6	12	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C60,FG65,G14,B93,94,N93
T7	2	TRANSMISSION BACKUP LIGHT SWITCH	16dO	16dO	UNDER THE SPARE WHEEL COVER	P5
T8	2	LICENSE PLATE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	F98
T10	6	REAR WIRING LOOM / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,N31-32,097
T11	8	B-PILLAR / TAILGATE	13aN	13aO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	K10,N031,32,098
T12	2	SIDE MARKER LIGHT LEFT REAR	18cO		UNDER THE TOOL KIT COVER	010
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	02
T14						
T15						
T16						
T17						
T18	14	FRONT END / ENGINE WIRING LOOM	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	026,27,033,JK39,083
T19	26	INSTRUMENT PANEL - / REAR WIRING LOOM	7dL	7dL	NEAR CENTRAL ELECTRIC	EF13,GH28,HJ23,M4,F96,97,J97
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	F58-60,HJ46,K43-44
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H42,F51-53
T22	12	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	C42,C51,H65,L14,093,94,093
T23	21	ABS	7dQ	7dQ	FOOTWELL AT LEFT SIDE PANEL	K73-76,F30
T24	6	TRAILER COUPLING	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	OP75,76
T25	1	WIRE CONNECTOR	L4	L4	IN ENGINE COMPARTMENT RIGHT	C85
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C12
T27	2	HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C11
T28						
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-34
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	036,086
T33	6	FRONT END / INSTRUMENT PANEL WIRING LOOM	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	C2,A98
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	F36
T36	6	MIRROR PASSENGER'S SIDE				B41-42
T37	15	MIRROR DRIVER'S SIDE				CD48, C21
T38	15	MIRROR PASSENGER'S SIDE WITH MEMORY				A52-54
T39	15	MIRROR DRIVER'S SIDE WITH MEMORY				A57-58
T40						
T41						
T42	6	WL INSTRUMENT PANEL / WL B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E13,E93,94
T43						
T44	3	WIRING LOOM B-PILLAR / TAILGATE LOCK	13aN	13aO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	E92
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	KL83,84
T46	19	DIAGNOSTIC CONNECTOR	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	JK30
T47	8	CODING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N84
T48	3	HEADED OXYGEN SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	089
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	LM32
T50	6	AUTOM. TRANSM., COUPLING TO GEARBOX WIRING LOOM	16dO	16dO	UNDER THE SPARE WHEEL COVER	HJ22
T51	6	AUTOM. TRANSMISSION, COUPLING TO REAR WIRING LOOM	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85,86,M2
T52	6	AIRBAG	8dN		IN CENTRE CONSOLE	M73
T53	2	AIRBAG	8dN		IN CENTRE CONSOLE	M73

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE
GP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
GP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
GP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
GP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
GP V	FIREWALL	8dM	8dP	ABOVE CENTRAL ELECTRIC
GP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
GP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
GP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
GP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
GP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
GP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
GP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT

ABBREVIATIONS

CODE	MEANING	CODE	MEANING
ABS	ANTILOCK BRAKING SYSTEM	NTC	NEGATIVE TEMPERATURE COEFFICIENT
AC	AIR CONDITIONING SYSTEM	NO	NUMBER
ADL	ADDITIONAL DRIVING LIGHTS	OP	OPEN
CE	CENTRAL ELECTRIC	PIN	PIN
CL	CLOSE	PL	PLUG
CLS	CENTRAL LOCKING SYSTEM	POT	POTENTIOMETER
CP	CONNECTING POINT	PSD	PORSCHE LIMITED SLIP DIFFERENTIAL
CU	CONTROL UNIT	RA	REAR AXLE
DEF	DEFROST	RDK	TIRE PRESSURE CONTROL
DI	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	RHD	RIGHT-HAND DRIVE
DP	DISCONNECTING POINT	RFL	REAR FOG LIGHT
ESO	ENGINE-SPEED SENSOR OUTPUT	RL	REAR LEFT
FA	FRONT AXLE	ROW	REST OF WORLD
FCU	FREQUENCY CONVERTER UNIT	RR	REAR RIGHT
FL	FRONT LEFT	SA	SAUDI ARABIA
FOG	FOG LIGHT	SCS	COMBINED STEERING COLUMN SWITCH
FR	FRONT RIGHT	SS	SPEED SENSOR
GP	GROUND POINT	TE	TERMINAL
HCS	HEADLIGHT CLEANING SYSTEM	USA	USA
HF	HIGH FREQUENCY	WL	WIRING LOOM
IC	INSTRUMENT CLUSTER	WP	WELD POINT
LED	LIGHT-EMITTING DIODE	WW	WORLDWIDE
LF	LOW FREQUENCY		
LHD	LEFT-HAND DRIVE		
MFI + DI	DIGITAL ENGINE ELECTRONICS		

FIELD IN WIRING DIAGRAM
C098
B97
C44,C55-60,D22,A93,94,K92,93
B42,C51-54,C93,94,K92,93
C3-H3, K23,H33
C44,C60,FG65,G14,B93,94,N93
P5
P6
F98
LM10,N31-32,097
K10,N031,32,098
010
02
026,27,033,JK39,083
EF13,GH28,HJ23,M4,F96,97,,J97
F58-60,HJ46,K43-44
H42,F51-53
C42,C51,H65,L14,D93,94,093
K73-76,F30
OP75,76
C85
C12
C11
F33
F33-34
BC33
036,086
C2,A98
G39
F36
B41-42
C048, C21
A52-54
A57-58
E13,E93,94
E92
KL83,84
JK30
N84
089
LM32
HJ22
BC85,86,M2
M73
M73

GROUND POINTS

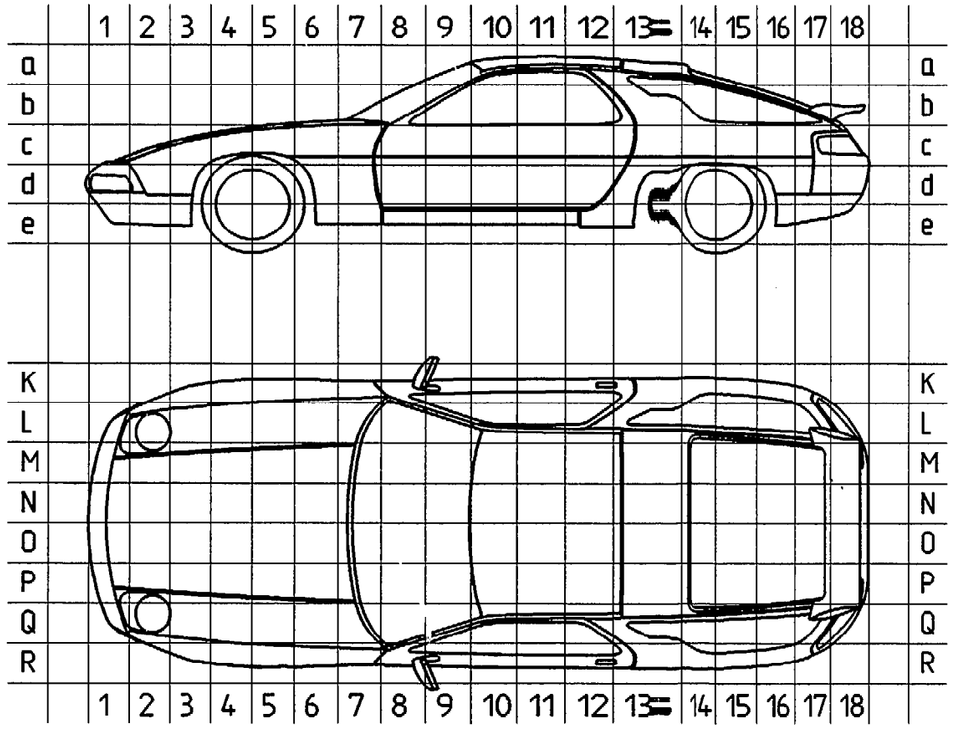
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GP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
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CU	CONTROL UNIT	RA	REAR AXLE
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DI	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	RHD	RIGHT-HAND DRIVE
DP	DISCONNECTING POINT	RFL	REAR FOG LIGHT
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LED	LIGHT-EMITTING DIODE	WW	WORLDWIDE
LF	LOW FREQUENCY		
LHD	LEFT-HAND DRIVE		
MFI + DI	DIGITAL ENGINE ELECTRONICS		

M - NUMBERS

M 061	ENGLAND VERSION
M 139	ADJUSTABLE SEAT HEATING SEAT LEFT
M 193	JAPAN VERSION
M 195	TELEPHONE PREPARATION CELLULAR (MOTOROLA)
M 208	TRAILER COUPLING
M 215	SAUDI-ARABIA VERSION
M 249	AUTOMATIC TRANSMISSION
M 261	OUTSIDE MIRROR FLAT PASSENGER'S SIDE
M 340	ADJUSTABLE SEAT HEATING SEAT RIGHT
M 383	SPORT SEAT LEFT
M 387	SPORT SEAT RIGHT
M 479	AUSTRALIAN VERSION
M 481	TRANSMISSION
M 484	USA VERSION
M 513	LUMBAR SUPPORT SEAT RIGHT
M 525	ALARM SYSTEM WITH CONTINUOUS TONE (SWITZERLAND)
M 528	OUTSIDE MIRROR KONVEX PASSENGER'S SIDE
M 537	SEATING POSITION CONTROL COMFORT SEAT LEFT
M 538	SEATING POSITION CONTROL COMFORT SEAT RIGHT
M 553	USA - CANADA VERSION
M 562	AIRBAG
M 570	ADD. AIR CONDITIONER (INCREASED COOLING CAPACITY)
M 576	REAR FOG LIGHT
M 586	LUMBAR SUPPORT SEAT LEFT
M 602	HIGH MOUNTED STOP LIGHT
M 612	TELEPHONE PREPARATION C-NETWORK (PHILIPS)
M 650	ELECTRIC SUN ROOF



14

Wiring Diagram Type 928 GTS Model 93

	Coordinates	
Sheet 1	1 - 10	Lights RoW
Sheet 2	1 - 10	Lights USA
Sheet 3	11 - 20	Body
Sheet 4	21 - 30	Instrument Cluster and Senders
Sheet 5	31 - 40	Engine Cooling, Heater, Air Conditioner
Sheet 6	41 - 50	Outside Mirror, Power Seat
Sheet 7	51 - 60	Seat and Mirror Memory
Sheet 8	61 - 70	Radio, Telephone
Sheet 9	71 - 80	Antilock System, Tire Pressure Control, Airbag, Porsche Lock Differential, Trailor Coupling, Brake Pad Wear Indicator
Sheet 10	81 - 90	Motor, Fuel and Ignition, Cruise Control
Sheet 11	91 - 100	Alarm System, Central Locking System, Inside Lights
Sheet 12	101 - 110	Central Electric
Sheet 13		Constr. Components
Sheet 14		Plug Connections, Ground Points, M-Numbers, Abbreviations

Wiring Diagram Type 928 GTS
Model 93

The wiring diagram comprises of 12 individual wiring diagrams, 1 sheet construction components and 1 sheet plug connections, ground points, M-numbers and abbreviations. They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central-electrical system within a dash-dot frame.

This part of the central-electrical system shows all the lines and relays required for the individual wiring diagram.

The ground-connecting points are designated with "GP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Parts 2, is the "module element".

Both parts are identified by the digits 1.....5.

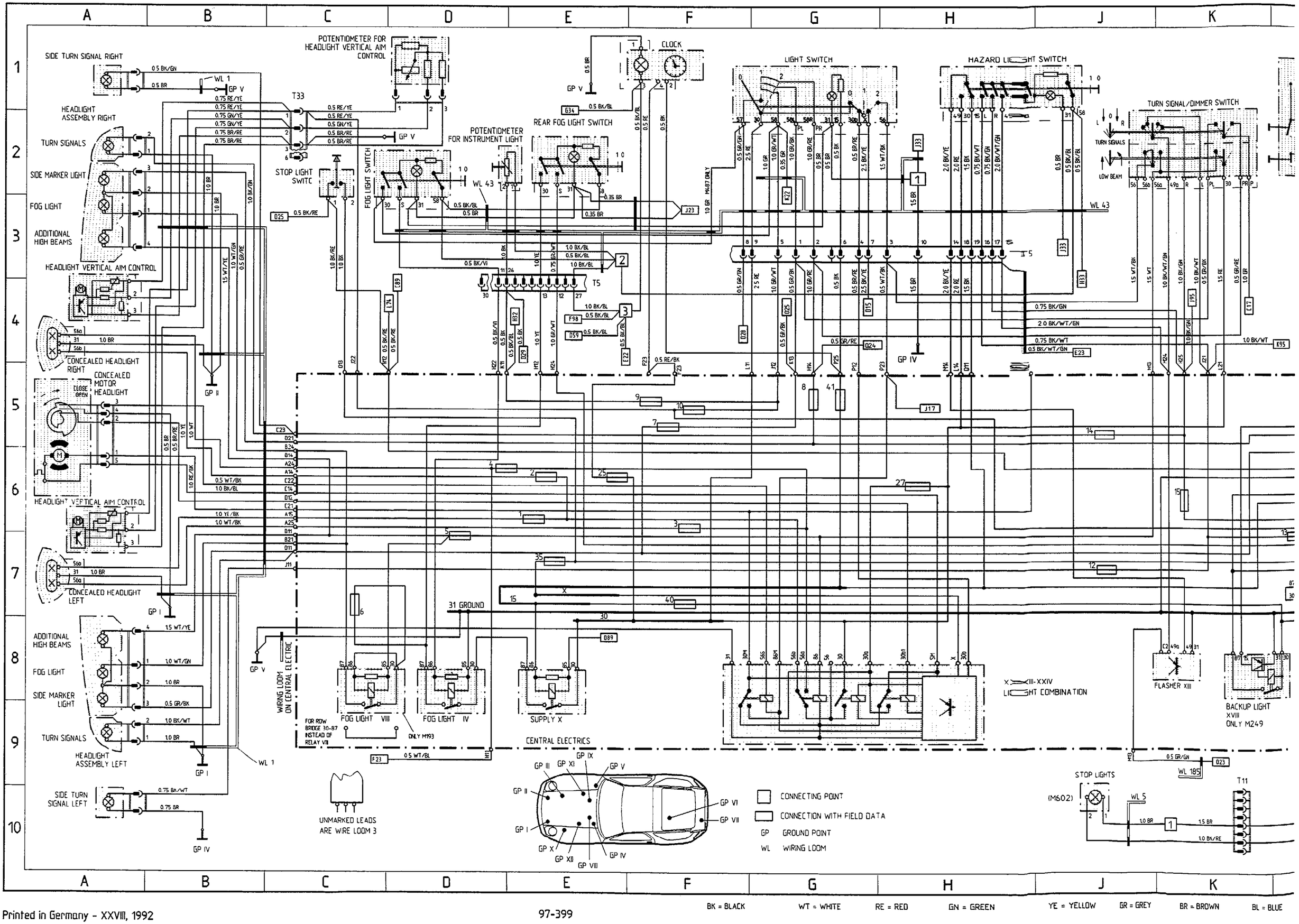
Part 3 is a "coding element".

The designations of the plug connections in the wiring diagram for central electrical system refer e.g. from A 11.....15, to the "initial element", from A 21.....25 to module element.

Printed in Germany – XXVIII, 1992

928 GTS MODEL 93 SHEET 1

LIGHTS ROW OUTSIDE



F G H J K L M N O P

1 2 3 4 5 6 7 8 9 10

CLOCK

LIGHT SWITCH

HAZARD LIGHT SWITCH

TURN SIGNAL/DIMMER SWITCH
TURN SIGNALS
LOW BEAM

(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH

BULB CONTROL UNIT
FAILURE STOP LIGHT
FAILURE SIDE MARKER LIGHT

TAIL LIGHTS — RIGHT
REAR FOG LIGHT
SIDE MARKER LIGHT
TURN SIGNALS
STOP LIGHTS
BACKUP LAMP

BACKUP LIGHT SWITCH (M481)

LICENSE PLATE LIGHTS

TAIL LIGHTS LEFT

XXIII-XXIV
LIGHT COMBINATION

FLASHER XIII

BACKUP LIGHT
XVIII
ONLY M249

BRIDGE
M481 INSTEAD
REL. XVIII

STOP LIGHTS
(M602)

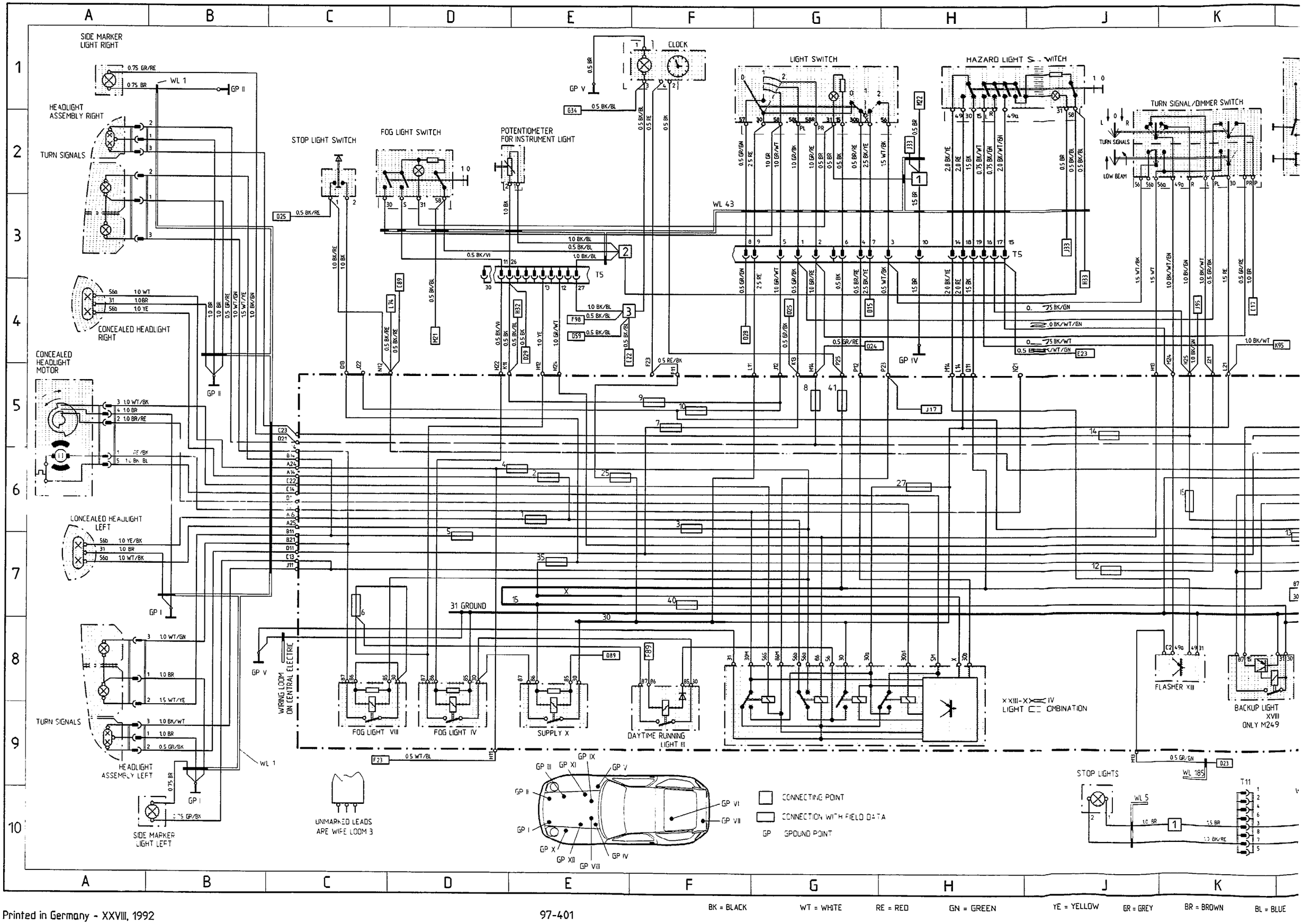
GP VI
GP VII

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT
WL WIRING LOOM

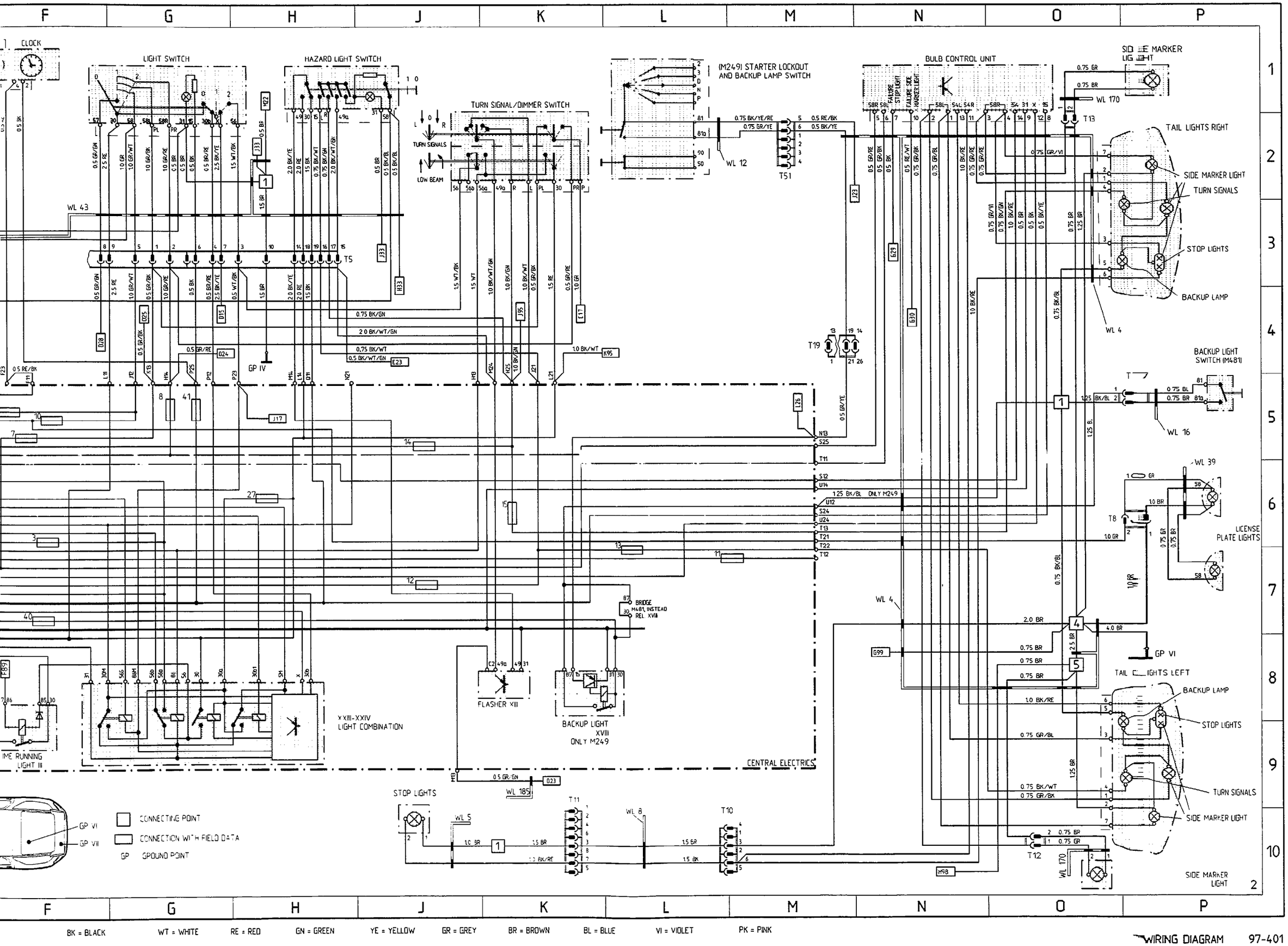
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 2

LIGHTS USA OUTSIDE

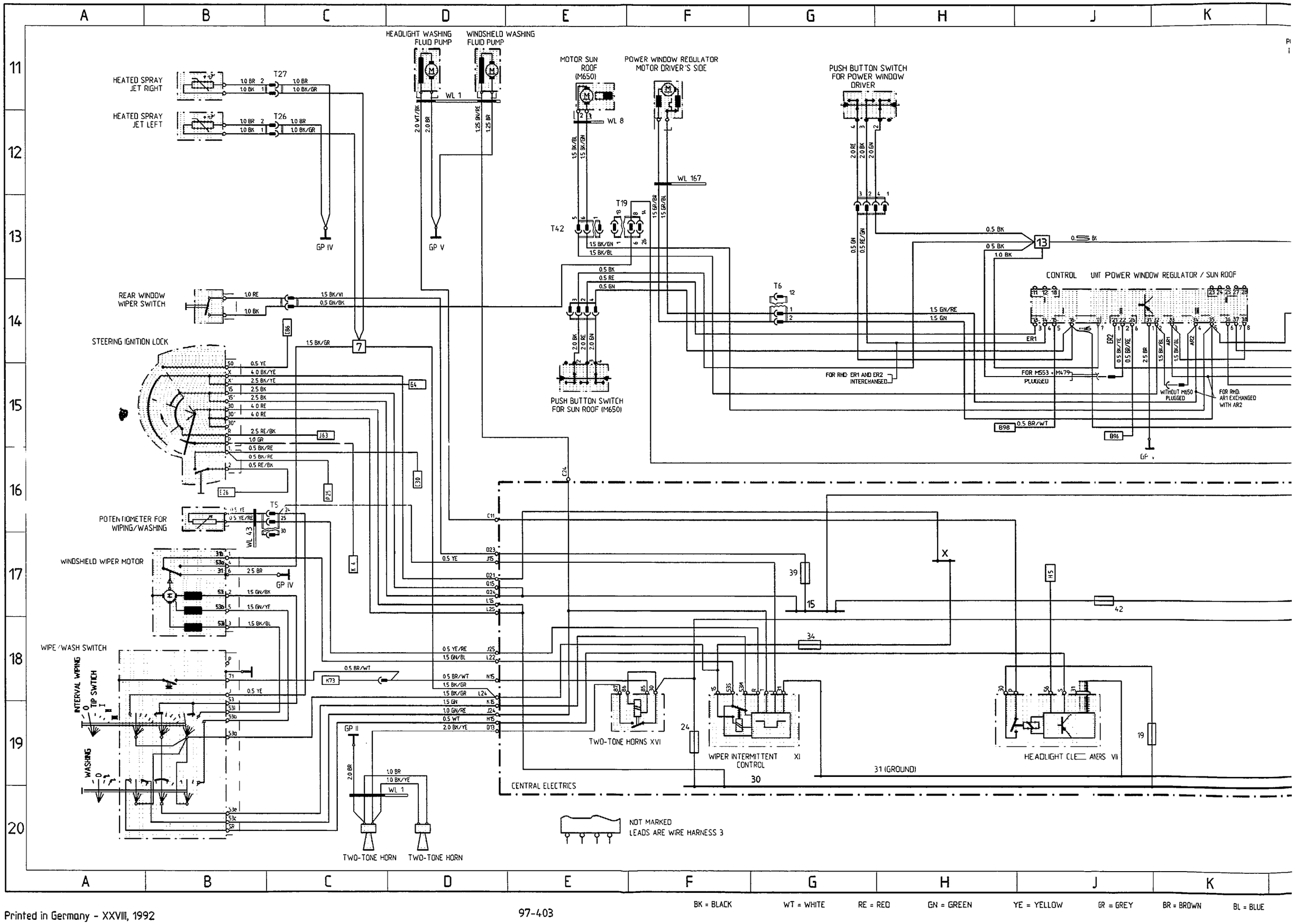


BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

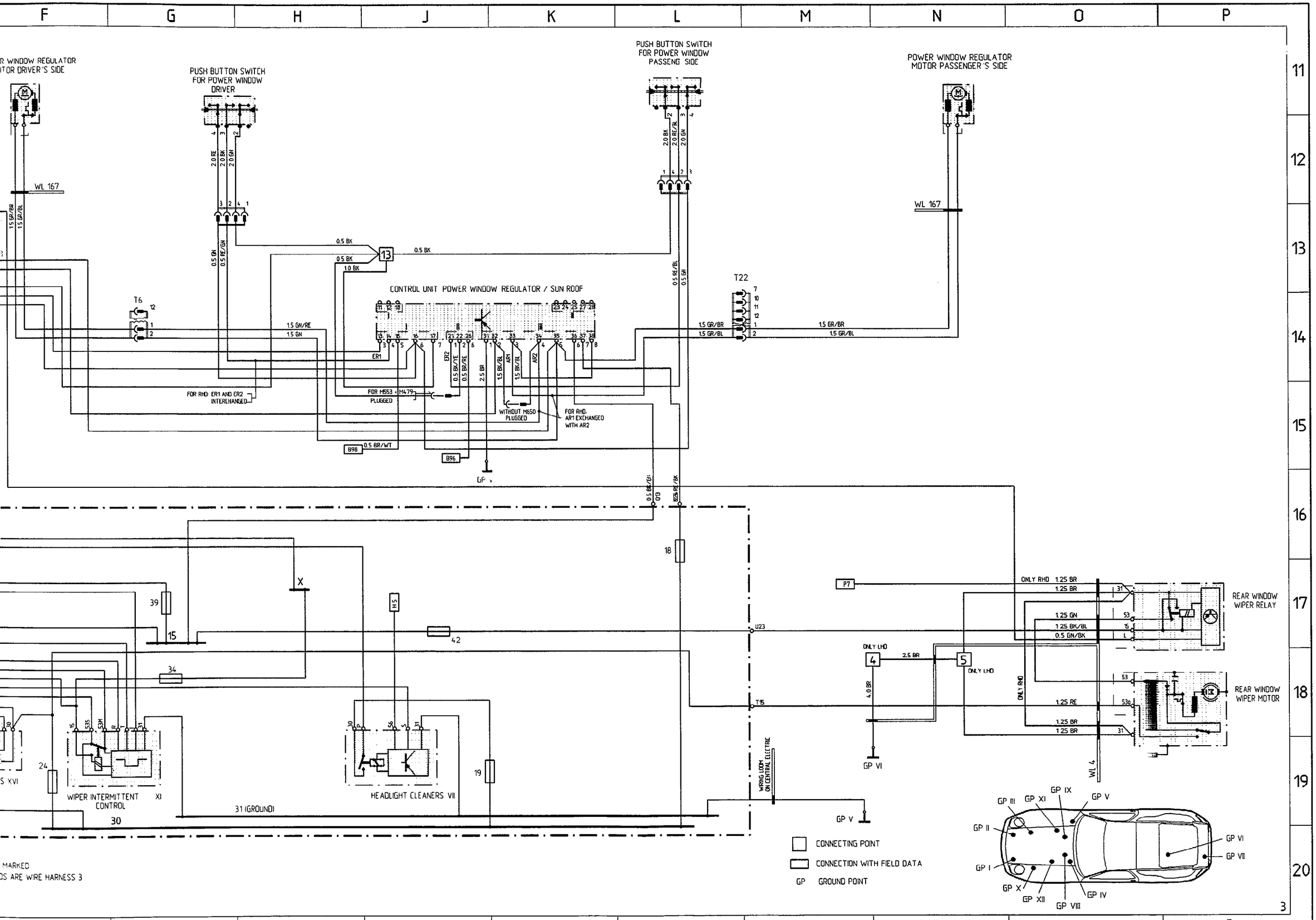

F
G
H
J
K
L
M
N
O
P
1
2
3
4
5
6
7
8
9
10
CLOCK
LIGHT SWITCH
HAZARD LIGHT SWITCH
TURN SIGNAL/DIMMER SWITCH
TURN SIGNALS
LOW BEAM
(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH
BULB CONTROL UNIT
FAILURE STOP LIGHT
FAILURE SIDE MARKER LIGHT
SIDE MARKER LIGHT
WL 170
T13
TAIL LIGHTS RIGHT
SIDE MARKER LIGHT
TURN SIGNALS
STOP LIGHTS
BACKUP LAMP
WL 4
BACKUP LIGHT SWITCH (M481)
WL 16
WL 39
LICENSE PLATE LIGHTS
GP VI
TAIL LIGHTS LEFT
BACKUP LAMP
STOP LIGHTS
TURN SIGNALS
SIDE MARKER LIGHT
SIDE MARKER LIGHT
WL 43
T5
T51
WL 12
T19
GP IV
J17
J33
J123
G29
G30
G99
H98
T12
T8
T10
T11
WL 8
WL 5
WL 185
STOP LIGHTS
BRIDGE M481 INSTEAD REL. XVII
FLASHER XIII
BACKUP LIGHT XVIII ONLY M249
XXIII-XXIV LIGHT COMBINATION
CENTRAL ELECTRICS
IME RUNNING LIGHT III
CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT
ONLY M249
0.75 BK/YE/RE
0.75 GR/YE
0.5 RE/BK
0.5 BK/YE
0.75 BK/GN
2.0 BK/WT/GN
0.75 BK/WT
0.5 BK/WT/GN
1.0 BK/WT
0.5 GR/RE
0.5 GR/GN
0.5 RE/BK
0.75 GR/RE
0.75 GR/BK
0.75 GR/VI
0.75 BK/BL
0.75 BR
0.75 BL
1.25 BK/BL
1.25 BR
1.25 GR
2.0 BR
4.0 BR
1.0 BR
1.0 GR
1.0 BK/RE
1.5 BR
1.5 BK/RE
1.5 GR
1.5 BK
BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

928 GTS MODEL 93 SHEET 3

BODY



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

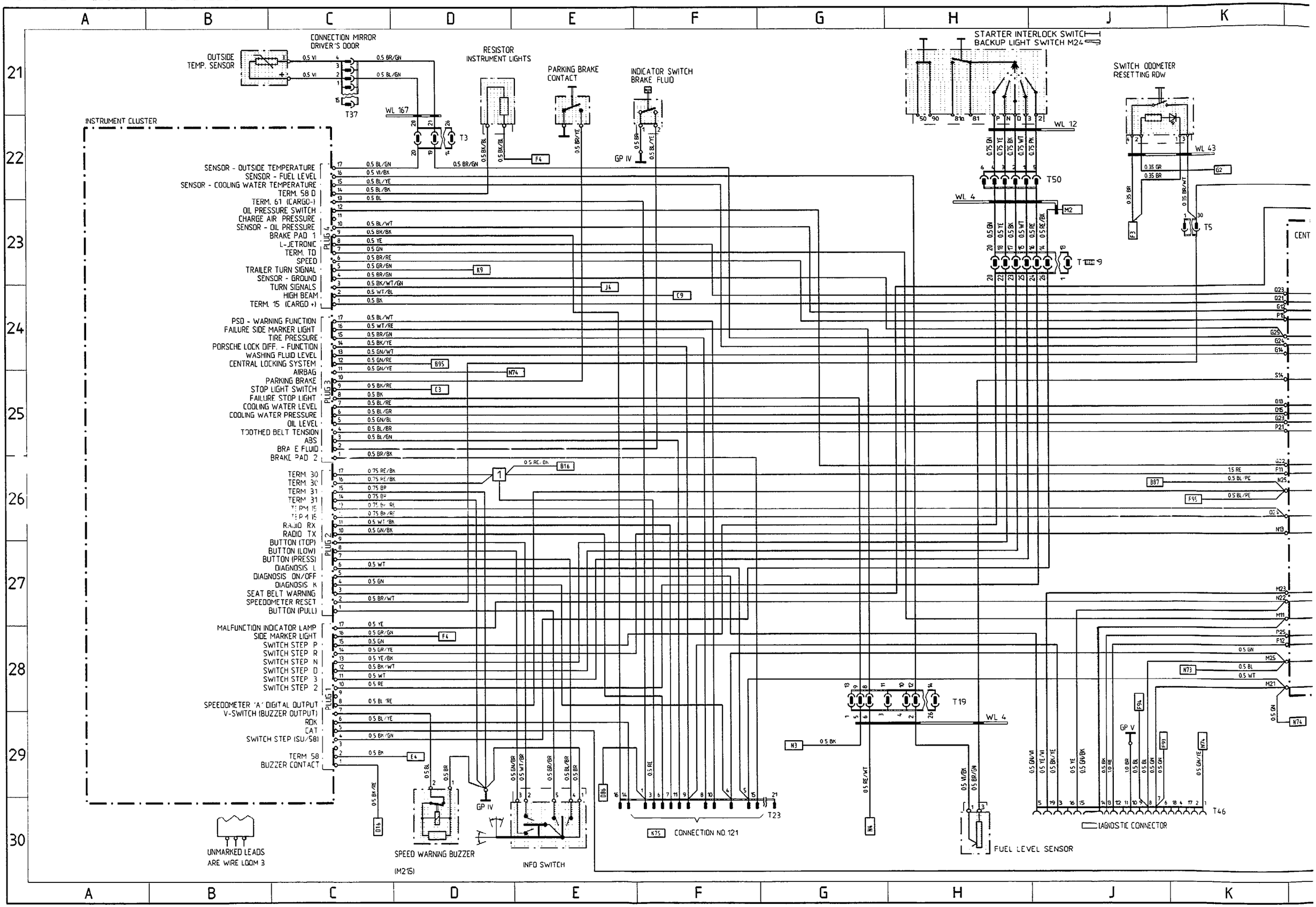


MARKED
DS ARE WIRE HARNESS 3

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 4

INSTRUMENT CLUSTER AND SENDERS



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

21 22 23 24 25 26 27 28 29 30

STARTER INTERLOCK SWITCH
BACKUP LIGHT SWITCH M249

SWITCH ODOMETER RESETTING RDW

SWITCH ODOMETER RESETTING M553

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT

TOOTHED BELT TENSION SWITCH

SEAT BELT

CENTRAL ELECTRICS

RELAY FOR FCU XIX

RELAY SOCKET ONLY FOR LHD
TIMING RELAY (M 216,M553)

WL 12 WL 43 WL 4 WL 15 WL 1 WL 2 WL 202

T50 T5 T19 T23 T46 T18

M2 M5 M6 M83 M84 M85 M87

N3 N13 N25 N73 N74 N84

C9 C16 C88 C75

L87 L89

F3 F11 F12 F93 F94 F95

B87 B99

G64 N74

GP V

39 41 43 25 30 15

OIL LEVEL SWITCH

COOLANT TEMP. SENSOR

OIL PRESSURE SENSOR

THERMOELEMENT NO.2

THERMOELEMENT NO.1

CATALYTIC CONVERTER CONTROL (M 193)

SWITCHING UNIT 2

SWITCHING UNIT 1

WASHING FLUID LEVEL

COOLANT LEVEL SWITCH

PRESSURE SWITCH COOLANT

DIAGNOSTIC CONNECTOR

FUEL LEVEL SENSOR

CONNECTION NO 121

ONLY RHD
ONLY LHD

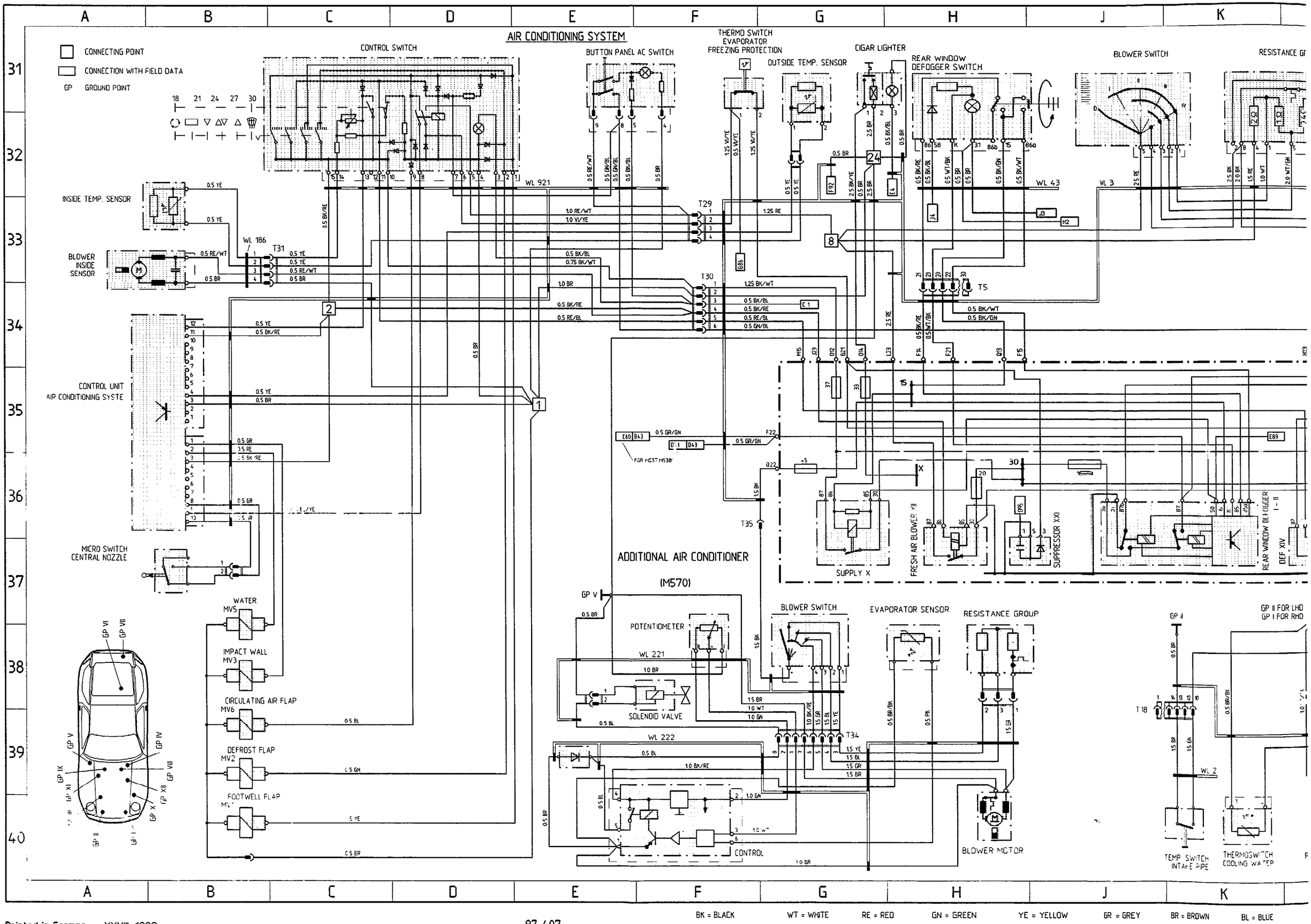
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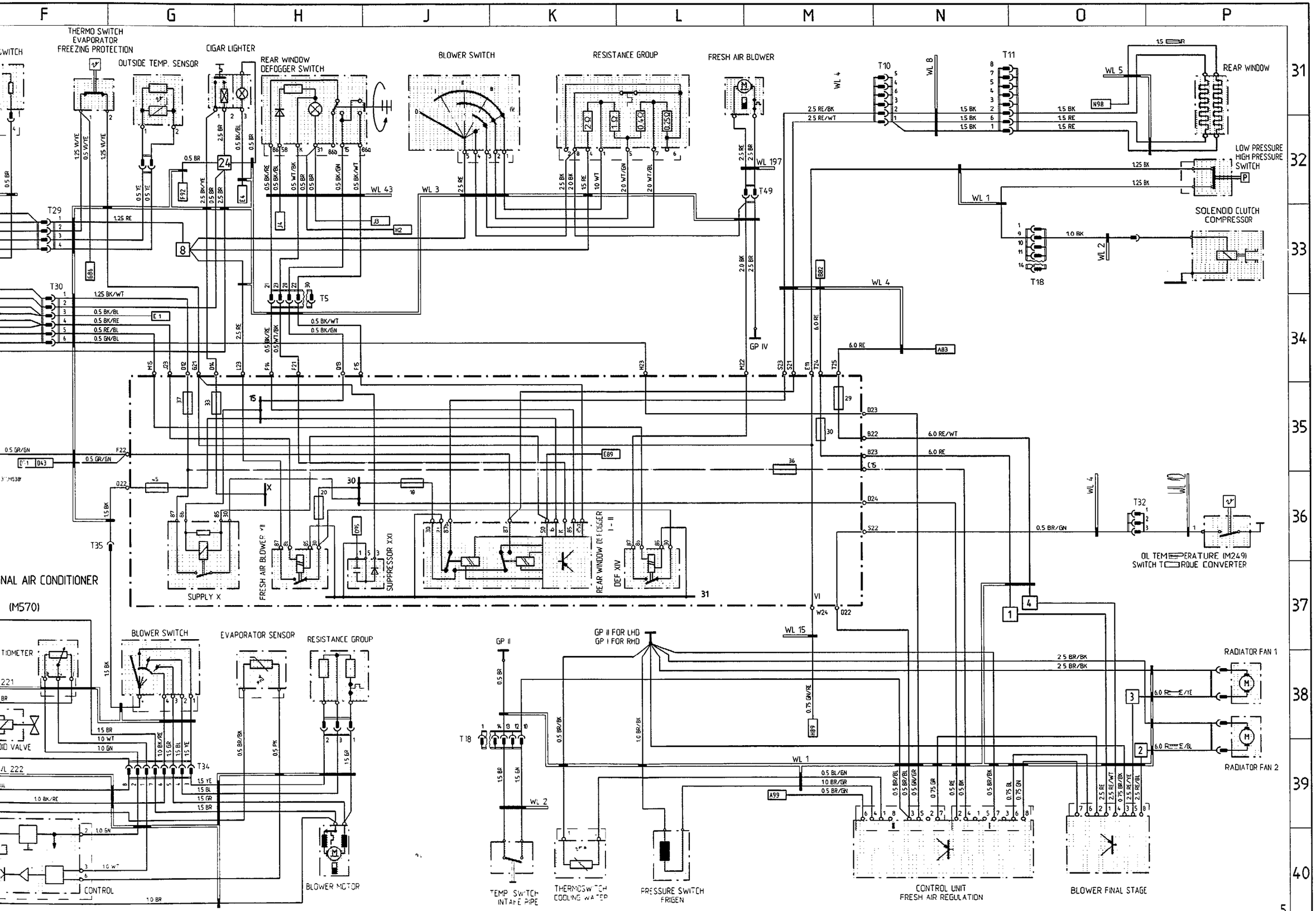
F G H J K L M N O P

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928 GTS MODEL 93 SHEET 5

ENGINE COOLING, HEATER, AIR CONDITIONER




F
G
H
J
K
L
M
N
O
P
31
32
33
34
35
36
37
38
39
40
THERMO SWITCH EVAPORATOR FREEZING PROTECTION
OUTSIDE TEMP. SENSOR
CIGAR LIGHTER
REAR WINDOW DEFOGGER SWITCH
BLOWER SWITCH
RESISTANCE GROUP
FRESH AIR BLOWER
T10
T11
WL 4
WL 8
WL 5
REAR WINDOW
N98
LOW PRESSURE HIGH PRESSURE SWITCH
SOLENOID CLUTCH COMPRESSOR
T18
WL 1
WL 2
WL 197
T49
GP IV
T29
T30
T5
T35
T34
T32
OIL TEMPERATURE (M249) SWITCH TORQUE CONVERTER
SUPPLY X
FRESH AIR BLOWER VII
SUPPRESSOR XXI
REAR WINDOW DEFOGGER I - II
DEF XIV
NAL AIR CONDITIONER
(M570)
BLOWER SWITCH
EVAPORATOR SENSOR
RESISTANCE GROUP
CONTROL
BLOWER MOTOR
GP II
GP II FOR LHD
GP I FOR RHD
WL 15
RADIATOR FAN 1
RADIATOR FAN 2
TEMP SWITCH INTAKE PIPE
THERMOSWITCH COOLING WATER
PRESSURE SWITCH FRIGEN
CONTROL UNIT FRESH AIR REGULATION
BLOWER FINAL STAGE
BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

928 GTS MODEL 93 SHEET 6

OUTSIDE MIRROR, POWER SEAT

MIRROR PASSENGER'S SIDE (M261, M528)

CONNECTION MIRROR

T36

T4

T22

WL 167

TE 31 CP

WL 3

F35

GP V

T6

CHANGEOVER SWITCH

T3

GP IV

MIRROR SWITCH

CP 1

D21 OUTSIDE TEMP. SENSOR

T37

DISCONNECTING POINT MIRROR

MIRROR DRIVER'S SIDE

CENTRAL ELECTRICS

M12

CONNECTION POWER SEAT RIGHT

T21

WL 227

SEAT HEATE POWER SEA INVERSELY I WITH LEFT

T20

SPORT SEAT
(M383, M387)

2-WAY SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

SEAT CUSHION HEIGHT CONTROL FRONT

WIRING LOOM ON SWITCH

SEAT BACKREST CONTROL

CONNECTION POWER SEAT LEFT

SEAT CUSHION HEIGHT CONTROL REAR

WL 343
NOT APPLICABLE WITH M139 M340, M586, M513

SEAT LUMBAR (MS86) HEIGHT CONTROL (MS13)

SEAT LUMBAR (MS86) CURVE CONTROL (MS13)

WL 337 M340, M

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

41 42 43 44 45 46 47 48 49 50

ADJUSTABLE SEAT HEATING (M139, M340)

COMFORT SEAT - STANDARD LEFT

SPORT SEAT (M383, M387)

CONNECTION POWER SEAT RIGHT

SEAT HEATER AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

DELAYING RELAY

SEAT HEATER SWITCH

BACKREST

SEAT

SIDE ELEMENTS

WIRING LOOM ON SWITCH

WL 337/338/340

CENTRAL ELECTRICS

T21

T20

WL 227

GP V

GP IV

4-WAY SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

SEAT BACKREST CONTROL

CONNECTION POWER SEAT LEFT

2-WAY SWITCH

WL 343
NOT APPLICABLE WITH M139
M340, M586, M513

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

SEAT LUMBAR (M586) CURVE CONTROL (M513)

WL 337 WITH M139, M340, M513, M586

SEAT CUSHION HEIGHT CONTROL FRONT

SEAT BACK FORWARD CONTROL

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

WL WIRING LOOM

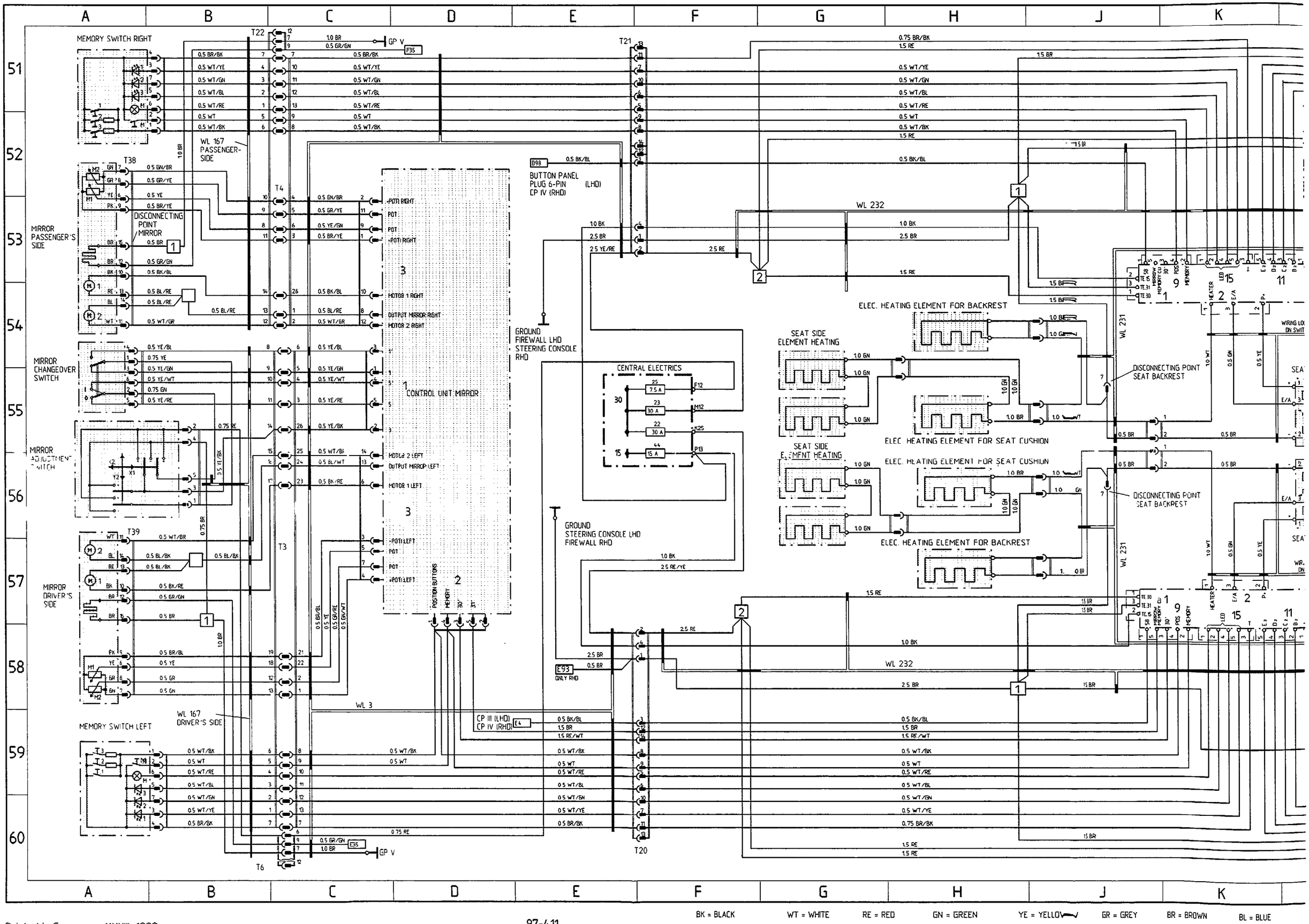
6

F G H J K L M N O P

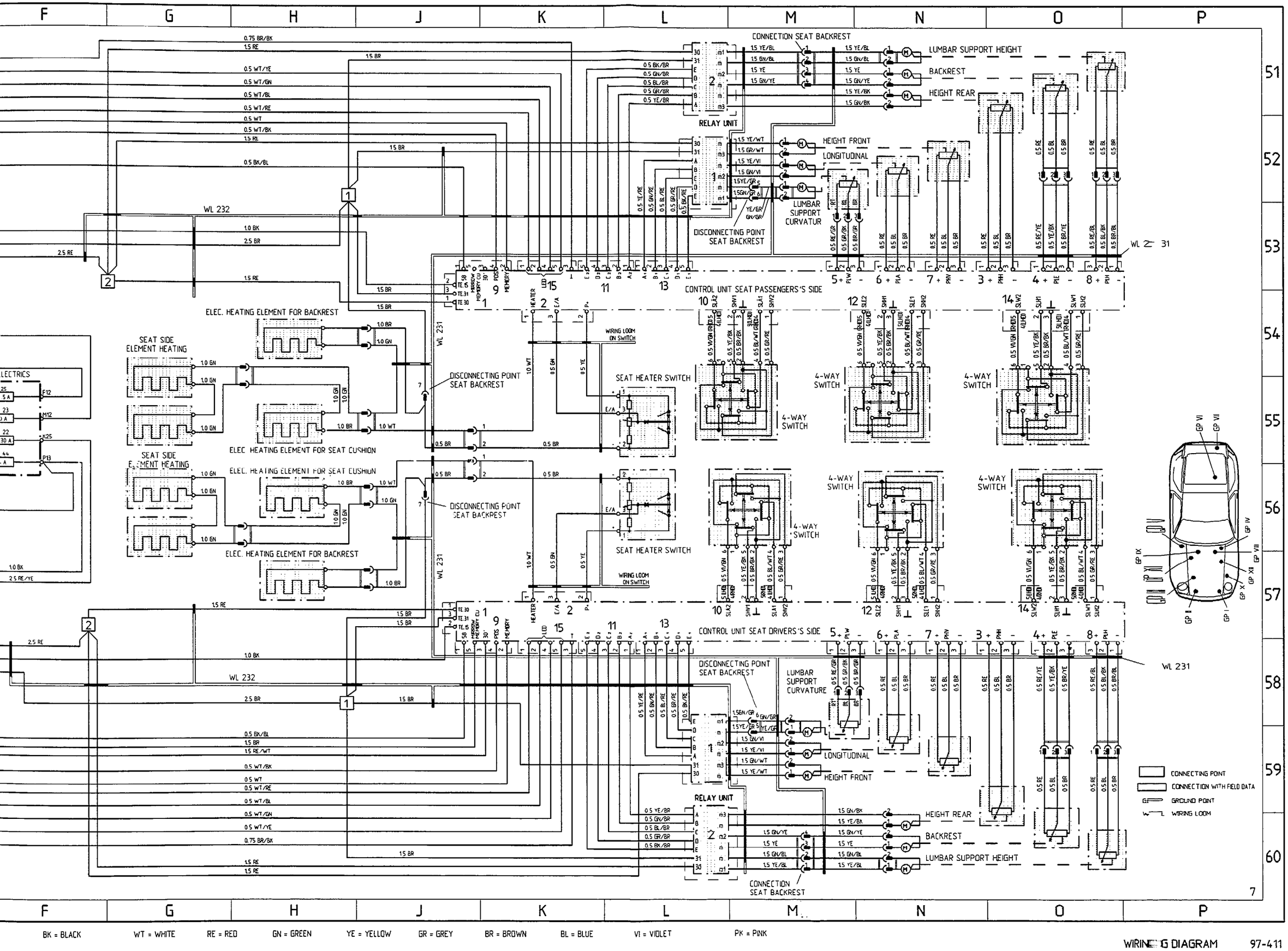
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 7

(M537, M538) SEAT AND MIRROR MEMORY



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 8

RADIO, TELEPHONE

ROOF ANTENNA

NOT ON C-NETWORK

ANTENNA EXTENSION WIRE

1.0 WT

2.5 RE

2.5 BR

0.5 BR/YE

0.5 BR/YE

PIN 3 (MUTE) NOT ON CD-PLAYER

RADIO AND CD-PLAYER

ALARM CONTACT IN CD-PLAYER

ALARM CONTACT IN RADIO SUPPORT FRAME

SUPPRESSOR

15 BR

2.5 RE/BK

WL 3

GP V

TELEPHONE RECEIVER

NOT CONTAINED IN M

4.0 BR

4.0 RE

ROW M327+M692 CD - CHANGER

INTERFACE

928.645.450.00 M692

CONNECTION 8-WIRE RADIO - CD - CHANGER

USA/JAPAN M331+M692/M332+M692 CD - CHANGER

BOOSTER LEFT RIGHT

15 BL 15 BR/BK

15 BR/WT 15 BL/WT

T6

T22

WL 167 LEFT

WL 167 RIGHT

BOOSTER 15 A

F24

21

TERM. 15

CENTRAL EL

FRONT LEFT

HIGH RANGE RADIO SPEAKER

MIDDLE RANGE SPEAKER

15 GN 15 BR 15 YE 15 BR

SEPARATING FILTER DOOR LEFT

WL 4

15 VI 15 BR/BK 15 GN 15 BR

15 BR/WT 15 GN/WT 15 BR/VI 15 VI/WT

SEPARATING FILTER DOOR RIGHT

FRONT RIGHT

HIGH RANGE RADIO SPEAKER

MIDDLE RANGE SPEAKER

DEEP RANGE SPEAKER

REAR LEFT

WL 69 LEFT

WL 69 RIGHT

REAR RIGHT

MIDDLE RANGE SPEAKER

15 VI 15 BR

HIGH RANGE RADIO SPEAKER

15 GN 15 BR/WT

TELEPHONE RECEIV

NOT CONTAINED IN M

CONNECTION PLAN BOOSTER

SPEAKER PLUG DEEP RANGE TUNER LEFT YELLOW

SPEAKER PLUG DEEP RANGE TUNER RIGHT RED

PRE-AMPLIFIER INPUT LF-WIRE

CONNECTION PLUG 6-PIN

SPEAKER PLUG FRONT LEFT WHITE

SPEAKER PLUG FRONT RIGHT BLACK

SPEAKER PLUG REAR RIGHT RED

SPEAKER PLUG REAR LEFT YELLOW

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

97-413

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

Printed in Germany - XXVIII, 1992

F G H J K L M N O P

61 62 63 64 65 66 67 68 69 70

ROOF ANTENNA

NOT ON C-NETWORK

INA
ISION WIRE

SUPPRESSOR

1.0 WT
2.5 RE
2.5 BR
0.5 BR/YE
0.5 BR/YE
2.5 RE

G92

15 BR
2.5 RE/BK

PIN 3 (MUTE)
NOT ON
CD-PLAYER

RADIO AND CD-PLAYER

ALARM CONTACT IN
RADIO SUPPORT
FRAME

ALARM CONTACT
IN CD-PLAYER

WL 3

C15

4.0 BR

GP V

4.0 RE

BOOSTER

LEFT

RIGHT

15 BL
15 BR/BK

T6

WL 167 LEFT

15 BR/WT
15 BR/WT

T22

WL 167 RIGHT

15 BR/WT
15 BR/WT

WL 4

15 GN
15 BR
15 YE
15 BR

SEPARATING FILTER
DOOR LEFT

15 VI
15 BR/BK
15 GN
15 BR

15 BR/WT
15 GN/WT
15 BR/VI
15 VI/WT

SEPARATING FILTER
DOOR RIGHT

15 GN
15 BR
15 YE
15 BR

FRONT RIGHT

HIGH RANGE
RADIO SPEAKER

MIDDLE RANGE
SPEAKER

DEEP RANGE
SPEAKER

WL 69 LEFT

WL 69 RIGHT

15 VI
15 BR

15 GN
15 BR/WT

REAR RIGHT

MIDDLE RANGE
SPEAKER

HIGH RANGE
RADIO SPEAKER

CTING POINT

TION WITH FIELD DATA

D POINT

TELEPHONE PREPARATION C-NETWORK M 612

(Philips "Porty")

TELEPHONE RECEIVER

NOT CONTAINED IN M612

CONNECTION CABLE
TELEPHONE RECEIVER PLATES

WIRE HARNESS FOR
TELEPHONE RECEIVER

15-WIRE

TRANSMITTER-RECEIVER
C-NETWORK
NOT CONTAINED IN M612

COMBINED RADIO AND
TELEPHONE ANTENNA

ANTENNA

RADIO

RADIO

COMBINER

ANTENNA LEAD
RADIO CROSS-OVER

WIRING LOOM
C-NETWORK SUPPLY

C81 PLUS LEAD
FOR TELEPHONE

15 A

NON-CES FUSE
IN BATTERY COMPARTMENT

4.0 RE

4.0 BK

GP I

0.5 PK

RADIO MUTE

RADIO PLUG CHAMBER 3
NOT CONNECTED

RADIO ANTENNA INPUT

0.5 YE
0.5 GR
0.5 WT

> NOT CURRENTLY CONNECTED

30

F24

BOOSTER
15 A

21

TELEPHONE

TERM.15

N24

0.5 GN

43

CENTRAL ELECTRICS

1.0 RE
1.0 RE

TELEPHONE PREPARATION CELLULAR M T 95

(Motorola)

GP I

WIRING LOOM
CELLULAR

0.5 GN/BK

TRANSMITTER-RECEIVER
CELLULAR

ANTENNA CELLULAR

NOT CONTAINED IN M612

1.0 BR
1.0 BR

TELEPHONE RECEIVER

MULTI-LEAD
8 WIRE

BL
BR
GN
WT

NOT CONTAINED IN M195

NOT CONTAINED IN M195

CONNECTION LOUDSPEAKER
(FREE-HANDED SPEAKING)

CONNECTION MICROPHONE
(FREE-HANDED SPEAKING)

8

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 9

ABS, TIRE PRESSURE CONTROL, AIRBAG, PORSCHE LOCK DIFFERENTIAL, BRAKE PAD WEAR INDICATOR, TRAILER COUPLING

ABS - ANTILOCK SYSTEM AND PSD - PORSCHE LOCK DIFFERENTIAL

SOLENOID VALVE

GP X

GROUND STRAP NO. 928.612.189.01

HYDRAULIC UNIT ABS

6 mm²

1.5 GN/WT

1.5 YE/RE

1.0 GN/WT

1.5 GN/WT

0.5 GN/BK

0.75 BR/GN

1.0 BK/BR

4.0 RE

1.5 GN/VI

1.5 GN/YE

1.5 GN/RE

2.5 GN/WT

0.5 BL/GN

0.75 GN/BL

4.0 RE — F82

WIRE CONNECTOR

B85 — 10.0 RE — WL 2

PRESSURE WARNING SWITCH

0.5 BL/WT

0.5 BL/WT

0.5 BL/YE

PUMP

0.75 BR/RE

0.75 BR

4.0 BR

4.0 BK

PUMP RELAY

1.5 BR

0.75 BK/RE

4.0 RE/BK

4.0 RE — F83

GP IV

AIRBAG LEFT

0.5 GR/BL

0.5 GR/RE

0.5 BR/WT

ACCELERATING SENSOR (M221)

C48

0.5 BR/BL

0.5 YE/BL

0.5 RE/BL

GP IV

T23

0.5 BR

0.5 BK/RE

0.5 BL/GN

0.5 BK/YE

0.5 RE

0.5 BL/WT

1.5 BK/RE

2.0 RE

0.5 VI/RE

F30

DISCONNECTING POINT NO.3

0.5 WT

0.5 GN

0.5 BK/WT

0.5 BL

0.5 BK/WT

0.5 GN

0.5 WT

0.5 GN/BK

0.5 WT/BK

0.5 BL/YE

0.5 VI/RE

0.5 VI/GN

0.5 VI/WT

0.5 VI/YE

0.5 BR

0.5 YE

0.5 WT

0.5 GN

0.5 RE

CONTROL UNIT TYRE PRESSU

WL 121

RDK - TIRE PRESSURE CO

GP IV

10 BR

GP XII

COMBINATION LEADS

T17 — GP VI — REAR RIGHT

T16 — GP VI — REAR LEFT

T15 — GP XI — FRONT RIGHT

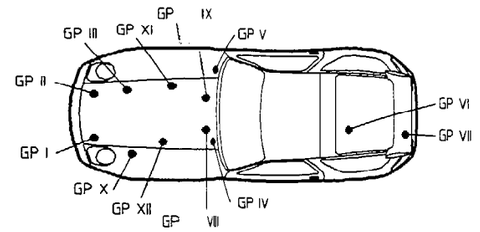
T14 — GP XII — FRONT LEFT

BRAKE PAD WEAR INDICATOR

HF SENSOR

SPEED SENSOR

GP WHEEL SUSPENSION



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

AND PSD - PORSCHE LOCK DIFFERENTIAL

AIRBAG

AIRBAG CONTROL UNIT

AIRBAG LEFT

SHORT-CIRCUITING BRACKET

SLIDING CONTACT UNIT

STEERING WHEEL WITH HORN CONTACT

ACCELERATING SENSOR (M221)

AIRBAG RIGHT

CRASH SENSOR RIGHT

CRASH SENSOR LEFT

TRAILER COUPLING (M 208)

PLUG SOCKET TRAILER COUPLING

GROUND ABS

XV ABS

DISCONNECTING POINT NO.3

CONTROL UNIT TYRE PRESSURE CONTROL

RDK - TIRE PRESSURE CONTROL

CENTRAL ELECTRICS

COMBINATION LEADS

FRONT RIGHT

FRONT LEFT

BRAKE PAD WEAR INDICATOR

HF SENSOR

SPEED SENSOR

GP WHEEL SUSPENSION

REAR FOG LIGHT

BULB CONTROL UNIT - STOP LIGHTS

TURN SIGNAL REAR RIGHT

TURN SIGNAL REAR LEFT

BULB CONTROL UNIT - SIDE MARKER LIGHT RIGHT

BULB CONTROL UNIT - SIDE MARKER LIGHT LEFT

CONNECTING POINT

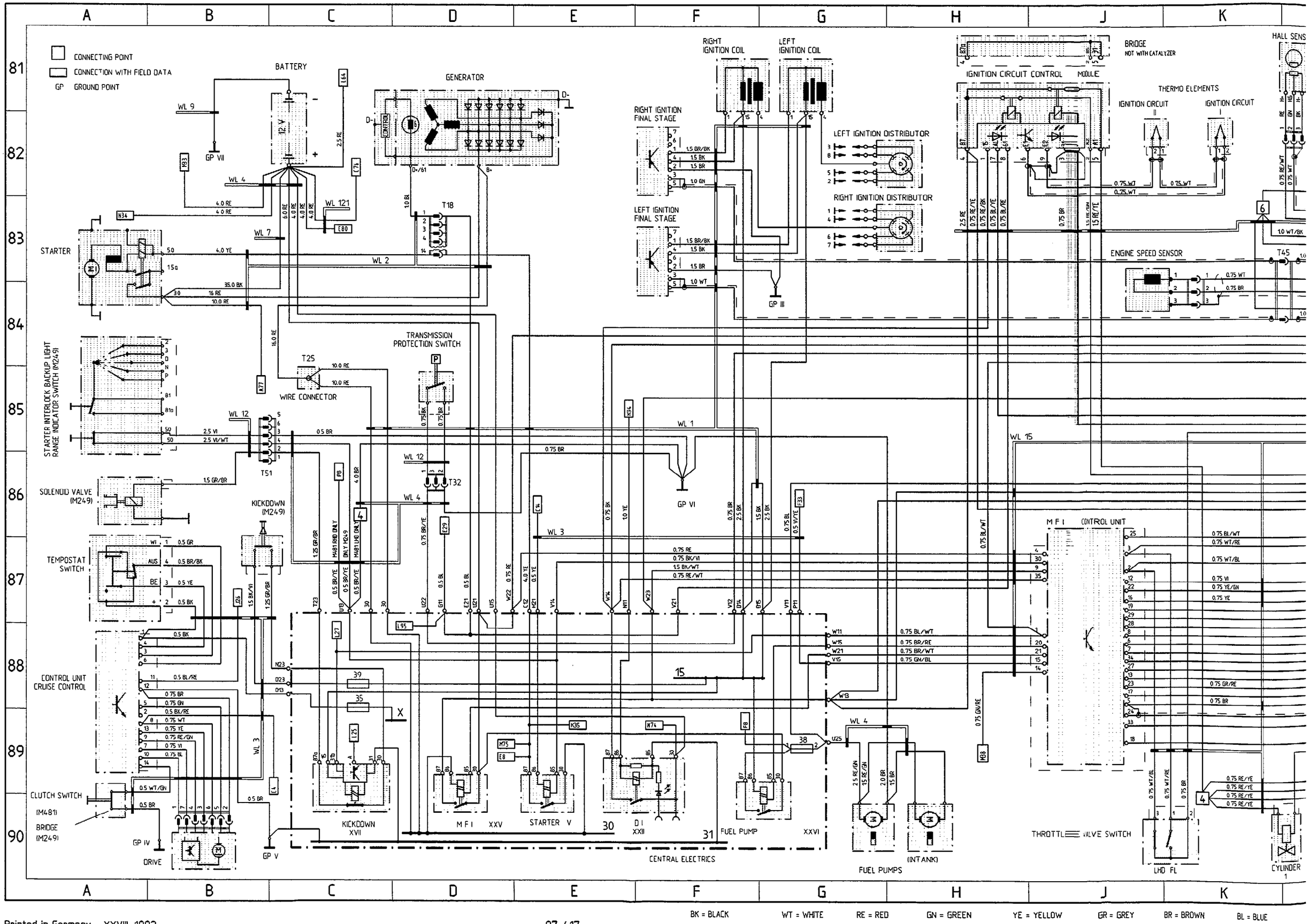
CONNECTION WITH FIELD DATA

GP GROUND POINT

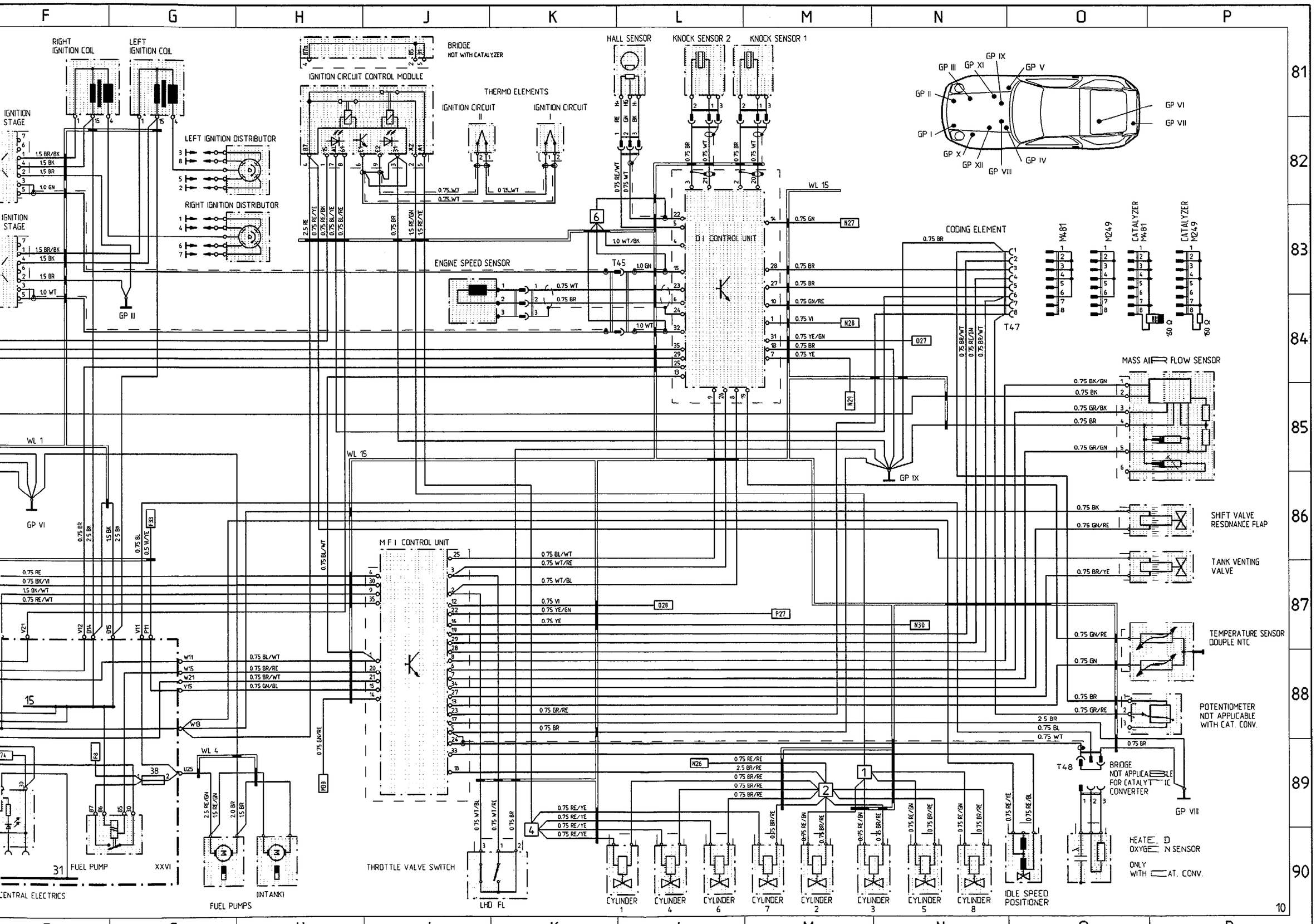
BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 10

MOTOR, FUEL AND IGNITION, CRUISE CONTROL



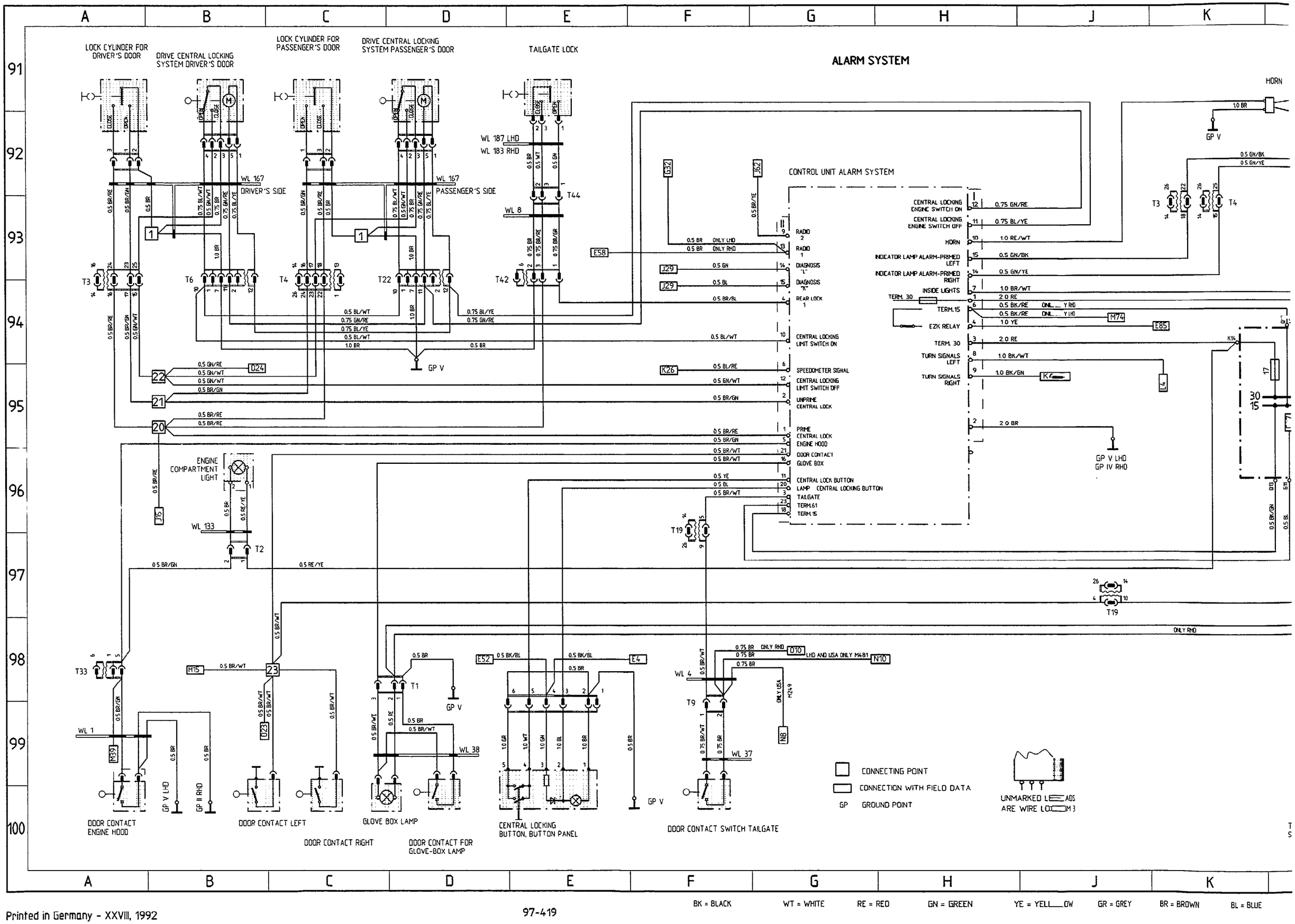
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BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 11

ALARM SYSTEM, CENTRAL LOCKING SYSTEM, INSIDE LIGHTS



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

ALARM SYSTEM

91 92 93 94 95 96 97 98 99 100

CONTROL UNIT ALARM SYSTEM

G32 J62 0.5 BR/YE

RADIO 2
RADIO 1
DIAGNOSIS "L"
DIAGNOSIS "K"
REAR LOCK 1
CENTRAL LOCKING LIMIT SWITCH ON
SPEEDOMETER SIGNAL
CENTRAL LOCKING LIMIT SWITCH OFF
UNPRIME CENTRAL LOCK
PRIME CENTRAL LOCK
ENGINE HOOD
DOOR CONTACT
GLOVE BOX
CENTRAL LOCK BUTTON
LAMP CENTRAL LOCKING BUTTON
TAILGATE
TERM.61
TERM.15

0.5 BR ONLY LHD
0.5 BR ONLY RHD
J29 0.5 GN
J29 0.5 BL
0.5 BR/BL
0.5 BL/WT
K26 0.5 BL/RE
0.5 GN/WT
0.5 BR/GN
0.5 BR/RE
0.5 BR/GN
0.5 BR/WT
0.5 BR/WT
0.5 YE
0.5 BL
0.5 BR/WT

T19 (26/9)

CENTRAL LOCKING ENGINE SWITCH ON 12 0.75 GN/RE
CENTRAL LOCKING ENGINE SWITCH OFF 11 0.75 BL/YE
HORN 10 1.0 RE/WT
INDICATOR LAMP ALARM-PRIMED LEFT 15 0.5 GN/BK
INDICATOR LAMP ALARM-PRIMED RIGHT 14 0.5 GN/YE
INSIDE LIGHTS 7 1.0 BR/WT
TERM. 30 1 2.0 RE
TERM.15 6 0.5 BK/RE ONLY RHD / 0.5 BK/RE ONLY LHD
EZK RELAY 4 1.0 YE — M74 — E85
TERM. 30 3 2.0 RE — K14
TURN SIGNALS LEFT 8 1.0 BK/WT
TURN SIGNALS RIGHT 9 1.0 BK/GN — K4 — L4
2 2.0 BR — GP V LHD / GP IV RHD

HORN — 1.0 BR — GP V

T3 (26/14/22) T4 (26/14/25)

0.5 GN/BK
0.5 GN/YE

WL 167 DRIVER'S SIDE

ALARM-PRIMED INDICATOR LAMP, DRIVER'S SIDE
FLOOR LAMP DRIVER'S SIDE
FLOOR LAMP PASSENGER'S SIDE
ALARM-PRIMED INDICATOR LAMP, PASSENGER'S SIDE

0.5 RE 0.75 RE 0.75 BR/WT — DOOR LOCK LIGHT DRIVER'S SIDE
0.75 BR 0.75 BR/WT — WL 167 PASSENGER'S SIDE
0.75 BR/WT 1.0 BR 0.75 RE — T6 (12/5/7/1/6)
0.75 RE 1.0 BR 0.75 BR/WT — T22 (12/5/1/7/6)
0.75 BR/WT 0.5 RE 0.5 RE — DOOR LOCK LIGHT PASSENGER'S SIDE

LIGHTS CENTRAL ELECTRIC (2/1)

0.5 BR/WT — 1.0 BR — GP V
0.75 BR/WT
0.75 RE

0.5 RE/YE — K25 — P24 — F12

D12 D21 — 30 / 15 — D87 — 17 — 22 — 25 — 26

H36 — F11 — 0.5 RE/BK — F23

CENTRAL ELECTRICS

D13 G11 F13 D11 S11 T14 S15 U11

0.5 BR/GN 0.5 BL 1.0 RE 1.0 RE 1.0 YE 1.0 YE 1.0 YE 1.0 RE

ONLY RHD M10 — M10 ONLY LHD

WL 4 — T10 (4/1/3/2/6/5)
0.5 RE 1.5 BR 2.0 BR 0.5 BR/WT

WL 8 — T11 (1/2/4/6/3/8/7/5)
1.5 BK 1.5 BR 1.5 BK

D31 1.5 BR — 1
0.5 WT 0.5 BR
WL 5
0.5 GN

0.5 RE 1.5 BR 0.5 BR/WT
0.75 RE 0.75 BR 0.75 BR/WT

T19 (26/14/4/10)

ONLY RHD

0.75 BR ONLY RHD — D10
0.75 BR — LHD AND USA ONLY M481 — N10
0.75 BR
0.5 BR/WT — WL 4 — T9 (1/2) — ONLY USA M249 — N8
0.75 BR/WT 0.75 BR — WL 37
GP V

DOOR CONTACT SWITCH TAILGATE

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT

UNMARKED LEADS ARE WIRE LOOM 3

1.0 RE 1.0 RE ONLY LHD 1.0 YE — TAILG. UNLOCK SWITCH (30b/53)

1.0 YE 0.5 BR/WT 1.0 RE — WL 4 — TAILGATE UNLOCKING DRIVE (2/3/4/1)

INSIDE LIGHTS TAILGATE II
INSIDE LIGHTS TAILGATE I
INSIDE LIGHTS ROOF

11

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 93 SHEET 12

CENTRAL ELECTRIC

	FUSE OUTPUT	FUSE INPUT		FUSE OUTPUT	FUSE INPUT
1	LOW BEAM LEFT	A15	7.5A → XXIII-XXIV 56b		
2	LOW BEAM RIGHT	A14	7.5A → XXIII-XXIV 56b		
3	HIGH BEAM LEFT	A25	7.5A → XXIII-XXIV 56a, VII 85		
4	HIGH BEAM RIGHT	A24	7.5A → XXIII-XXIV 56a, VII 85		
5	ADDITIONAL DRIVING LIGHTS	B14	15A → H 13, XXII-XXIV 86		
6	FOG LIGHT	VII 30 (ONLY M193)	15A → III 87, IV 87		
7	SIDE MARKER LIGHT LEFT	T11,D11	5A → K 13		
8	SIDE MARKER LIGHT RIGHT	S25,D21	5A → H 14		
9	ASHTRAY- INSTRUMENT-LIGHTS	K11	5A		
10	LICENSE PLATE LIGHTS	J22,T21	5A → J 12		
11	REAR FOG LIGHT	T12	5A → H 24		
12	TURN SIGNAL FRONT LEFT	J11,C13	5A → J 21		
13	TURN SIGNAL REAR LEFT	T22	5A		
14	TURN SIGNAL FRONT RIGHT	C23	5A → H 25		
15	TURN SIGNAL REAR RIGHT	T13	5A		
16	REAR WINDOW DEFOGGER	I-II 30	25A → 30		
17	WARNING FLASHER ENGINE COMPARTMENT LIGHT	K14	15A → 30		
18	POWER WINDOW REGULATOR SUN ROOF	K24	25A → X 30		
19	HEADLIGHT CLEANING SYSTEM	VII 30	25A → V 30		
20	FRESH AIR BLOWER	XII 30	30A → L 15		
21	BOOSTER GLOVE BOX LAMP	F24	15A		
22	POWER SEAT LEFT LIGHTS CES	K25	30A		
23	POWER SEAT RIGHT	M12	30A → 24		
24	TWO-TONE HORNS	XVI 30, T15		15A → 23, L 25 XXIII-XXIV 30	
25	INSIDE LIGHTS DIAGNOSIS CONNECTION INSTRUMENT CLUSTER	XXI 1, F13		7.5A → D 24	
26	TAILGATE UNLOCKING	T14		1A → 30	
27	CONCEALED HEADLIGHT MOTOR	XXIII-XXIV 30a		15A → 30	
28	ABS	XV 30		15A → U 15, (B+)	
29	RADIATOR FAN 1	B22		30A → T 25, (B+)	
30	RADIATOR FAN 2	B23		30A → T 24, (B+)	
31					
32					
33	CIGAR LIGHTER	D14		25A → X	
34	WINDSHIELD WIPERS HEATED SPRAY JET	X15, L24		25A → D 21	
35	STOP LIGHT, CRUISE CONTROL	U24, D13		7.5A → XXIII-XXIV X	
36	CONTROL UNIT FAN	C15		5A → L 13	
37	AIR CONDITIONING SYSTEM	D12		7.5A	
38	FUEL PUMP, HEATER OXYGEN SENSOR	U25		15A → III 86, XXVI 87	
39	INSTRUMENT, CONTROL LAMPS KICKDOWN, SOLENOID VALVE SWITCH FOR REAR WINDOW WIPER	D23, D24		5A → S 24, XXVI 86	
40	BACKUP LIGHT, MIRROR ADJUSTMENT TIRE PRESSURE CONTROL	XVIII30, P14		7.5A	
41	LIGHTS, LIGHT SWITCH BUTTON PANEL RELAY TIMING CU INSIDE LIGHTS DIAGNOSIS CONNECTION TERM 15	P25		5A → 15	
42	REAR WINDOW WIPER	U23		7.5A → D 15	
43	TELEPHONE	N24, D25		7.5A → D 14	
44	SEAT HEATER	P13		15A → D 15	
45	ADD. AC	D22		15A → D 24	

I-II REAR WINDOW DEFOGGER

III DAYTIME RUNNING LIGHT

IV FOG LIGHT

V STARTER

X SUPPLY

XI WIPER INTERMITTENT CONTROL

XII FRESH AIR BLOWER

XIII FLASHER

XIV DEF

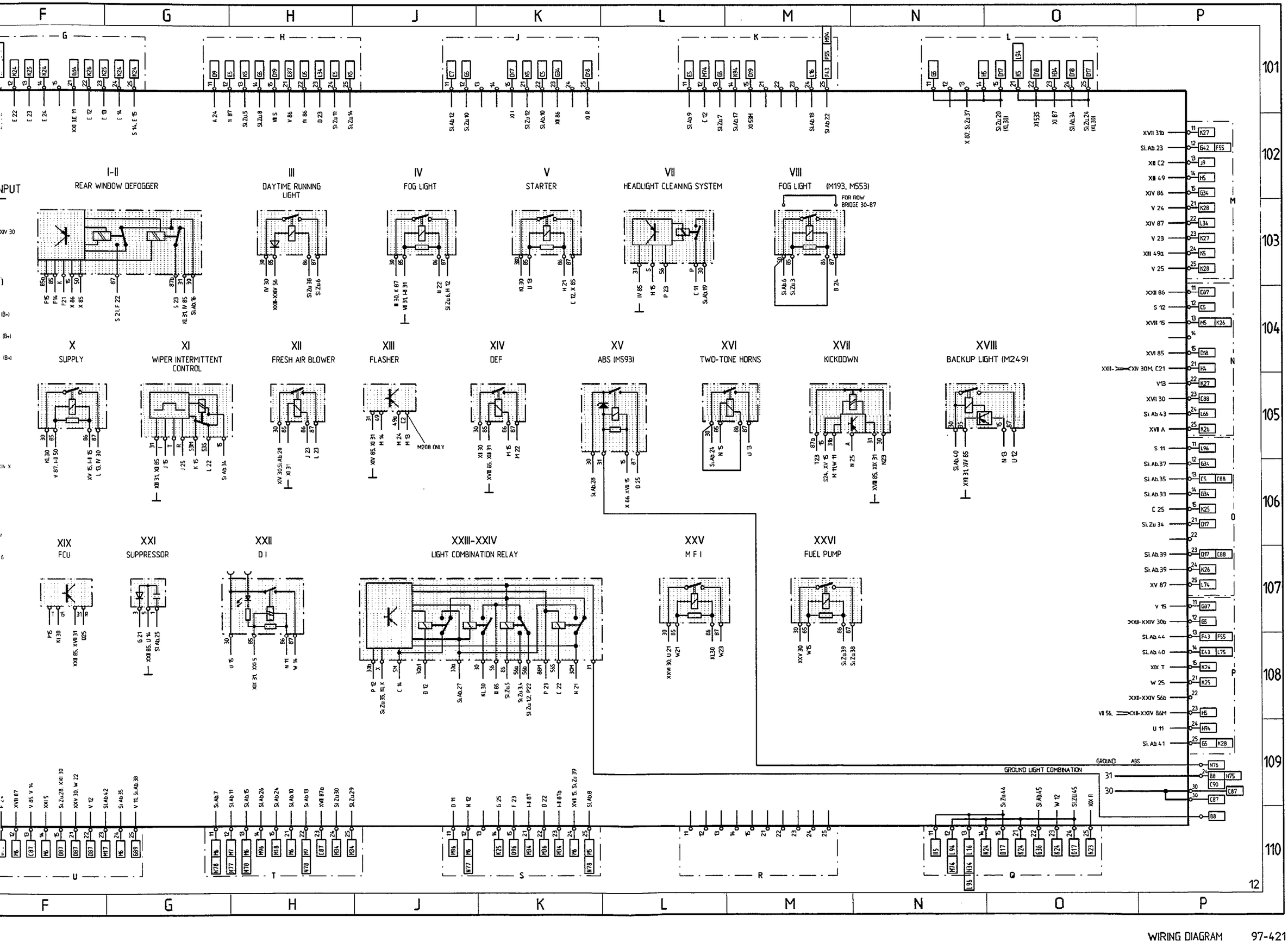
XV ABS (M59

XIX FCU

XXI SUPPRESSOR

XXII D I

XXIII-XXIV LIGHT COMBINATION RELAY


F
G
H
J
K
L
M
N
O
P
101
102
103
104
105
106
107
108
109
110
12
I-II
REAR WINDOW DEFOGGER
III
DAYTIME RUNNING LIGHT
IV
FOG LIGHT
V
STARTER
VII
HEADLIGHT CLEANING SYSTEM
VIII
FOG LIGHT (M193, M553)
FOR ROW BRIDGE 30-87
X
SUPPLY
XI
WIPER INTERMITTENT CONTROL
XII
FRESH AIR BLOWER
XIII
FLASHER
M208 ONLY
XIV
DEF
XV
ABS (M593)
XVI
TWO-TONE HORNS
XVII
KICKDOWN
XVIII
BACKUP LIGHT (M249)
XIX
FCU
XXI
SUPPRESSOR
XXII
D I
XXIII-XXIV
LIGHT COMBINATION RELAY
XXV
M F I
XXVI
FUEL PUMP
GROUND ABS
GROUND LIGHT COMBINATION

A	B	C	D	E	F	G	H	J	K

CONSTRUCTION COMPONENTS

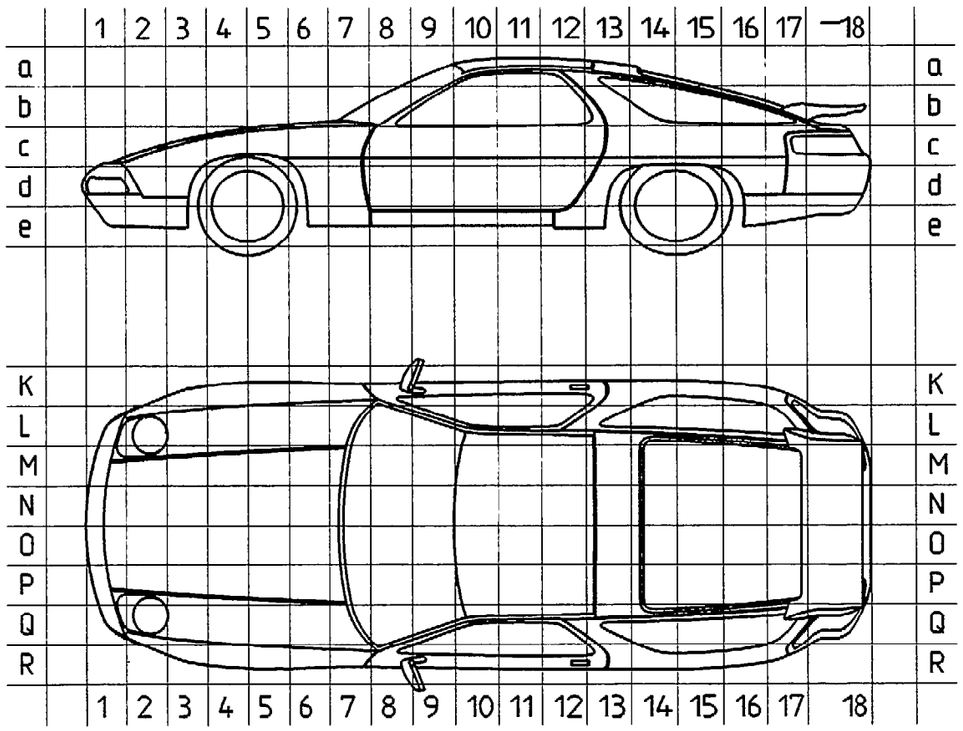
DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT	7cQ		IN DRIVER'S FOOTWELL ON SIDE	DJ 71-72
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT		7cQ	ABOVE CENTRAL ELECTRICS	DJ 71-72
ACCELERATING SENSOR	10eQ	10eQ	UNDER THE LEFT SEAT	K 73
AIR CONDITIONING SYSTEM CONTROL UNIT	8cN-O	8cN-O	IN HEATER BOX	AB 34-36
ASHTRAY LIGHT				GH 31
ALARM-PRIMED INDICATOR LAMPS				MP 91,92
BACKUP LIGHT SWITCH				P5, L1,2
BATTERY				C 82
BLOWER FINAL STAGE				O 39,40
BLOWER INSIDE SENSOR				AB 33,34
BLOWER MOTOR				H 40
BLOWER SWITCH FRESH AIR				JK 31,32
BLOWER SWITCH ADDITIONAL AIR CONDITIONING SYSTEM				G 37,38
BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	GH 64,65
BRAKE PAD WEAR INDICATOR				O-H 79,80
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
BUTTON PANEL AC SWITCH				EF 31,32
CENTRAL ELECTRICS	7dM	7dP	IN PASSENGER'S FOOTWELL ON FIREWALL	
CENTRAL LOCK BUTTON				E 99,100
CIGAR LIGHTER				GH 31
CLOCK				F 1
CLUTCH SWITCH				A 89,90
CODING ELEMENT				OP 83,84
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
CONCEALED HEADLIGHT LEFT				A 7
CONCEALED HEADLIGHT MOTOR				A 5,6
CONCEALED HEADLIGHT RIGHT				A 4
CONTROL UNIT CRUISE CONTROL	6dQ		IN DRIVER'S FOOTWELL BELOW THE FOOT REST	AB 88,89
CONTROL UNIT CRUISE CONTROL		7dN-O	IN CENTRE CONSOLE AT FRONT	AB 88,89
CONTROL UNIT ALARM SYSTEM	7cM	7cP	BEHIND GLOVE COMPARTMENT	GH 92-96
CONTROL UNIT AIRBAG				M-O 71
CONTROL UNIT POWER WINDOWS, SUNROOF				JK 14
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39,40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MN 39,40
COOLANT LEVEL SWITCH				M 29,30
COOLANT TEMP. SENSOR				P 26
DELAYING RELAY SEAT HEATER				M 42
DIAGNOSIS CONNECTION				JK 30
DI CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	L 82-84
DOOR CONTACT FOR GLOVE COMPARTMENT LIGHT				D 99,100
DOOR CONTACT SWITCH LEFT				BC 99,100
DOOR CONTACT SWITCH RIGHT				C 99,100
DOOR CONTACT SWITCH TAILGATE				F 99,100
DOOR LOCK LIGHT DRIVER'S SIDE				M 93
DOOR LOCK LIGHT PASSENGER'S SIDE				P 93
DRIVE CRUISE CONTROL				B 90
DRIVE CENTRAL LOCKING SYSTEM DRIVER'S DOOR				B 91,92
DRIVE CENTRAL LOCKING SYSTEM PASSENGER'S DOOR				D 91,92
ENGINE SPEED SENSOR				JK 83,84
ENGINE COMPARTMENT LIGHT				B 96
EVAPORATOR SENSOR				H 37,38
FLOOR LAMP DRIVER'S SIDE				N 91,92
FLOOR LAMP PASSENGER'S SIDE				O 91,92
FREEZING PROTECTION SWITCH AIR CONDITIONING SYSTEM	7cM	7cM	UNDER THE WINDSHIELD WIPER COVER	FG 31
FRESH AIR BLOWER ENGINE				LM 31,32
FREQUENCY SWITCHES				FG 66, H66
FRONT SENSOR AIRBAG				OP 73,74
FUEL INJECTORS				L-N 90
FUEL LEVEL SENSOR				H 30
FUEL PUMP				GH 90
GENERATOR				DE 81,82
GLOVE BOX LAMP				CD 100
HALL SENSOR				L 81
HAZARD LIGHT SWITCH				HJ 1
HEADLIGHT VERTICAL AIM CONTROL				A4, A 6,7
HEADLIGHT WASHING FLUID PUMP				D 11
HEATED OXYGEN SENSOR				O 90
HF SENSOR				O-G 79,80

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
HORN ALARM SYSTEM				L 91,92
HYDRAULIC UNIT ABS				AB 73-76
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82
IGNITION DISTRIBUTER				GH 82,83
IGNITION FINAL STAGE				F 82,83
INDICATOR SWITCH BRAKE FLUID				F 21,22
INFO SWITCH				E 30
INSIDE LIGHTS TAILGATE I				O 99,100
INSIDE LIGHTS TAILGATE II				N 99,100
INSIDE LIGHTS ROOF				P 99,100
INSIDE TEMP. SENSOR				B 32,33
INSTRUMENT CLUSTER				A-C 22-30
KICKDOWN SOLENOID VALVE				AB 86
KICK-DOWN SWITCH				BC 86,87
KNOCK SENSOR				LM 81
LIGHTS CENTRAL ELECTRIC				LM 93
LICENSE PLATE LIGHTS				P 6,7
LOCK CYLINDER FOR DRIVER'S DOOR				A 91,92
LOCK CYLINDER FOR PASSENGER'S DOOR				C 91,92
MASS AIR FLOW SENSOR				OP 84,85
MEMORY SWITCH RIGHT				A 51,52
MEMORY SWITCH LEFT				A 59,60
M.F.I. CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
MICRO SWITCH CENTRAL NOZZLE				AB 37
MIRROR ADJUSTMENT SWITCH				AB 46,47, A 55,56
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	D 52-57
MOTOR POWER WINDOW DRIVER'S SIDE				F 11
MOTOR POWER WINDOW PASSENGER'S SIDE				N 11
MOTOR SUN ROOF				E 11
ODOMETER RESET SWITCH				JKL 21,22
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	P 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 36
OIL PRESSURE SENSOR				P 27
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
OUTSIDE TEMP. SENSOR				D 21
PARKING BRAKE CONTACT				E 21,22
POTENTIOMETER IDLE SPEED CO				OP 88
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM				F 37,38
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL				D 1
POTENTIOMETER FOR WIPING/WASHING				B 16
POTENTIOMETER INSTRUMENT LIGHT				DE 2
PRESSURE SWITCH COOLANT				MN 30
PRESSURE SWITCH FRIGEN				L 40
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
PUSH BUTTON SWITCH FOR POWER WINDOW				G 11, L 11
PUSHBUTTON SUNROOF				E 14,15
RADIATOR FAN				P 38,39
REAR WINDOW DEFOGGER				P 31,32
REAR WINDOW WIPER MOTOR				P 18,19
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE TOOL KIT COVER	OP 17
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL-M	ON BLOWER HOUSING	KL 31,32
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
ROOF ANTENNA				EF 61,62
SEAT BELT				O 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
SHIFT VALVE RESONANCE FLAP				OP 86
SOLENOID CLUTCH COMPRESSOR				P 33
SOLENOID VALVE ABS				C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
SOLENOID VALVES AIR CONDITIONING				B 37-40
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SPEAKER				F-J 66-69
SPEED SENSOR				E-H 79,80
STARTER INTERLOCK				L1,2, H21, A85

A	B	C	D	E	F	G	H	J	K

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
HORN ALARM SYSTEM				L 91,92
HYDRAULIC UNIT ABS				AB 73-76
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82
IGNITION DISTRIBUTER				GH 82,83
IGNITION FINAL STAGE				F 82,83
INDICATOR SWITCH BRAKE FLUID				F 21,22
INFO SWITCH				E 30
INSIDE LIGHTS TAILGATE I				O 99,100
INSIDE LIGHTS TAILGATE II				N 99,100
INSIDE LIGHTS ROOF				P 99,100
INSIDE TEMP SENSOR				B 32,33
INSTRUMENT CLUSTER				A-C 22-30
KICKDOWN SOLENOID VALVE				AB 86
KICK-DOWN SWITCH				BC 86,87
KNOCK SENSOR				LM 81
LIGHTS CENTRAL ELECTRIC				LM 93
LICENSE PLATE LIGHTS				P 6,7
LOCK CYLINDER FOR DRIVER'S DOOR				A 91,92
LOCK CYLINDER FOR PASSENGER'S DOOR				C 91,92
MASS AIR FLOW SENSOR				OP 84,85
MEMORY SWITCH RIGHT				A 51,52
MEMORY SWITCH LEFT				A 59,60
M F I CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
MICRO SWITCH CENTRAL NOZZLE				AB 37
MIRROR ADJUSTMENT SWITCH				AB 46,47, A 55,56
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	D 52-57
MOTOR POWER WINDOW DRIVER'S SIDE				F 11
MOTOR POWER WINDOW PASSENGER'S SIDE				N 11
MOTOR SUN ROOF				E 11
ODOMETER RESET SWITCH				JKL 21,22
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	P 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 36
OIL PRESSURE SENSOR				P 27
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
OUTSIDE TEMP. SENSOR				D 21
PARKING BRAKE CONTACT				E 21,22
POTENTIOMETER IDLE SPEED CO				OP 88
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM				F 37,38
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL				D 1
POTENTIOMETER FOR WIPING/WASHING				B 16
POTENTIOMETER INSTRUMENT LIGHT				DE 2
PRESSURE SWITCH COOLANT				MN 30
PRESSURE SWITCH FRIGEN				L 40
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
PUSH BUTTON SWITCH FOR POWER WINDOW				G 11, L 11
PUSHBUTTON SUNROOF				E 14,15
RADIATOR FAN				P 38,39
REAR WINDOW DEFOGGER				P 31,32
REAR WINDOW WIPER MOTOR				P 18,19
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE TOOL KIT COVER	OP 17
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
RESISTANCE GROUP FOR BLOWER	7cL-M	7cL-M	ON BLOWER HOUSING	KL 31,32
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
ROOF ANTENNA				EF 61,62
SEAT BELT				O 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
SHIFT VALVE RESONANCE FLAP				OP 86
SOLENOID CLUTCH COMPRESSOR				P 33
SOLENOID VALVE ABS				C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
SOLENOID VALVES AIR CONDITIONING				B 37-40
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SPEAKER				F-J 66-69
SPEED SENSOR				E-H 79,80
STARTER INTERLOCK				L1,2, H21, A85

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
STEERING IGNITION LOCK				B 14-16
STOP LIGHT TAILGATE				J 9,10
STOP LIGHT SWITCH				C 2,3
SUPPRESSOR FOR RADIO	8dO	8dO	IN CENTRE CONSOLE IN FRONT OF RADIO	DE 61
SWITCHING UNIT EX (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
TAILGATE LOCK				E 91
TAILGATE UNLOCKING DRIVE				M 99,100
TAILGATE UNLOCKING SWITCH				KL 99,100
TANK VENTING VALVE				OP 86,87
TEMPOSTAT SWITCH				A 87
TEMPERATURE SENSOR COOLING WATER				K 40
TEMPERATURE SENSOR DOUPLE NTC				OP 87,88
TEMPERATURE SWITCH SUCTION TUBE				K 40
THERMO ELEMENTS CATALYTIC CONVERTER				O 28,29
THERMO ELEMENTS IGNITION CIRCUIT				JK 82
THROTTLE VALVE SWITCH	5cM	5cP	IN COOLANT HOSE BEFORE EXPANSION TANK	JK 90
TIME RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	P 23-25
TIRE PRESSURE CONTROL CONTROL UNIT	7cP	7cM	ON INTRUMENT PANEL	K 76-78
TOOTHED BELT TENSION SWITCH				N 22
TRAILER COUPLING				075
TRANSMISSION PROTECTION SWITCH				D 84,85
TURN SIGNAL / DIMMER SWITCH				JK 1,2
TWO-TONE HORNS				CD 20
WARNING BUZZER	8cP	8cM	ON STEERING PROTECTIVE TUBE	D 29,30
WASHING FLUID LEVEL SWITCH	6cL	6cL	ON WINDSHIELD WASHER TANK	MN 28,29
WASHING JETS				B 11,12
WINDSHIELD WASHING FLUID PUMP				D 11
WIPE/WASH SWITCH				AB 18-20



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PLUG CONNECTIONS, GROUND POINTS

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
T1	3	GLOVE BOX LAMP	7cL	7cQ	ABOVE D I M F I CONTROL UNIT	CD98
T2	2	ENGINE COMPARTMENT LIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	B97
T3	26	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C55-60,D22,A93,94,K92,93
T4	26	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	B42,C51-54,C93,94,K92,93
T5	30	INSTRUMENT SCUTTLE	7cQ	7cL	AT SUPPORTING TUBE ON STEERING COLUMN	C3-H3, K23,H33
T6	12	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C60,FG65,G14,B93,94,N93
T7	2	TRANSMISSION BACKUP LIGHT SWITCH	16dO	16dO	UNDER THE SPARE WHEEL COVER	P5
T8	2	LICENSE PLATE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	F98
T10	6	REAR WIRE HARNESS / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,N31-32,097
T11	8	B-PILLAR / TAILGATE	13dN	13dO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	K10,N031,32,098
T12	2	SIDE MARKER LIGHT LEFT REAR	18cO		UNDER THE TOOL KIT COVER	O10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	O2
T14	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT FRONT	5cP	5cP	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	G78
T15	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT FRONT	5cM	5cM	IN ENGINE COMPARTMENT AT SUSPENSION STRUT MOUNT	F78
T16	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR LEFT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	EF78
T17	3×2	BRAKE PAD WEAR CONTACT, SPEED SENSOR RIGHT REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER	DE78
T18	14	FRONT END / ENGINE WIRE HARNESS	3cM	3cM	IN ENGINE COMPARTMENT AT RIGHT WHEEL HOUSING	026,27,033,JK39,083
T19	26	INSTRUMENT PANEL - / REAR WIRE HARNESS	7dL	7dL	NEAR CENTRAL ELECTRICS	EF13,GH28,HJ23,M4,F96,97,J97
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	F58-60,HJ46,K43-44
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H42,F51-53
T22	12	DOOR PASSENGER'S SIDE	7cL	7cO	IN PASSENGER'S DOOR	C42,C51,H65,L14,093,94,093
T23	21	ABS	7dQ	7dQ	FOOTWELL AT LEFT SIDE PANEL	K73-76,F30
T24	6	TRAILER COUPLING	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	OP75,76
T25	1	WIRE CONNECTOR	L4	L4	IN ENGINE COMPARTMENT RIGHT	C85
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C12
T27	2	HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C11
T28						
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-34
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dL	16dO	UNDER THE SPARE WHEEL COVER	036,086
T33		FRONT END / INSTRUMENT PANEL WIRE HARNESS	6dL	6dO	UNDER THE CENTRAL ELECTRIC	C2 A98
T34	3	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	F36
T36	6	MIRROR PASSENGER'S SIDE				B41-42
T37	15	MIRROR DRIVER'S SIDE				CD48, C21
T38	15	MIRROR PASSENGER'S SIDE WITH MEMORY				A52-54
T39	15	MIRROR DRIVER'S SIDE WITH MEMORY				A57-58
T40						
T41						
T42	6	WH INSTRUMENT PANEL / WH B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E13,E93,94
T43						
T44	3	WIRE HARNESS B-PILLAR / TAILGATE LOCK	13dN	13dO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	E92
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	KL83,84
T46	19	DIAGNOSIS CONNECTION	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	JK30
T47	8	CODING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N84
T48	3	HEATED OXYGEN SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	089
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	LM32
T50	6	AUTOM. TRANSM. COUPLING TO GEARBOX WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	HJ22
T51	6	AUTOM. TRANSMISSION, COUPLING TO REAR WIRE HARNESS	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85,86,M2
T52	6	AIRBAG	8dN		IN CENTRE CONSOLE	M73
T53	2	AIRBAG	8dN		IN CENTRE CONSOLE	M73

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE
GP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
GP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
GP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
GP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
GP V	FIREWALL	8dM	8dM	ABOVE CENTRAL ELECTRICS
GP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
GP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
GP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
GP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
GP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
GP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
GP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT

ABBREVIATIONS

CODE	MEANING	CODE	MEANING
ABS	ANTILOCK BRAKING SYSTEM	LHD	LEFT-HAND DRIVE
AC	AIR CONDITIONING SYSTEM	MFI	MULTIPORT FUEL IGNITION
ADL	ADDITIONAL DRIVING LIGHTS	NTC	NEGATIVE TEMPERATURE COEFFICIENT
CES	CENTRAL E ECTRICS	NO	NUMBER
CL	CLOSE	OP	OPEN
CLS	CENTRAL LOCKING SYSTEM	PIN	PIN
CP	CONNECTING POINT	PL	PLUG
CU	CONTROL UNIT	POT	POTENTIOMETER
DEF	DEFROST	PSD	PORSCHE LIMITED SLIP DIFFERENTIAL
DI	DISTRIBUTOR IGNITION	RA	REAR AXLE
DME	DIGITAL ENGINE ELECTRONICS	ROK	TIRE PRESSURE CONTROL
DP	DISCONNECTING POINT	RFL	REAR FOG LIGHT
ESO	ENGINE-SPEED SENSOR OUTPUT	RHD	RIGHT-HAND DRIVE
EZK	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	RL	REAR LEFT
FA	FRONT AXLE	ROW	REST OF WORLD
FCU	FREQUENCY CONVERTER UNIT	RR	REAR RIGHT
FL	FRONT LEFT	SA	SAUDI ARABIA
FOG	FOG LIGHT	SCS	COMBINED STEERING COLUMN SWITCH
FR	FRONT RIGHT	SS	SPEED SENSOR
GP	GROUND POINT	TE	TERMINAL
HCS	HEADLIGHT CLEANING SYSTEM	USA	USA
HF	HIGH FREQUENCY	WL	WIRING LOOM
IC	INSTRUMENT CLUSTER	WP	WELD POINT
LED	LIGHT-EMITTING DIODE	WW	WORLDWIDE
LF	LOW FREQUENCY		

FIELD IN WIRING DIAGRAM
CD98
B97
C44,C55-60,D22,A93,94,K92,93
B42,C51-54,C93,94,K92,93
C3-H3, K23,H33
C44,C60,FG65,G14,B93,94,N93
P5
P6
F98
LM10,N31-32,097
K10,N031,32,098
010
02
G78
F78
EF78
DE78
026,27,033,JK39,083
EF13,GH28,HJ23,M4,F96,97,J97
F58-60,HJ46,K43-44
H42,F51-53
C42,C51,H65,L14,D93,94,093
K73-76,F30
OP75,76
C85
C12
C11
F33
F33-34
BC33
036,086
C2 A98
G39
F36
B41-42
CD48, C21
A52-54
A57-58
E13,E93,94
E92
KL83,84
JK30
N84
089
LM32
HJ22
BC85,86,M2
M73
M73

GROUND POINTS

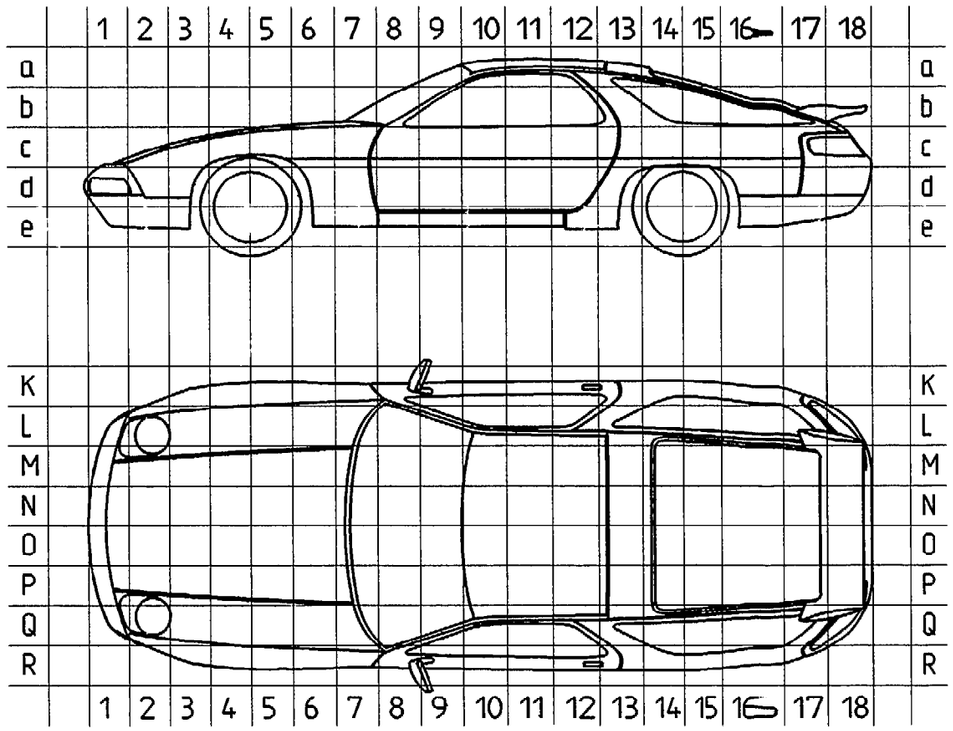
CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE
GP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
GP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
GP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
GP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
GP V	FIREWALL	8dM	8dM	ABOVE CENTRAL ELECTRICS
GP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
GP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
GP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
GP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
GP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
GP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
GP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT

ABBREVIATIONS

CODE	MEANING	CODE	MEANING
ABS	ANTILOCK BRAKING SYSTEM	LHD	LEFT-HAND DRIVE
AC	AIR CONDITIONING SYSTEM	MFI	MULTIPORT FUEL IGNITION
ADL	ADDITIONAL DRIVING LIGHTS	NTC	NEGATIVE TEMPERATURE COEFFICIENT
CES	CENTRAL E ECTRICS	NO	NUMBER
CL	CLOSE	OP	OPEN
CLS	CENTRAL LOCKING SYSTEM	PIN	PIN
CP	CONNECTING POINT	PL	PLUG
CU	CONTROL UNIT	POT	POTENTIOMETER
DEF	DEFROST	PSD	PORSCHE LIMITED SLIP DIFFERENTIAL
DI	DISTRIBUTOR IGNITION	RA	REAR AXLE
DME	DIGITAL ENGINE ELECTRONICS	RDK	TIRE PRESSURE CONTROL
DP	DISCONNECTING POINT	RFL	REAR FOG LIGHT
ESO	ENGINE-SPEED SENSOR OUTPUT	RHD	RIGHT-HAND DRIVE
EZK	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	RL	REAR LEFT
FA	FRONT AXLE	ROW	REST OF WORLD
FCU	FREQUENCY CONVERTER UNIT	RR	REAR RIGHT
FL	FRONT LEFT	SA	SAUDI ARABIA
FOG	FOG LIGHT	SCS	COMBINED STEERING COLUMN SWITCH
FR	FRONT RIGHT	SS	SPEED SENSOR
GP	GROUND POINT	TE	TERMINAL
HCS	HEADLIGHT CLEANING SYSTEM	USA	USA
HF	HIGH FREQUENCY	WL	WIRING LOOM
IC	INSTRUMENT CLUSTER	WP	WELD POINT
LED	LIGHT-EMITTING DIODE	WW	WORLDWIDE
LF	LOW FREQUENCY		

M - NUMBERS

M 061	ENGLAND VERSION
M 139	ADJUSTABLE SEAT HEATING SEAT LEFT
M 193	JAPAN VERSION
M 195	TELEPHONE PREPARATION CELLULAR (MOTOROLA)
M 208	TRAILER COUPLING
M 215	SAUDI-ARABIA VERSION
M 249	AUTOMATIC TRANSMISSION
M 261	OUTSIDE MIRROR FLAT PASSENGER'S SIDE
M 340	ADJUSTABLE SEAT HEATING SEAT RIGHT
M 383	SPORT SEAT LEFT
M 387	SPORT SEAT RIGHT
M 479	AUSTRALIAN VERSION
M 481	TRANSMISSION
M 484	USA VERSION
M 513	LUMBAR SUPPORT SEAT RIGHT
M 525	ALARM SYSTEM WITH CONTINUOUS TONE (SWITZERLAND)
M 528	OUTSIDE MIRROR KONVEX PASSENGER'S SIDE
M 537	SEATING POSITION CONTROL COMFORT SEAT LEFT
M 538	SEATING POSITION CONTROL COMFORT SEAT RIGHT
M 553	USA - CANADA VERSION
M 562	AIRBAG
M 570	ADD. AIR CONDITIONER (INCREASED COOLING CAPACITY)
M 576	REAR FOG LIGHT
M 586	LUMBAR SUPPORT SEAT LEFT
M 602	HIGH MOUNTED STOP LIGHT
M 612	TELEPHONE PREPARATION C-NETWORK (PHILIPS)
M 650	ELECTRIC SUN ROOF



14

Page

Wiring

Wiring diagram 928 GTS model '94 . . . . . 97 - 459

Printed in Germany – XXXII, 1993

Wiring Diagram Type 928 GTS Model 94

	Coordinates	
Sheet 1	1 - 10	Lights RoW
Sheet 2	1 - 10	Lights USA
Sheet 3	11 - 20	Body
Sheet 4	21 - 30	Instrument Cluster and Sensor
Sheet 5	31 - 40	Engine Cooling, Heater, Air Conditioner
Sheet 6	41 - 50	Outside Mirror, Power Seat
Sheet 7	51 - 60	Seat and Mirror Memory
Sheet 8	61 - 70	Radio, Telephone
Sheet 9	71 - 80	Antilock System, Airbag, Porsche Lock Differential, Trailor Coupling, Brake Pad Wear Indicator
Sheet 10	81 - 90	Motor, Fuel and Ignition, Cruise Control
Sheet 11	91 - 100	Alarm System, Central Locking System, Inside Lights
Sheet 12	101 - 110	Central Electric
Sheet 13		Constr. Components
Sheet 14		Plug Connections, Ground Points, M-Numbers, Abbreviations

USA: For vehicles with V.I.N.s from WPO AA2 92 RS 82 0061 to WPO AA2 92 RS 82 0079 use the wiring diagram model 93/2.

Wiring Diagram Type 928 GTS
Model 94

The wiring diagram comprises of 12 individual wiring diagrams, 1 sheet construction components and 1 sheet plug connections, ground points, M-numbers and abbreviations. They are subdivided into coordinate fields.

Each individual wiring diagram comprises a part of the central-electrical system within a dash-dot frame.

This part of the central-electrical system shows all the lines and relays required for the individual wiring diagram.

The ground-connecting points are designated with "GP" and their location is shown in a vehicle diagram.

The 10-pole plugs on central electrical system are clipped together from 3 parts.

Part 1, with the cast-on fastening pin, is the "initial element".

Parts 2, is the "module element".

Both parts are identified by the digits 1.....5.

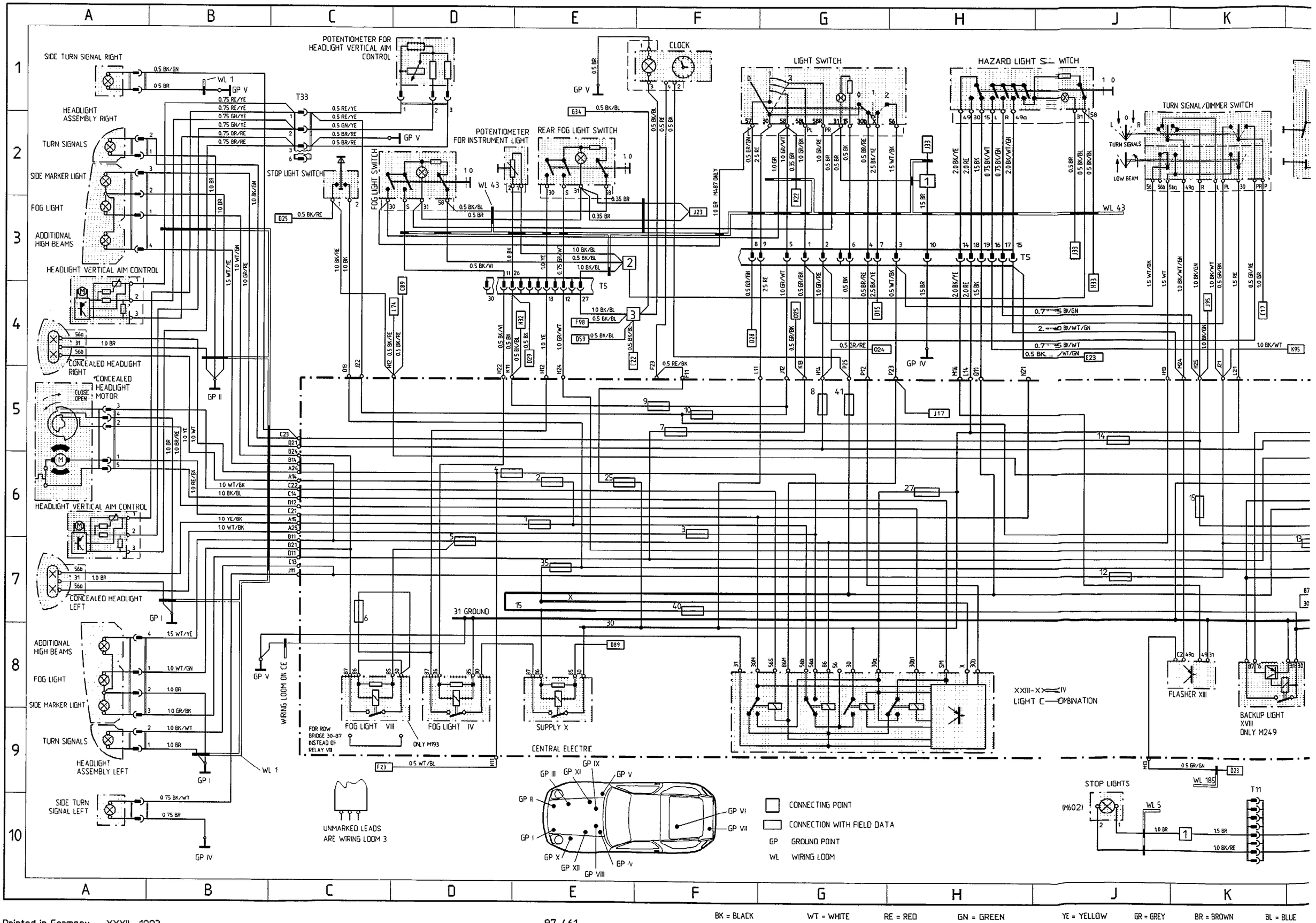
Part 3 is a "coding element".

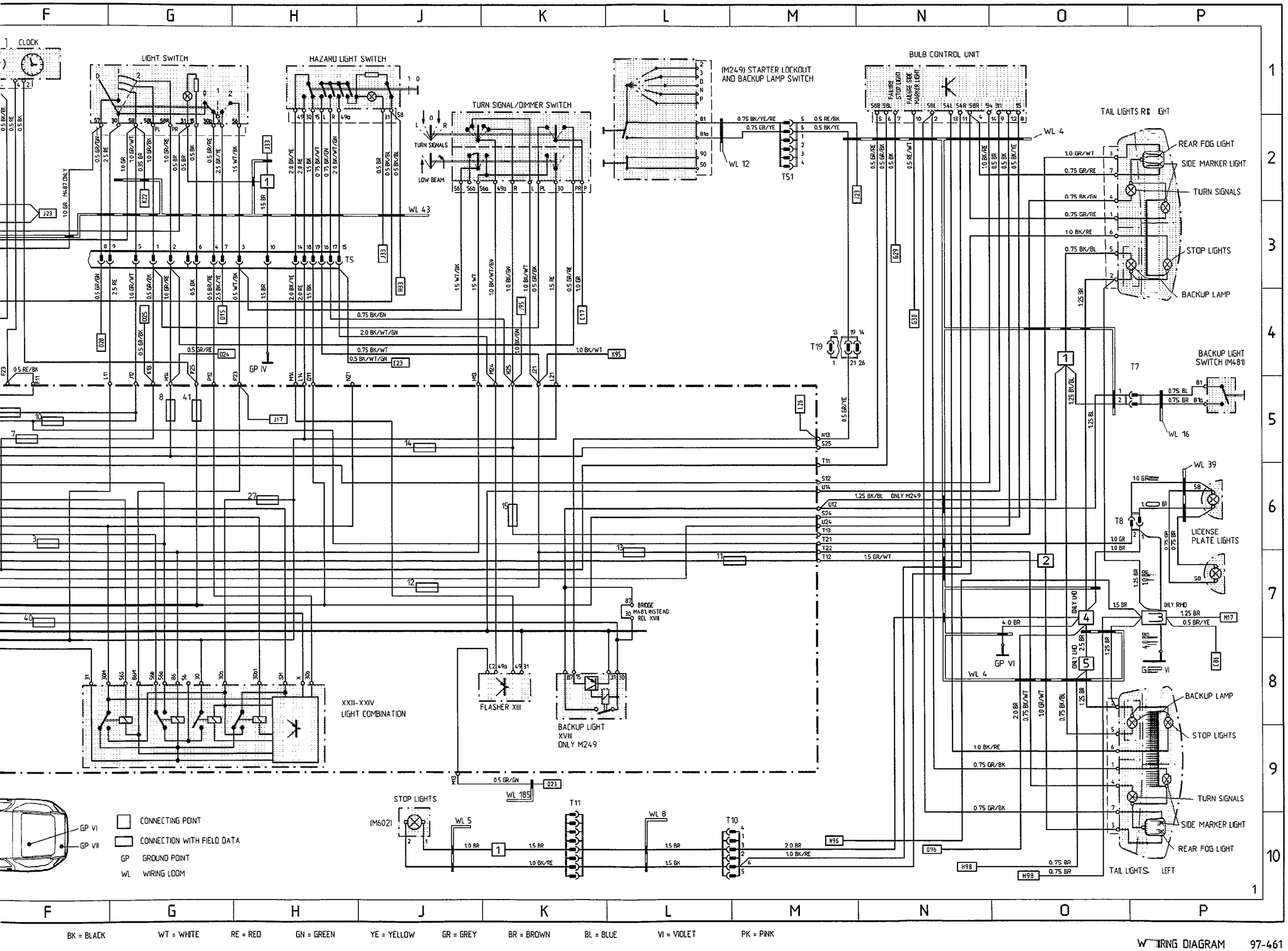
The designations of the plug connections in the wiring diagram for central electrical system refer e.g. from A 11.....15, to the "initial element", from A 21.....25 to module element.

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928 GTS MODEL 94 SHEET 1

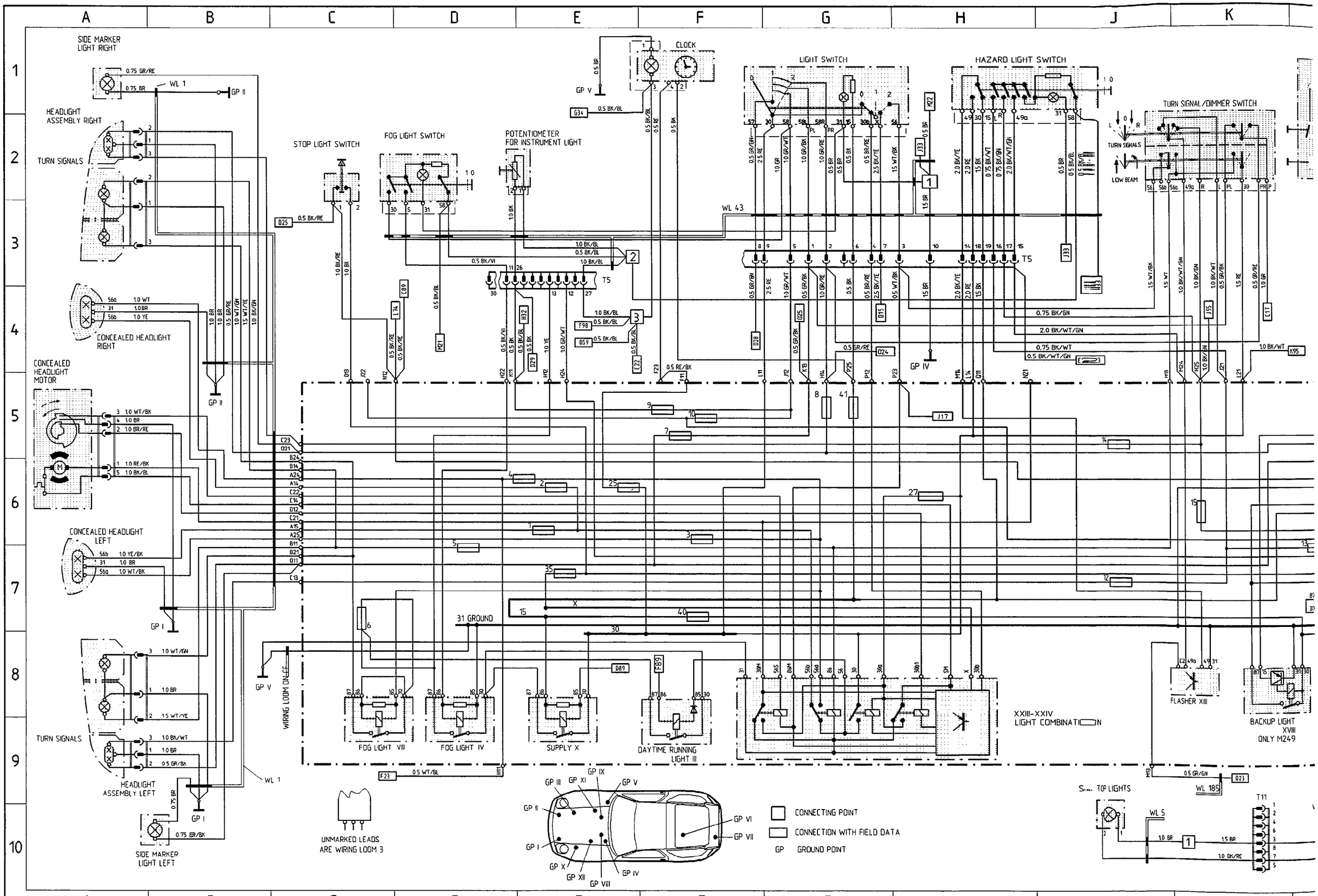
LIGHTS ROW OUTSIDE



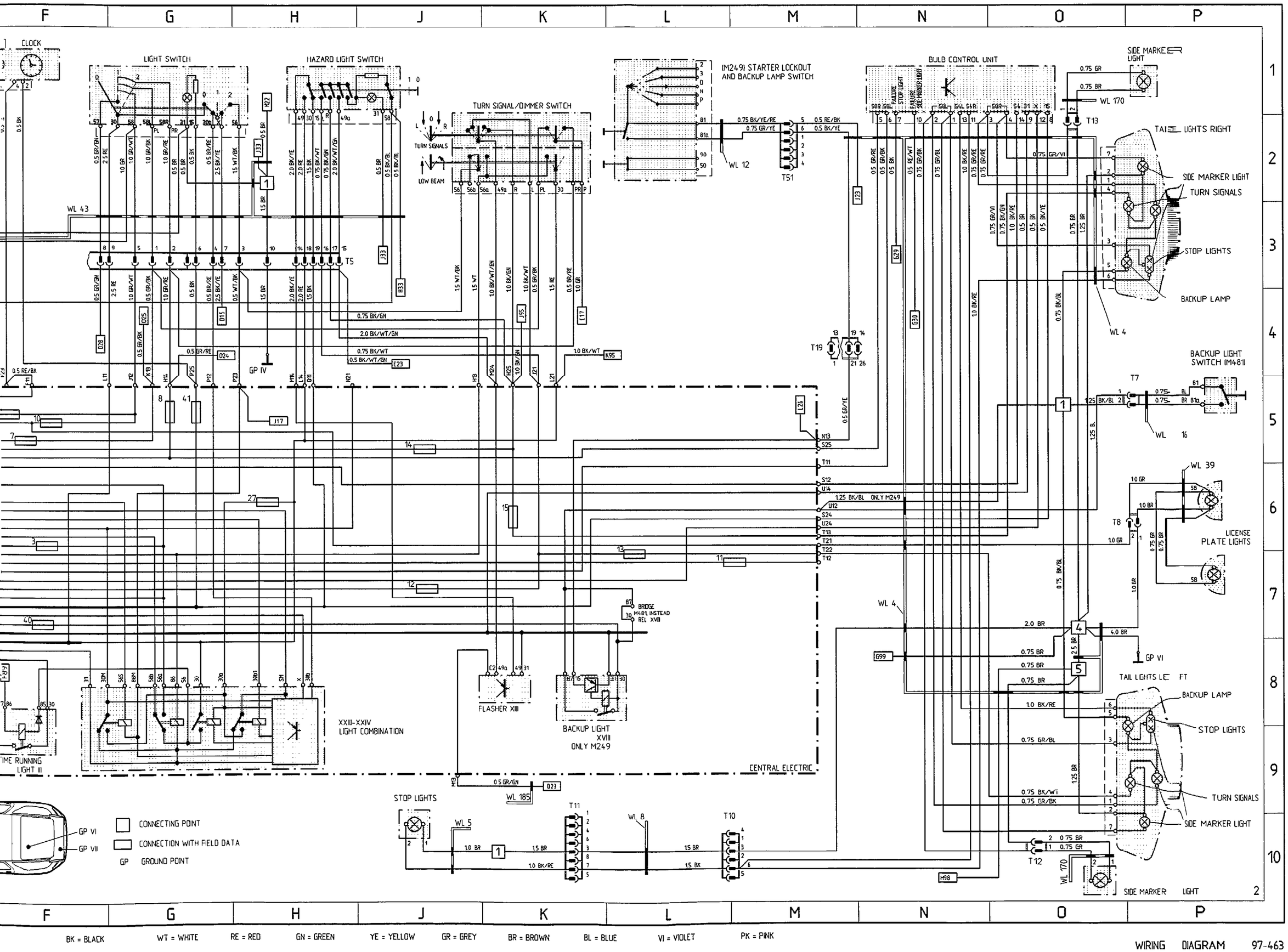

F
G
H
J
K
L
M
N
O
P
1
2
3
4
5
6
7
8
9
10
CLOCK
LIGHT SWITCH
HAZARD LIGHT SWITCH
TURN SIGNAL/DIMMER SWITCH
TURN SIGNALS
LOW BEAM
(M249) STARTER LOCKOUT AND BACKUP LAMP SWITCH
BULB CONTROL UNIT
FAILURE STOP LIGHT
FAILURE SIDE MARKER LIGHT
TAIL LIGHTS RIGHT
REAR FOG LIGHT
SIDE MARKER LIGHT
TURN SIGNALS
STOP LIGHTS
BACKUP LAMP
BACKUP LIGHT SWITCH (M481)
LICENSE PLATE LIGHTS
TAIL LIGHTS LEFT
ONLY M497
ONLY M249
ONLY RHD
ONLY LHD
BRIDGE M481 INSTEAD REL XVIII
XXIII-XXIV LIGHT COMBINATION
FLASHER XIII
BACKUP LIGHT XVIII ONLY M249
WL 4
WL 5
WL 8
WL 12
WL 16
WL 39
WL 43
WL 185
GP IV
GP VI
GP VII
T5
T7
T8
T10
T11
T12
T19
T51
J17
J23
J33
K22
K95
G29
G30
C17
C86
D15
D23
D24
D25
D28
E23
J95
L26
M17
N96
U96
H98
CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT
WL WIRING LOOM
BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

928 GTS MODEL 94 SHEET 2

LIGHTS USA OUTSIDE



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 94 SHEET 3

BODY

HEADLIGHT WASHING FLUID PUMP

WINDSHIELD WASHING FLUID PUMP

HEATED SPRAY JET RIGHT

HEATED SPRAY JET LEFT

T27

T26

GP IV

GP V

WL 1

MOTOR SUN ROOF (M650)

POWER WINDOW REGULATOR MOTOR DRIVER'S SIDE

WL 8

WL 167

T19

T42

PUSH BUTTON SWITCH FOR POWER WINDOW DRIVER

PUSH BUTTON SWITCH FOR SUN ROOF (M650)

T6

CONTROL UNIT POWER WINDOW REGULATOR / SUN ROOF

FOR RHDER1 AND ER2 INTERCHANGED

WITHOUT M650 PLUGGED

FOR RHD AR1 EXCHANGED WITH AR2

REAR WINDOW WIPER SWITCH

STEERING IGNITION LOCK

POTENTIOMETER FOR WIPING/WASHING

WINDSHIELD WIPER MOTOR

WIPE/WASH SWITCH

INTERVAL WIPING

TIP SWITCH

WASHING

TWO-TONE HORN

TWO-TONE HORN

TWO-TONE HORNS XVI

WIPER INTERMITTENT CONTROL XI

HEADLIGHT CLEANERS VII

31 (GROUND)

CENTRAL ELECTRIC

NOT MARKED
LEADS ARE WIRING LOOM 3

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F | G | H | J | K | L | M | N | O | P

11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20

R WINDOW REGULATOR
OTOR DRIVER'S SIDE

PUSH BUTTON SWITCH
FOR POWER WINDOW
DRIVER

PUSH BUTTON SWITCH
FOR POWER WINDOW
PASSENG. SIDE

POWER WINDOW REGULATOR
MOTOR PASSENGER'S SIDE

WL 167

1.5 GR/BR
1.5 GR/BL

2.0 RE
2.0 BK
2.0 GN

2.0 BK
2.0 RE/BL
2.0 GN

0.5 BK
0.5 BK
1.0 BK
0.5 BK

13

0.5 GN
0.5 RE/GN

0.5 RE/BL
0.5 GN

T6
T2

T22
7
10
11
12
1
2

1.5 GN/RE
1.5 GN

1.5 GR/BR
1.5 GR/BL

1.5 GR/BR
1.5 GR/BL

CONTROL UNIT POWER WINDOW REGULATOR / SUN ROOF

ER1
ER2
0.5 BK/YE
0.5 BR/RE
2.5 BR
1.5 BK/BL
AR1
1.5 BK/BL
AR2

FOR RHDER1 AND ER2
INTERCHANGED

FOR M553 | M479
PLUGGED

WITHOUT M650
PLUGGED

FOR RHD
AR1 EXCHANGED
WITH AR2

B98 0.5 BR/WT

B96

GP V

0.5 BK/GN
0.5 RE/BK

18

X

39

15

H5

42

U23

34

T16

ONLY LHD
4
2.5 BR
5
ONLY LHD

4.0 BR

GP VI

ONLY RHD 1.25 BR
1.25 BR

1.25 GN
1.25 BK/BL
0.5 GN/BK

ONLY RHD

1.25 RE

1.25 BR
1.25 BR

REAR WINDOW
WIPER RELAY

REAR WINDOW
WIPER MOTOR

WL 4

WIRING LOOM ON CE

GP V

24

19

WIPER INTERMITTENT XI
CONTROL

HEADLIGHT CLEANERS VII

31 (GROUND)

30

NS XVI

MARKED
OS ARE WIRING LOOM 3

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

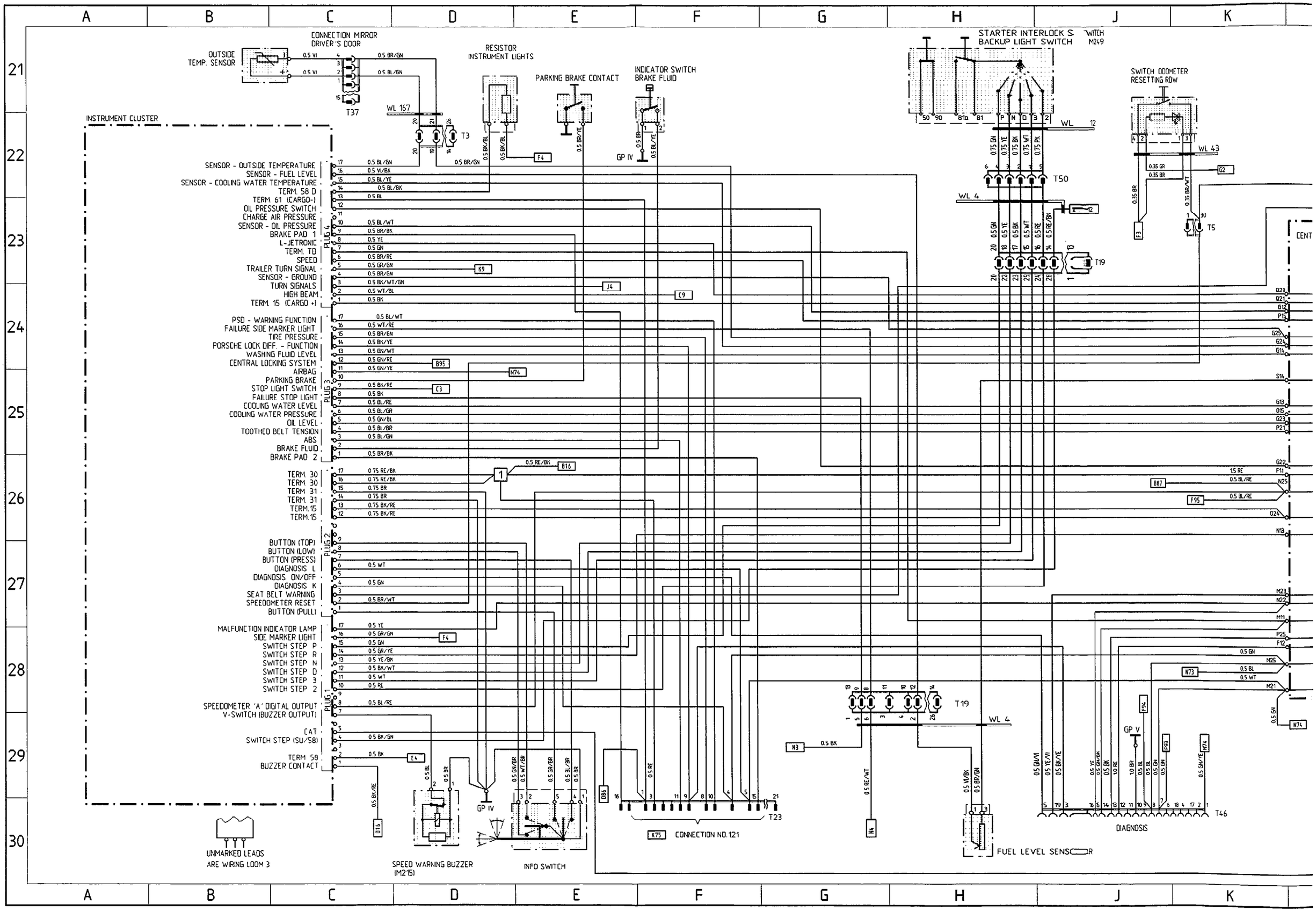
GP I
GP II
GP III
GP IV
GP V
GP VI
GP VII
GP VIII
GP IX
GP X
GP XI
GP XII

3

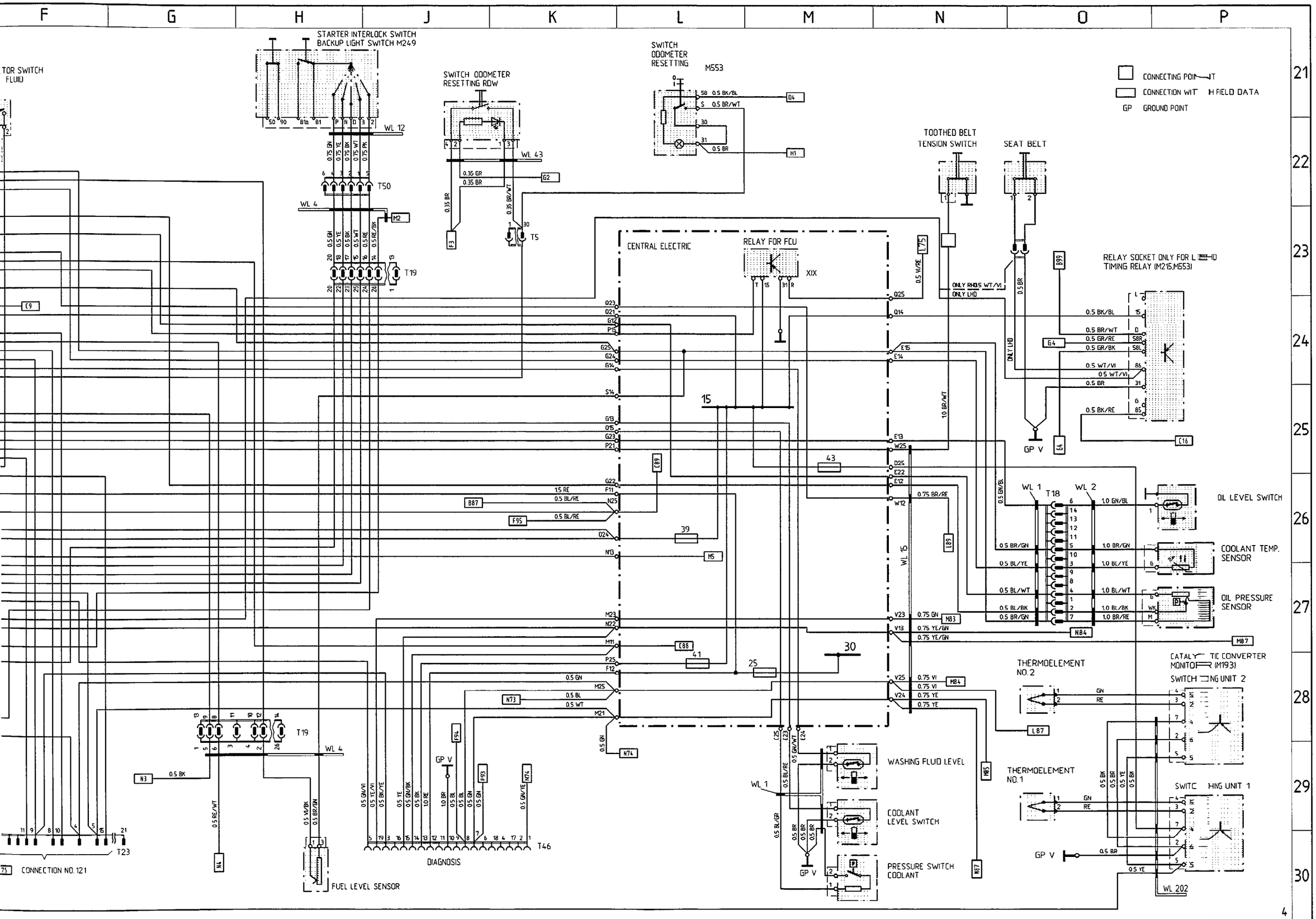
BK = BLACK | WT = WHITE | RE = RED | GN = GREEN | YE = YELLOW | GR = GREY | BR = BROWN | BL = BLUE | VI = VIOLET | PK = PINK

928 GTS MODEL 94 SHEET 4

INSTRUMENT CLUSTER AND SENSOR

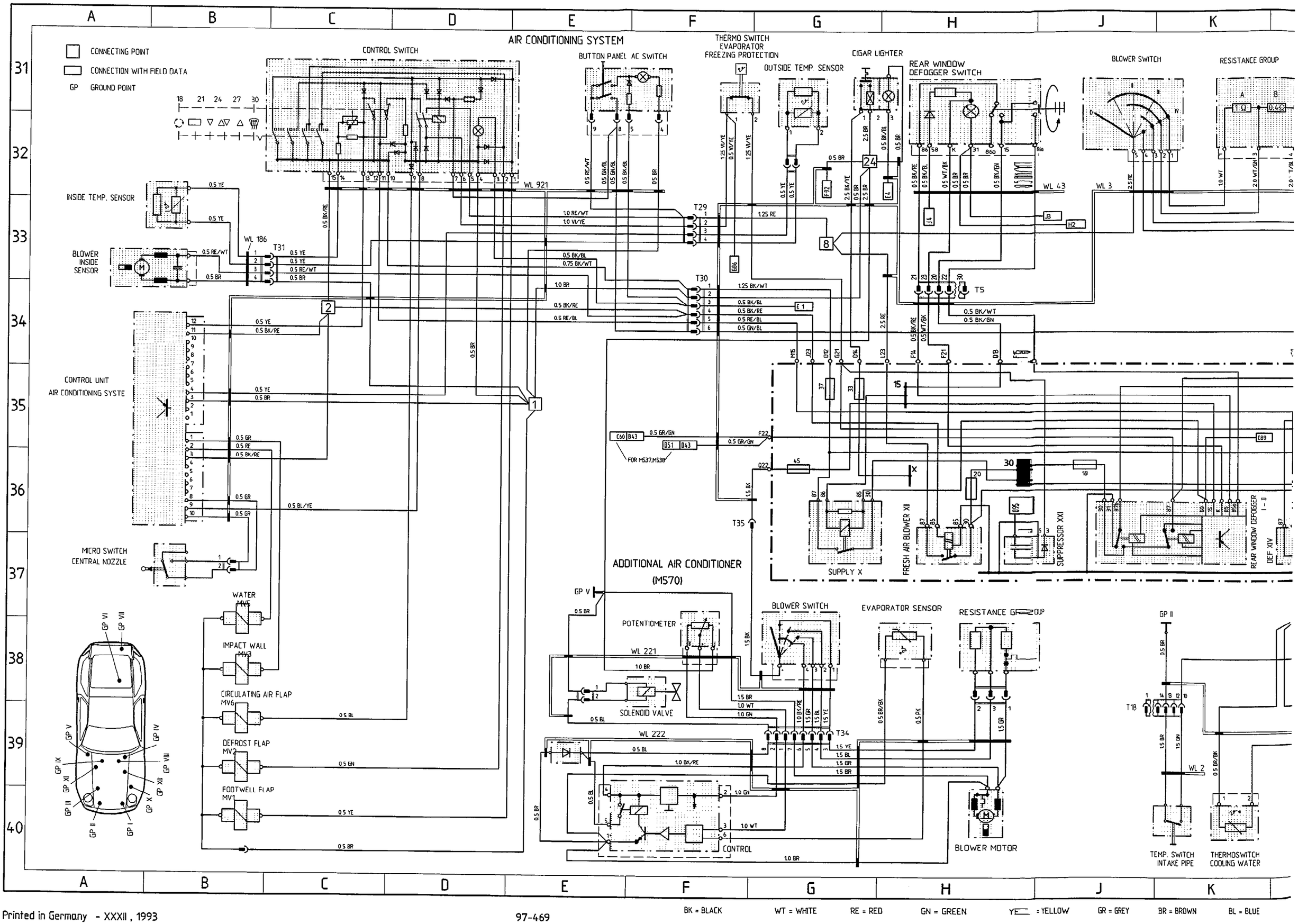


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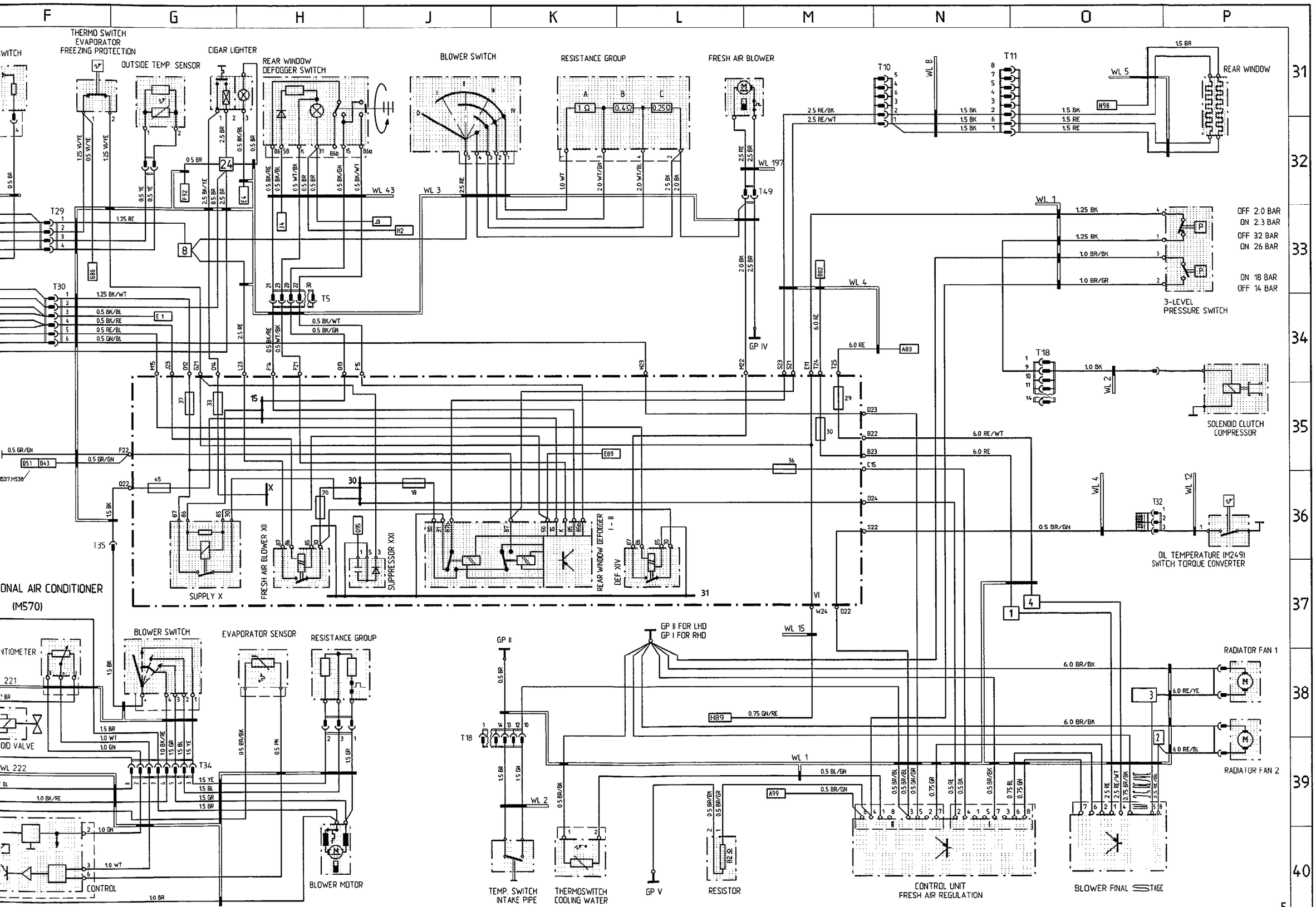

F
G
H
J
K
L
M
N
O
P
21
22
23
24
25
26
27
28
29
30
CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT
STARTER INTERLOCK SWITCH
BACKUP LIGHT SWITCH M249
SWITCH ODOMETER RESETTING RDW
SWITCH ODOMETER RESETTING M553
TOOTHED BELT TENSION SWITCH
SEAT BELT
CENTRAL ELECTRIC
RELAY FOR FCU
XIX
RELAY SOCKET ONLY FOR L HD TIMING RELAY (M215,M553)
WL 12
WL 43
WL 4
WL 15
WL 1
WL 2
T50
T19
T23
T46
T18
CONNECTION NO. 121
DIAGNOSIS
FUEL LEVEL SENSOR
WASHING FLUID LEVEL
COOLANT LEVEL SWITCH
PRESSURE SWITCH COOLANT
OIL LEVEL SWITCH
COOLANT TEMP. SENSOR
OIL PRESSURE SENSOR
THERMOELEMENT NO.2
THERMOELEMENT NO.1
CATALYTIC CONVERTER MONITORING (M193)
SWITCHING UNIT 2
SWITCHING UNIT 1
WL 202
GP V
ONLY RHD
ONLY LHD
BK = BLACK
WT = WHITE
RE = RED
GN = GREEN
YE = YELLOW
GR = GREY
BR = BROWN
BL = BLUE
VI = VIOLET
PK = PINK

928 GTS MODEL 94 SHEET 5

ENGINE COOLING, HEATER, AIR CONDITIONER



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 94 SHEET 6

OUTSIDE MIRROR, POWER SEAT

MIRROR PASSENGER'S SIDE (M261, M528)

T36

0.5 BR
0.5 BR
0.5 BK
0.5 RE
0.5 BL
0.5 WT

0.5 BR
0.5 GR/GN
0.5 GN
0.5 WT
0.5 WT
0.5 BL

WL 167

1.0 BR

CONNECTION MIRROR

T4 T22

WL 3

F35 0.5 GR/GN

E 31 CP

0.5 BL 0.5 WT 0.5 BK 1.0 BR

GP V

0.75 WT/RE
1.0 BR

T6

GP V

CHANGEOVER SWITCH

R
L

T3

0.5 GN
0.75 GN/RE
0.5 BL
0.75 YE

WL 167

1.0 BR

CP 1

MIRROR SWITCH

0.75 BK
0.75 BR
0.5 WT
0.5 WT

GP I GP II GP III GP IV GP V GP VI GP VII GP VIII GP IX GP X GP XI GP XII

0.5 BL/WT 0.5 WT 0.5 WT 0.5 GN 0.5 GR/GN 0.5 BR

D21 OUTSIDE TEMP. SENSOR

T37

DISCONNECTING POINT MIRROR

0.5 WT 0.5 BL 0.5 RE 0.5 BK 0.5 BR 0.5 BR

MIRROR DRIVER'S SIDE

30 40 15 23 22 44

M12

CENTRAL ELECTRIC

P14 K25 P13

GP V

2.5 BR
1.0 GN
2.5 YE/RE

T21

2.0 BR
1.0 BK
1.5 RE

CONNECTION POWER SEAT RIGHT

WL 227

SEAT HE... POWER SE...

INVERSELY I... WITH LEFT

GP V

WL 227

2.5 BR
1.0 GN
2.5 RE/YE

T20

2.0 BR
1.0 BK
1.5 RE

GP IV

1.0 GN 2.5 BR 2.5 RE/YE

T20

1.0 BK 2.0 BR 1.5 RE

WL 227

CONNECT... IONPOWER SEAT LE... T

SPORT SEAT (M383, M387)

SEAT CUSHION HEIGHT CONTROL REAR

2-WAY SWITCH

1.5 BK/GN
1.5 BK/VI

1.5 BR
1.5 RE

WL ON SWITCH

2-WAY SWITCH

SEAT CUSHION HEIGHT CONTROL FRONT

1.5 BK/GN
1.5 BK/VI

1.5 BR
1.5 RE

SEAT CUSHION HEIGHT CONTROL REAR

SEAT BACKREST CONTROL

1.5 GR/YE
1.5 BK/YE

WL 343
NOT APPLICABLE WITH M139 M340, M586, M513

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

1.5 BK/GN
1.5 BK/VI

SEAT LUMBAR (M586) CURVE CONTROL (M513)

1.5 GR
1.5 BK/GR

WL 337
M340, M...

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

41 42 43 44 45 46 47 48 49 50

ADJUSTABLE SEAT HEATING (M139, M340)

COMFORT SEAT - ST ANDARD LEFT

PORT SEAT (383, M387)

CONNECTION POWER SEAT RIGHT

SEAT HEATER AND POWER SEAT RIGHT

INVERSELY IDENTICAL WITH LEFT

DELAYING RELAY

SEAT HEATER SWITCH

BACKREST

SEAT

SIDE ELEMENTS

CENTRAL ELECTRIC

30 23 15 22 44 K25 P13 M12

GP V

GP IV

T21

T20

WL 227

WL ON SWITCH

WL 337/338/340

2.5 BR 1.0 GN 2.5 YE/RE 2.0 BR 1.0 BK 1.5 RE

2.5 BR 1.0 GN 2.5 RE/YE 2.0 BR 1.0 BK 1.5 RE

0.75 RE 0.75 YE 1.0 BK 1.0 BR 1.0 BK/RE 1.0 BR 1.0 BK 1.0 GN 1.0 BR 1.0 GN

4-WAY SWITCH

SEAT CUSHION HEIGHT CONTROL REAR

SEAT BACKREST CONTROL

SEAT LUMBAR (M586) HEIGHT CONTROL (M513)

SEAT LUMBAR (M586) CURVE CONTROL (M513)

1.5 BK/GN 1.5 BK/VI 1.5 GR/YE 1.5 BK/YE 1.5 GR 1.5 BK 1.5 BK/GR 1.5 RE 1.5 BR

WL 343 NOT APPLICABLE WITH M139 M340, M586, M513

WL 337 WITH M139, M340, M513, M586

2-WAY SWITCH

CONNECTION POWER SEAT LEFT

SEAT CUSHION HEIGHT CONTROL FRONT

SEAT BACK FORWARD CONTROL

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

WL WIRING LOOM

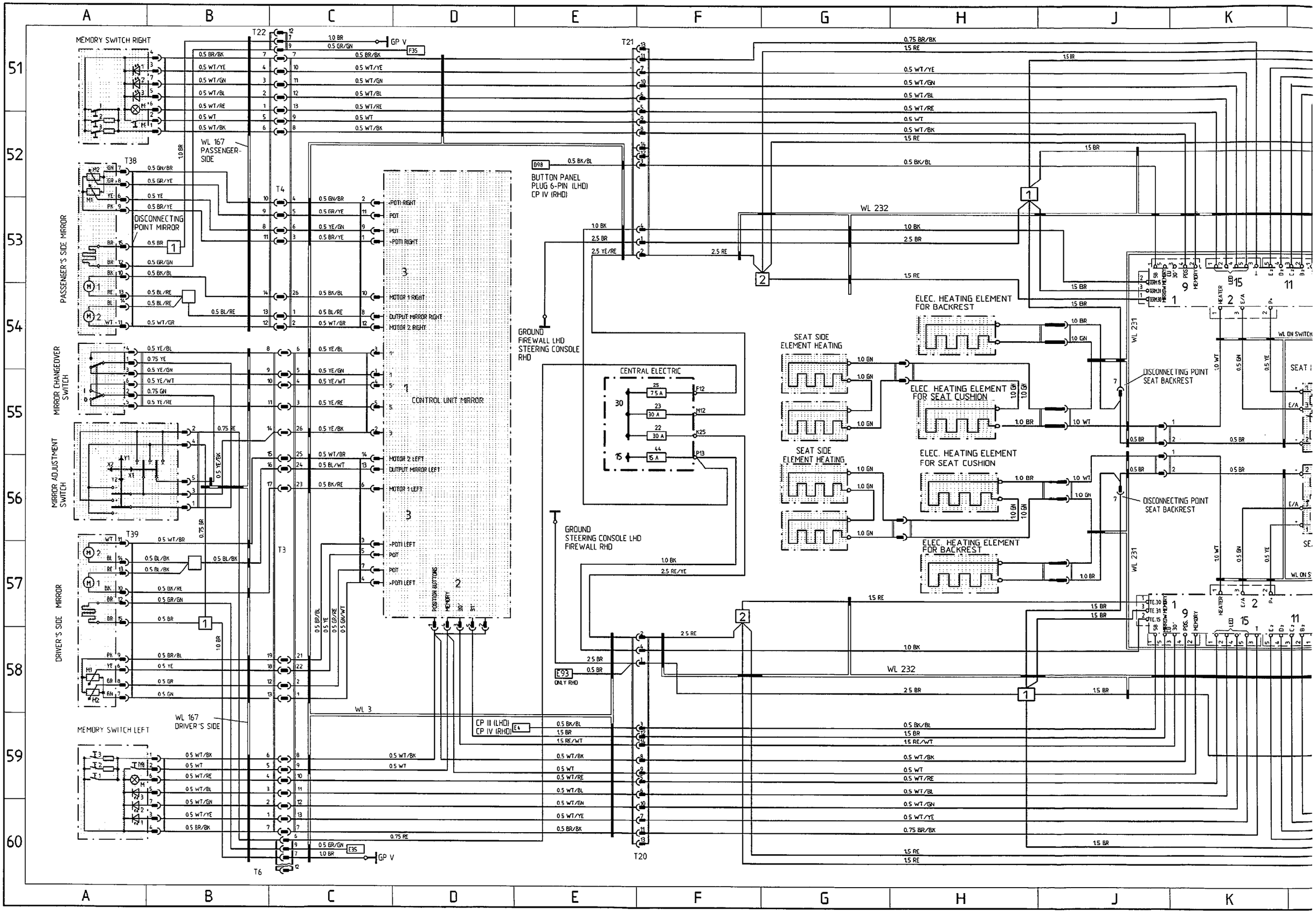
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F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 94 SHEET 7

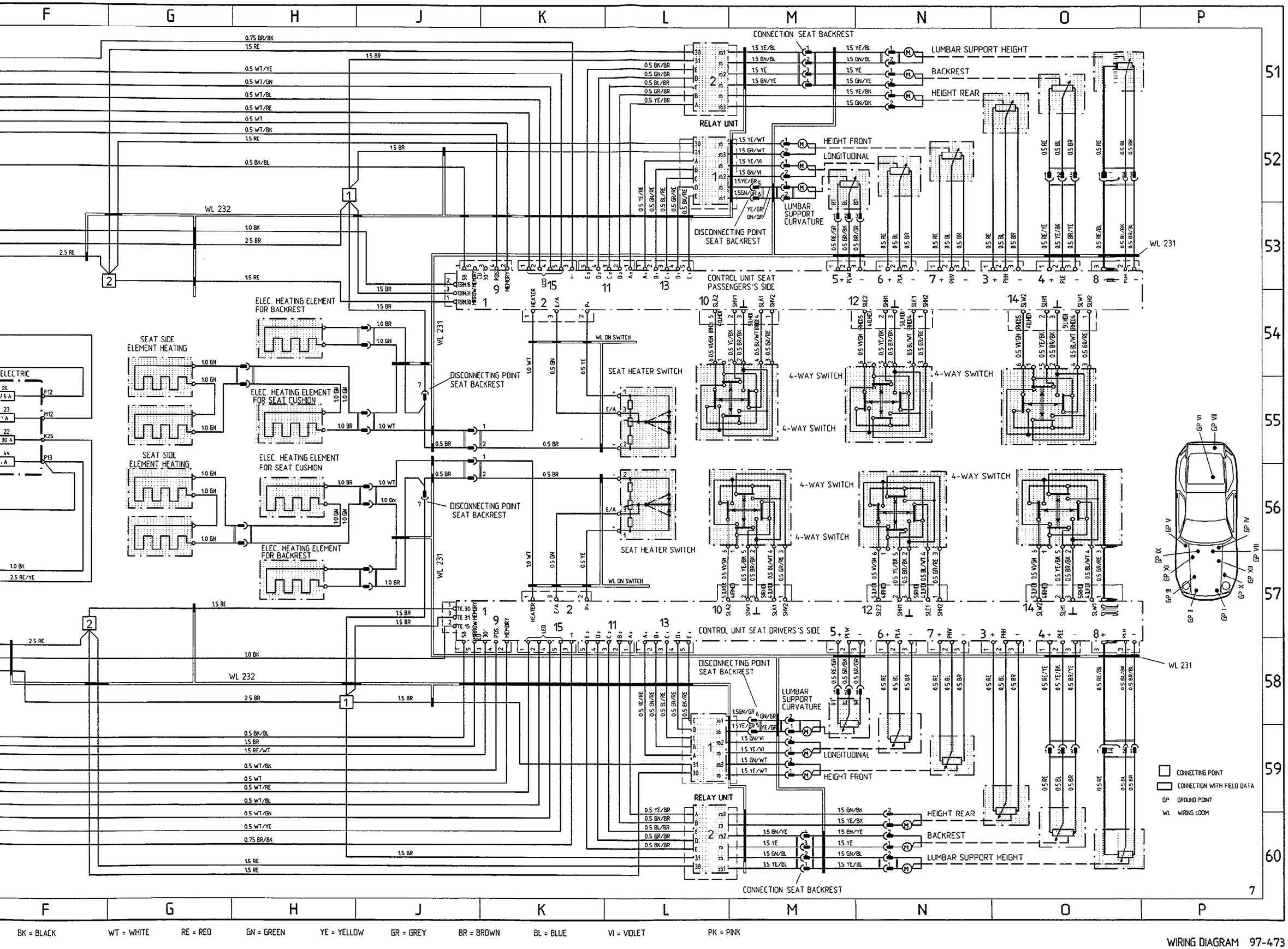
(M537, M538) SEAT AND MIRROR MEMORY



Printed in Germany - XXXII, 1993

97-473

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VI



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 94 SHEET 8

RADIO, TELEPHONE

ROOF ANTENNA
NOT WITH M612
OR M614

ANTENNA
EXTENSION WIRE

ROW
M334+M692
CD - CHANGER

INTERFACE

928.645.450.00
M692

USA
M331+M692
CD - CHANGER

CONNECTION 8-WIRE
RADIO - CD - CHANGER

1.0 WT
2.5 RE

ONLY
BLAUPUNKT

2.5 RE
2.5 BR
0.5 BR/YE
G92

7.5A
K15

PLUG III - BLACK
PLUG II - BROWN
RADIO AND CD-PLAYER
PLUG I - RED

ALARM CONTACT IN
RADIO SUPPORT FRAME
BLAUPUNKT:

ALPINE:
IN UNIT

WL 3
C15

15 BR
2.5 RE/BK

NOT M331
SUPPRESSOR

ONLY M331
PLUG BRIDGE

GP V

4.0 BR

CONNECTION
6-WIRE
RADIO - BOOSTER

NOT M334+M692

BOOSTER
LEFT
RIGHT

15 BL
15 BR/BK
T6

15 BR/WT
15 BL/WT
T22

WL 167 LEFT
WL 167 RIGHT

WL 4

FRONT LEFT
HIGH RANGE
RADIO SPEAKER
MIDDLE RANGE
SPEAKER

1.5 GN
1.5 BR
1.5 YE
1.5 BR

SEPARATING FILTER
DOOR LEFT

SEPARATING FILTER
DOOR RIGHT

FRONT RIGHT
HIGH RANGE
RADIO SPEAKER
MIDDLE RANGE
SPEAKER

1.5 VI
1.5 BR/BK
1.5 GN
1.5 BR
1.5 BR/WT
1.5 GN/WT
1.5 BR/VI
1.5 VI/WT

DEEP RANGE
SPEAKER
REAR LEFT
MIDDLE RANGE
SPEAKER
HIGH RANGE
RADIO SPEAKER

WL 69 LEFT
WL 69 RIGHT

1.5 VI
1.5 BR
1.5 GN
1.5 BR/WT

DEEP RANGE
SPEAKER
REAR RIGHT
MIDDLE RANGE
SPEAKER
HIGH RANGE
RADIO SPEAKER

TELEPHONE RECEIV
NOT CONTAINED I

BOOSTER
15 A
F24
21

TERM.15

CENTRAL

MULTI-LEAD 8 WIRE

SEPARATE CARD READER
NOT WITH M614

TELEPHONE REC
NOT WITH M6

CONNECTION PLAN BOOSTER

SPEAKER PLUG
DEEP RANGE TUNER
LEFT YELLOW

SPEAKER PLUG
DEEP RANGE TUNER
RIGHT RED

PRE-AMPLIFIER INPUT
LF-WIRE

CONNECTION PLUG 6-PIN

SPEAKER PLUG FRONT LEFT
WT

SPEAKER PLUG FRONT RIGHT
BLACK

SPEAKER PLUG REAR RIGHT
RED

SPEAKER PLUG REAR LEFT
YELLOW

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

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F G H J K L M N O P

61 62 63 64 65 66 67 68 69 70

NOT M331 SUPPRESSOR

ONLY M331 PLUG BRIDGE

ONLY BLAUPUNKT

1.0 WT
2.5 RE
2.5 RE
2.5 BR
0.5 BR/YE
G92
7.5A
PLUG III - BLACK
PLUG II - BROWN
PLUG I - RED
K15
RADIO AND CD-PLAYER
ALARM CONTACT IN RADIO SUPPORT FRAME BLAUPUNKT:
ALPINE: IN UNIT
1.5 BR
2.5 RE/BK
WL 3
C15
GP V
4.0 BR
NOT M334+M692
BOOSTER
LEFT
RIGHT
1.5 BL
1.5 BR/BK
1.5 BR/WT
1.5 BL/WT
T6
T22
WL 167 LEFT
WL 167 RIGHT
WL 4
1.5 BR/WT
1.5 BL/WT
1.5 GN
1.5 BR
1.5 YE
1.5 VI
1.5 BR/BK
1.5 GN/WT
1.5 BR/VI
1.5 VI/WT
SEPARATING FILTER DOOR LEFT
SEPARATING FILTER DOOR RIGHT
FRONT RIGHT
HIGH RANGE RADIO SPEAKER
MIDDLE RANGE SPEAKER
DEEP RANGE SPEAKER
REAR RIGHT
MIDDLE RANGE SPEAKER
HIGH RANGE RADIO SPEAKER
WL 69 LEFT
WL 69 RIGHT

INT
IH FIELD DATA

TELEPHONE PREPARATION C-NETWORK M 612
(Philips "Porty")

COMBINE RADIO AND TELEPHONE ANTENNA

TRANSMITTER-RECEIVER C-NETWORK
NOT CONTAINED IN M612

TELEPHONE RECEIVER
CONNECTION CABLE TELEPHONE RECEIVER PLATES
WIRING LOOM FOR TELEPHONE RECEIVER
15-WIRE
NOT CONTAINED IN M612

ANTENNA
RADIO
RADIO
COMBINER

ANTENNA LEAD RADIO CROSS-OVER

WIRING LOOM C-NETWORK SUPPLY

C81 PLUS LEAD FOR TELEPHONE
15 A
NUN-CES FUSE IN BATTERY COMPARTMENT
4.0 RE
4.0 BK
GP VII

0.5 PK
RADIO MUTE
RADIO PLUG CHAMBER 3 NOT CONNECTED

0.5 YE
0.5 GR
0.5 WT
NOT CURRENTLY CONNECTED

RADIO ANTENNA INPUT

30
BOOSTER 15 A
F24
21
TELEPHONE 7.5 A
TERM.15
43
N24
0.5 GN
CENTRAL ELECTRIC

10 RE
10 RE

TELEPHONE PREPARATION D-NETWORK M 614
(Motorola)

GP VI
WIRING LOOM D-NETWORK
10 BR
10 BR
0.5 GN/BK
0.5 YE/BK
MULTI-LEAD 8 WIRE
MULTI-LEAD 8 WIRE
0.5 BL
0.5 BR
0.25 BR
0.25 BR/WT

COMBINED RADIO AND TELEPHONE ANTENNA
ANTENNA
RADIO
RADIO
COMBINER
ANTENNA LEAD RADIO CROSS-OVER
RADIO ANTENNA INPUT

TRANSMITTER-RECEIVER NOT CONTAINED IN M614

SEPARATE CARD READER NOT WITH M614
TELEPHONE RECEIVER NOT WITH M614
SPEAKER (FREE-HANDED SPEAKING)
MICROPHONE (FREE-HANDED SPEAKING)

8

F G H J K L M N O P

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 94 SHEET 9

ABS, AIRBAG, PORSCHE LOCK DIFFERENTIAL, BRAKE PAD WEAR INDICATOR TRAILER COUPLING

ABS - ANTILOCK SYSTEM AND PSD - PORSCHE LOCK DIFFERENTIAL

SOLENOID VALVE

HYDRAULIC UNIT ABS

GP X

GROUND STRAP NO. 928.612.189.01

AIRBAG DRIVER'S SIDE

ACCELERATING SENSOR (M221)

T23

F30 DISCONNEC NO.3

WL 121

WIRE CONNECTOR

WL 2

PRESSURE WARNING SWITCH

PUMP

PUMP RELAY

GP VI

LHD: GP IV
RHD: GP V

BRAKE PAD WEAR INDICATOR

ENGINE SPEED SENSOR

GP WHEEL SUSPENSION

REAR RIGHT

REAR LEFT

FRONT RIGHT

FRONT LEFT

GP I GP II GP III GP IV GP V GP VI GP VII GP VIII GP IX GP X GP XI GP XII

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

AND PSD - PORSCHE LOCK DIFFERENTIAL

AIRBAG

AIRBAG DRIVER'S SIDE

SHORT-CIRCUITING BRACKET

SLIDING CONTACT UNIT

STEERING WHEEL WITH HORN CONTACT

WL 3

AIRBAG CONTROL UNIT

TERM 31

TERM 15

HFM + DI RELAY TERM 86

HAZARD LIGHT AIRBAG

L LEAD

K LEAD

DRIVER'S SIDE IGNITION TABLET 1/2

DRIVER'S SIDE IGNITION TABLET 1/1

PASSENGER'S SIDE IGNITION TABLET 3/1

PASSENGER'S SIDE IGNITION TABLET 3/2

PASSENGER'S SIDE IGNITION TABLET 2/1

PASSENGER'S SIDE IGNITION TABLET 2/2

CRASH SENSOR RIGHT

CRASH SENSOR LEFT

WL 8 LHD

WL 3 RHD

T52

T53

SHORT-CIRCUITING BRACKET

AIRBAG PASSENGER'S SID ONLY LHD

ONLY LHD

K28

L29

K29

O24

GP V

CRASH SENSOR RIGHT

CRASH SENSOR LEFT

ACCELERATING SENSOR (M221)

LHD: GP IV
RHD: GP V

T23

WL 121

DISCONNECTING POINT NO.3

F30

C4

N23

025

TRAILER COUPLING (M 208)

PLUG SOCKET TRAILER COUPLING

WL 180

T24

WL 161

F89

31

15

28

GROUND ABS

WIRING LOOM ON CE

GP V

XV ABS

CENTRAL ELECTRIC

SEE SHEET 1 FIELD M5-7 (CONNECTION TO CENTRAL ELECTRIC)

T12 REAR FOG LIGHT

S12 BULB CONTROL UNIT - STOP LIGHTS

T13 TURN SIGNAL REAR RIGHT

T22 TURN SIGNAL REAR LEFT

S25 BULB CONTROL UNIT - SIDE MARKER LIGHT RIGHT

T11 BULB CONTROL UNIT - SIDE MARKER LIGHT LEFT

WL 4

LHD: GP IV
RHD: GP V

GP VI

ENGINE SPEED SENSOR

GP WHEEL SUSPENSION

BRAKE PAD WEAR INDICATOR

FRONT RIGHT

FRONT LEFT

GP I GP II GP III GP IV GP V GP VI GP VII GP VIII GP IX GP X GP XI GP XII

CONNECTING POINT

CONNECTION WITH FIELD DATA

GP GROUND POINT

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 94 SHEET 10

MOTOR, FUEL AND IGNITION, CRUISE CONTROL

CONNECTING POINT
CONNECTION WITH FIELD DATA
GP GROUND POINT

BATTERY
GENERATOR
STARTER
RIGHT IGNITION COIL
LEFT IGNITION COIL
RIGHT IGNITION FINAL STAGE
LEFT IGNITION FINAL STAGE
LEFT IGNITION DISTRIBUTOR
RIGHT IGNITION DISTRIBUTOR
IGNITION CIRCUIT CONTROL MODUL
BRIDGE
NOT WITH CATALYZER
THERMO ELEMENTS
IGNITION CIRCUIT II
IGNITION CIRCUIT I
HALL SENSOR
ENGINE SPEED SENSOR
TRANSMISSION PROTECTION SWITCH
WIRE CONNECTOR
STARTER INTERLOCK BACKUP LIGHT RANGE INDICATOR SWITCH (M249)
SOLENOID VALVE (M249)
KICKDOWN (M249)
CRUISE CONTROL SWITCH
CONTROL UNIT CRUISE CONTROL
CLUTCH SWITCH (M48)
BRIDGE (M249)
DRIVE
KICKDOWN XVII
MULTIPORT FUEL INJECTION XXV
STARTER V
DI XXII
FUEL PUMP XXVI
CENTRAL ELECTRIC
M F I CONTROL UNIT
THROTTLE VALVE SWITCH
CYLINDER 1
FUEL PUMPS (INTANK)

BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

F G H J K L M N O P

81 82 83 84 85 86 87 88 89 90

RIGHT IGNITION COIL
LEFT IGNITION COIL
BRIDGE
NOT WITH CATALYZER
IGNITION CIRCUIT CONTROL MODUL
THERMO ELEMENTS
IGNITION CIRCUIT II
IGNITION CIRCUIT I
HALL SENSOR
KNOCK SENSOR 2
KNOCK SENSOR 1
LEFT IGNITION DISTRIBUTOR
RIGHT IGNITION DISTRIBUTOR
ENGINE SPEED SENSOR
D I CONTROL UNIT
WL 15
CODING ELEMENT
M4.81
M2.9
CATALYZER M4.81
CATALYZER M2.9
MASS AIR FLOW SENSOR
GP I GP II GP III GP IV GP V GP VI GP VII GP VIII GP IX GP X GP XI GP XII
WL 1
WL 4
WL 15
GP VI
GP III
GP IX
M F I CONTROL UNIT
SHIFT VALVE RESONANCE FLAP
TANK VENT
TEMPERATURE SENSOR DOUBLE NTC
POTENTIOMETER NOT APPLICABLE WITH CAT. CONV.
BRIDGE NOT APPLICABLE FOR CATALYTIC CONVERTER
HEATED OXYGEN SENSOR ONLY WITH CAT.CONV.
FUEL PUMP XXVI
FUEL PUMPS (INTANK)
CENTRAL ELECTRIC
THROTTLE VALVE SWITCH
IDLE SPEED POSITIONER
CYLINDER 1
CYLINDER 4
CYLINDER 6
CYLINDER 7
CYLINDER 2
CYLINDER 3
CYLINDER 5
CYLINDER 8

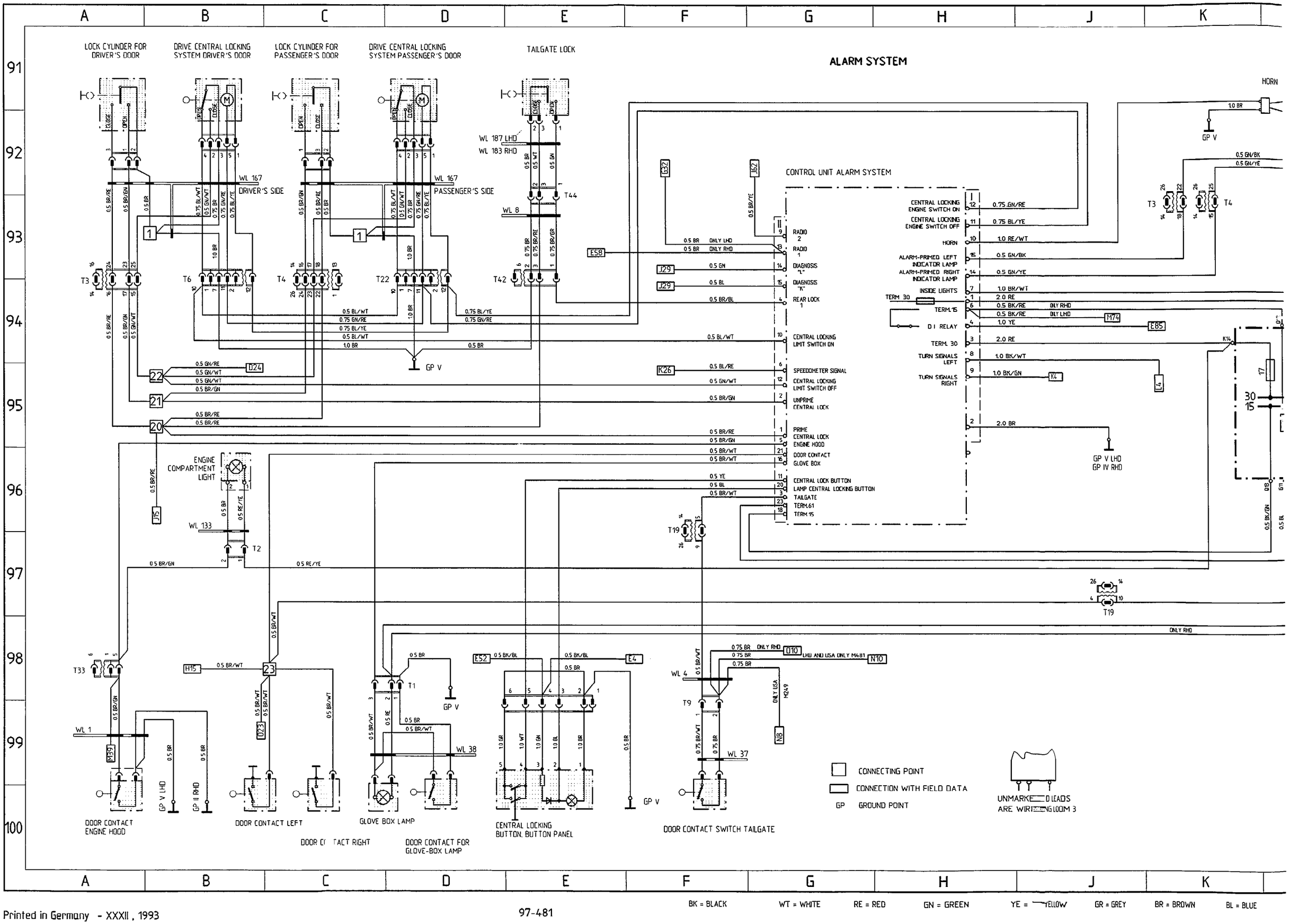
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F G H J K L M N O P

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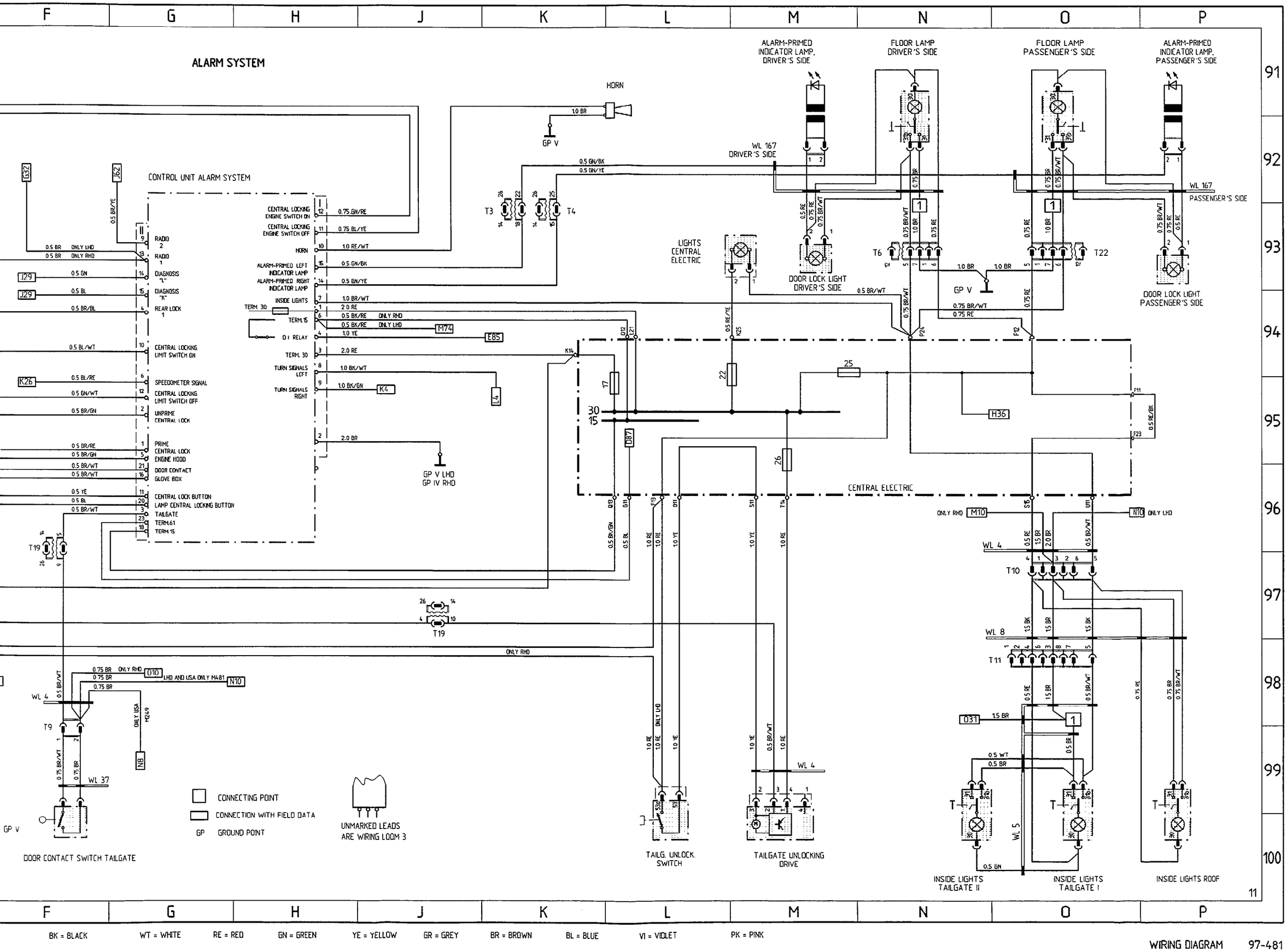
928 GTS MODEL 94 SHEET 11

ALARM SYSTEM, CENTRAL LOCKING SYSTEM INSIDE LIGHTS



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE

ALARM SYSTEM



BK = BLACK WT = WHITE RE = RED GN = GREEN YE = YELLOW GR = GREY BR = BROWN BL = BLUE VI = VIOLET PK = PINK

928 GTS MODEL 94 SHEET 12

CENTRAL ELECTRIC

	FUSE OUTPUT	FUSE INPUT
1	LOW BEAM LEFT	A15
2	LOW BEAM RIGHT	A14
3	HIGH BEAM LEFT	A25
4	HIGH BEAM RIGHT	A24
5	ADDITIONAL DRIVING LIGHTS	B14
6	FOG LIGHT	VIII 30 (ONLY M193)
7	SIDE MARKER LIGHT LEFT	T11,D11
8	SIDE MARKER LIGHT RIGHT	S25,D21
9	ASHTRAY- INSTRUMENT- LIGHTS	K11
10	LICENSE PLATE LIGHTS	J22,T21
11	REAR FOG LIGHT	T12
12	TURN SIGNAL FRONT LEFT	J11,L13
13	TURN SIGNAL REAR LEFT	T22
14	TURN SIGNAL FRONT RIGHT	L23
15	TURN SIGNAL REAR RIGHT	T13
16	REAR WINDOW DEFOGGER	I-II 30
17	WARNING FLASHER ENGINE COMPARTMENT LIGHT	K14
18	POWER WINDOW SUN ROOF REGULATOR	K24
19	HEADLIGHT CLEANING SYSTEM	VII 30
20	FRESH AIR BLOWER	XII 30
21	BOOSTER	F24
22	POWER SEAT LEFT LIGHTS CE	K25
23	POWER SEAT RIGHT	M12

	FUSE OUTPUT	FUSE INPUT
24	TWO-TONE HORNS	XVI 30, T15
25	INSIDE LIGHTS DIAGNOSTIC CONNECTOR INSTRUMENT CLUSTER	XXI 1, F13
26	TAILGATE UNLOCKING	T14
27	CONCEALED HEADLIGHT MOTOR	XXII-XXIV 30a
28	ABS	XV 30
29	RADIATOR FAN 1	B22
30	RADIATOR FAN 2	B23
31		
32		
33	CIGAR LIGHTER	O14
34	WINDSHIELD WIPERS HEATED SPRAY JET	XIII5, L24
35	STOP LIGHT, CRUISE CONTROL	U24, O13
36	CONTROL UNIT FAN	C15
37	AIR CONDITIONING SYSTEM	O12
38	FUEL PUMP, HEATER HEATED OXYGEN SENSOR	U25
39	INSTRUMENT, CONTROL LAMPS KICKDOWN, SOLENOID VALVE SWITCH FOR REAR WINDOW WIPER	O23, O24
40	BACKUP LIGHT, MIRROR ADJUSTMENT TIRE PRESSURE CONTROL	XVIII30, P14
41	LIGHTS, LIGHT SWITCH BUTTON PANEL RELAY TIMING CONTROL UNIT INSIDE LIGHTS DIAGNOSTIC CONNECTOR TERM 15	P25
42	REAR WINDOW WIPER	U23
43	TELEPHONE	N24, O25
44	SEAT HEATER	P13
45	ADD. AC	U22

I-II REAR WINDOW DEFOGGER

III DAYTIME RUNNING LIGHT

IV FOG LIGHT

V STARTER

X SUPPLY

XI WIPER INTERMITTENT CONTROL

XII FRESH AIR BLOWER

XIII FLASHER

XIV DEF

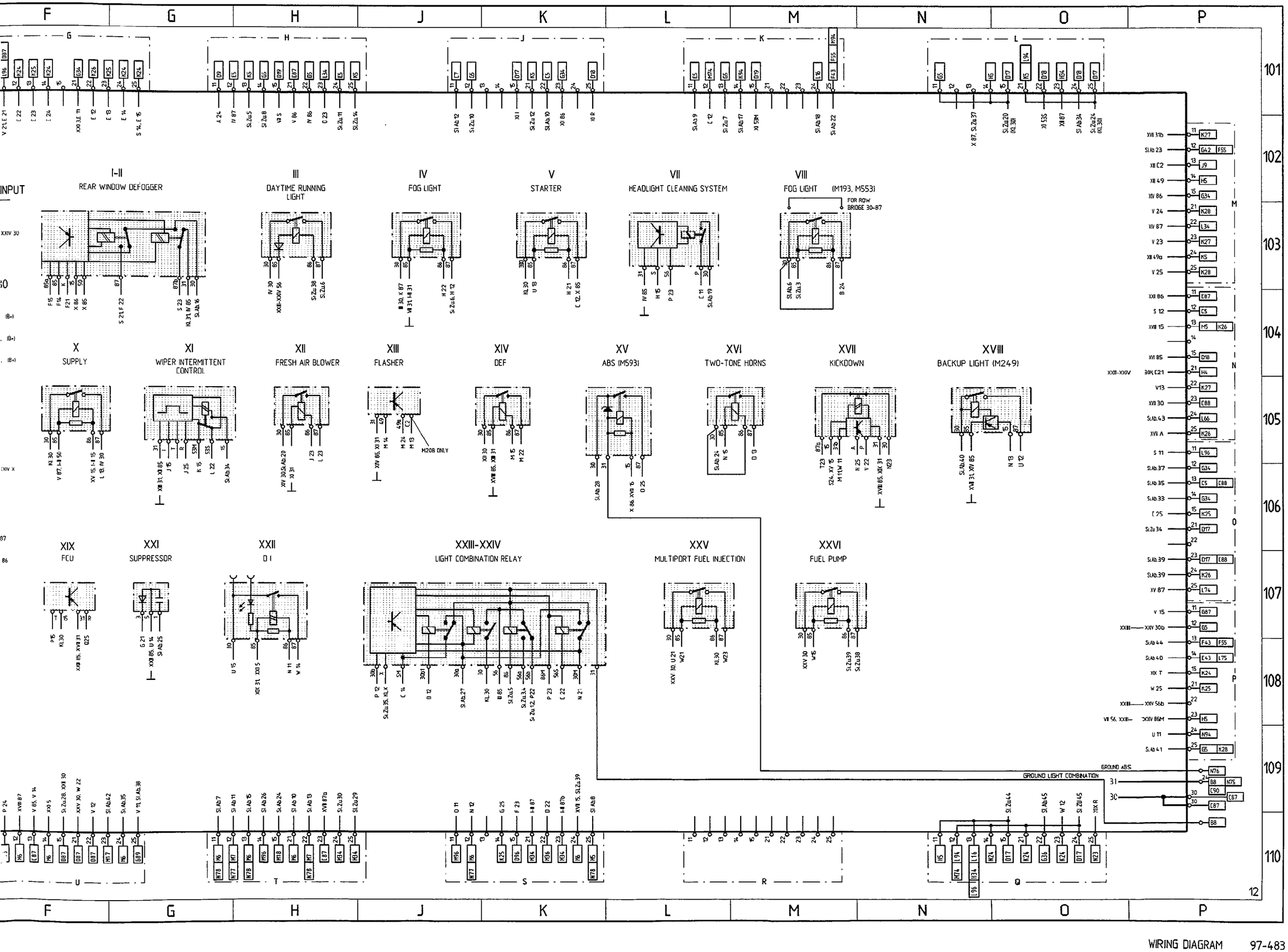
XV ABS (MS

XIX FCU

XXI SUPPRESSOR

XXII D I

XXIII-XXIV LIGHT COMBINATION RELAY


F
G
H
J
K
L
M
N
O
P
101
102
103
104
105
106
107
108
109
110
12
INPUT
I-II
REAR WINDOW DEFOGGER
III
DAYTIME RUNNING LIGHT
IV
FOG LIGHT
V
STARTER
VII
HEADLIGHT CLEANING SYSTEM
VIII
FOG LIGHT (M193, M553)
FOR ROW BRIDGE 30-87
X
SUPPLY
XI
WIPER INTERMITTENT CONTROL
XII
FRESH AIR BLOWER
XIII
FLASHER
M208 ONLY
XIV
DEF
XV
ABS (M593)
XVI
TWO-TONE HORNS
XVII
KICKDOWN
XVIII
BACKUP LIGHT (M249)
XIX
FCU
XXI
SUPPRESSOR
XXII
DI
XXIII-XXIV
LIGHT COMBINATION RELAY
XXV
MULTIPORT FUEL INJECTION
XXVI
FUEL PUMP
GROUND ABS
GROUND LIGHT COMBINATION

CONSTRUCTION COMPONENTS

A | B | C | D | E | F | G | H | J | K

CONSTRUCTION COMPONENTS

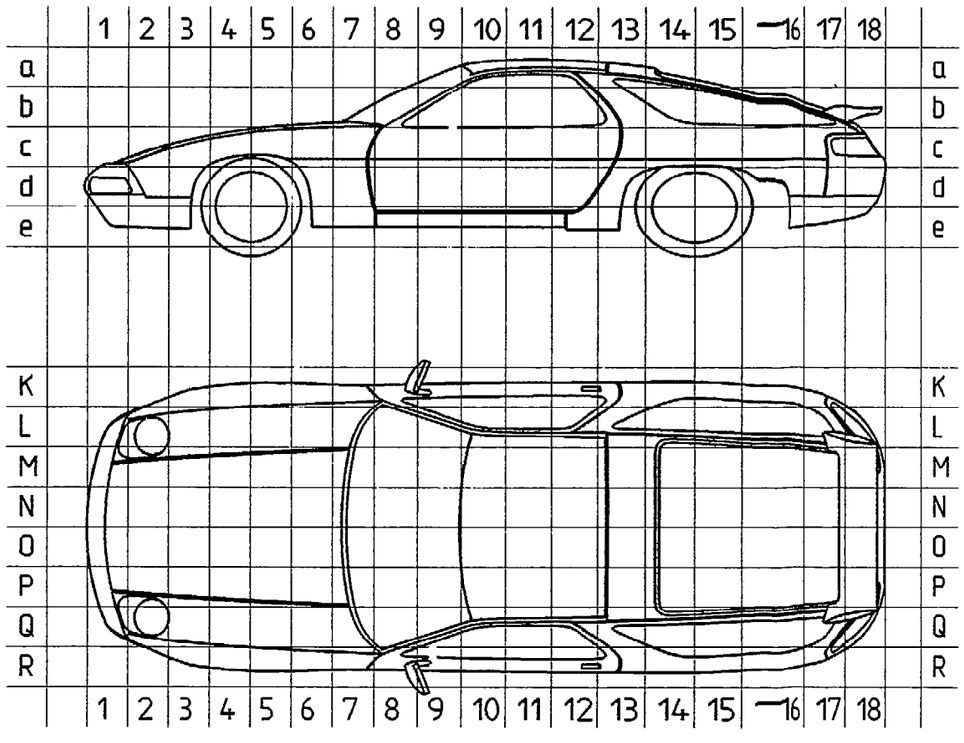
DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE	FIELD IN WIRING DIAGRAM
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT	7cQ		IN DRIVER'S FOOTWELL ON SIDE	DJ 71-72
ABS/PORSCHE DIFFER. LOCK CONTROL UNIT		7cQ	ABOVE CENTRAL ELECTRIC	DJ 71-72
ALARM-PRIMED INDICATOR LAMPS	12bK/R	12bK/R	IN PUSH-BUTTON	MP 91,92
ASHTRAY LIGHT	9dN-0	9dN-0	IN CENTRE CONSOLE	GH 31
ACCELERATING SENSOR	10eQ	10eQ	UNDER THE LEFT SEAT	K 73
AIR CONDITIONING SYSTEM CONTROL UNIT	8cN-0	8cN-0	IN HEATER BOX	AB 34-36
BATTERY	17d-e P	17d-e P	UNDER THE SPARE WHEEL	C 82
BOOSTER	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	GH 64,65
BRAKE PAD WEAR INDICATOR			AT EVERY WHEEL	D-H 79,80
BLOWER FINAL STAGE	1cM	1cM	ON HEADLIGHT RIGHT	O 39,40
BLOWER VSIDE SENSOR	8cM	8cP	IN CENTRE CONSOLE	AB 33,34
BLOWER MOTOR	7cL	7cQ	IN HEATER BOX	H 40
BLOWER SWITCH FRESH AIR	8cO	8cN	IN THE CENTER CONSOLE, ABOVE THE RADIO	JK 31,32
BLOWER SWITCH ADDITIONAL AIR CONDITIONING SYSTEM	8cN	8cO	IN THE CENTER CONSOLE, ABOVE THE RADIO	G 37,38
BUTTON PANEL AC SWITCH			IN CENTRE CONSOLE	EF 31,32
BACKUP LIGHT SWITCH			ON GEARBOX	P5, L1,2
BULB CONTROL UNIT	7cL	7cQ	ON PASSENGER'S PARCEL TRAY	NO 1
CONCEALED HEADLIGHT LEFT				A 7
CONCEALED HEADLIGHT RIGHT				A 4
CONCEALED HEADLIGHT MOTOR			AT LEFT HEADLAMP BODY	A 5,6
CODING ELEMENT	7dL	7dQ	IN PASSENGER'S FOOTWELL	OP 83,84
CLUTCH SWITCH			AT CLUTCH PEDAL	A 89,90
COOLANT FAN FINAL STAGE	1cN	1cN	IN ENGINE COMPARTMENT ON FRONT RIGHT END PANEL	O 39,40
COOLANT FAN CONTROL UNIT	10eK	10eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	MN 39,40
CONTROL FOR ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	EF 39,40
CONTROL UNIT AIRBAG	8dO	8dO	IN CENTRE CONSOLE	M-O 71
CONTROL UNIT ALARM SYSTEM	10cM	10cP	UNDER THE LEFT SEAT	GH 92-96
CONTROL UNIT POWER WINDOWS, SUNROOF	10eP	10eP	UNDER THE LEFT SEAT	JK 14
CONTROL UNIT CRUISE CONTROL	6dQ		IN DRIVER'S FOOTWELL BELOW THE FOOT REST	AB 88,89
CONTROL UNIT CRUISE CONTROL		7dN-0	IN CENTRAL CONSOLE AT FRONT	AB 88,89
CRUISE CONTROL SWITCH	8cP	8cP	ON STEERING COLUMN	A 87
CLOCK	9cN-0	9cN-0	IN CENTRE CONSOLE BELOW RADIO	F 1
CENTRAL ELECTRIC	7dM	7dP	IN PASSENGER'S FOOTWELL ON FIREWALL	
CENTRAL LOCK BUTTON			IN CENTRE CONSOLE	E 99,100
CIGAR LIGHTER	9cN	9cN	IN ASHTRAY	GH 31
COOLANT TEMP. SENSOR	4cO	4cO	ON ENGINE	P 26
COOLANT LEVEL SWITCH			ON EXPANSION TANK	M 29,30
DIAGNOSTIC CONNECTOR	10dK	10dQ	UNDER THE BOOSTER COVER ON RIGHT SILL	JK 30
D I CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	L 82-84
DRIVE CENTRAL LOCKING SYSTEM DRIVER'S DOOR			ON DRIVER'S DOOR	B 91,92
DRIVE CENTRAL LOCKING SYSTEM PASSENGER'S DOOR			IN PASSENGER'S DOOR	D 91,92
DRIVE CRUISE CONTROL	6dQ	6dQ	IN WHEEL HOUSING	B 90
DOOR CONTACT SWITCH LEFT	7dR	7dR	IN A-PILLAR	BC 99,100
DOOR CONTACT SWITCH RIGHT	7dK	7dK	IN A-PILLAR	C 99,100
DOOR CONTACT FOR GLOVE COMPARTMENT LIGHT			IN GLOVE BOX	D 99,100
DOOR CONTACT SWITCH TAILGATE	18bN-0	18bN-0	ON TAILGATE LOCK	F 99,100
DOOR LOCK LIGHT PASSENGER'S SIDE			IN DOOR	P 93
DOOR LOCK LIGHT DRIVER'S SIDE			IN DOOR	M 93
DELAYING RELAY SEAT HEATER			UNDER THE SEAT	M 42
DISTRIBUTER			ON ENGINE	GH 82,83
ENGINE SPEED SENSOR			ON ENGINE	JK 83,84
EVAPORATOR SENSOR	7cN-0	7cN-0	IN HEATER BOX	H 37,38
ENGINE COMPARTMENT LIGHT	3cN-0	3cN-0	ON ENGINE HOOD	B 96
FLOOR LAMP DRIVER'S SIDE	9dR	9dK	IN DRIVER'S FOOTWELL	N 91,92
FLOOR LAMP PASSENGER'S SIDE	9dK	9dR	IN PASSENGER'S FOOTWELL	O 91,92
FUEL INJECTORS			ON ENGINE	L-N 90
FREQUENCY SWITCHES			AT THE LOUDSPEAKER	FG 66, H66
FRESH AIR BLOWER ENGINE	1dN-0	1dN-0	ON RADIATOR	LM 31,32
FRONT SENSOR AIRBAG PASSENGER'S SIDE	7cL	7cL	IN PASSENGER COMPARTMENT ABOVE CONTROL UNIT	OP 73,74
FRONT SENSOR AIRBAG DRIVER'S SIDE	7cQ	7cQ	IN PASSENGER COMPARTMENT ABOVE CONTROL UNIT	OP 73,74
FREEZING PROTECTION SWITCH AIR CONDITIONING SYSTEM	7cM	7cM	UNDER THE WINDSHIELD WIPER COVER	FG 31
FUEL PUMP			ON FUEL TANK	GH 90
FUEL LEVEL SENSOR	15dM	15dM	IN FUEL TANK	H 30
GENERATOR	4dP	4dP	IN ENGINE COMPARTMENT	DE 81,82
GLOVE BOX LAMP	7cM	7cP	IN GLOVE BOX	CD 100
HALL SENSOR				L 81
HF SENSOR			NOT APPLICABLE WITH R-PROGRAM	D-G 79,80
HIGH PRESSURE AND LOW PRESSURE SWITCH	2dM	2dM	IN FRONT OF AIR CONDITIONING COMPRESSOR RIGHT	P 32
HORN ALARM SYSTEM	7cK	7cR	IN HEATER BOX	L 91,92
HYDRAULIC UNIT ABS	3cQ	3cQ	IN WHEEL HOUSING	AB 73-76

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE	FIELD IN WIRING DIAGRAM
HAZARD LIGHT SWITCH	8cO	8cL	ABOVE IGNITION LOCK	HJ 1
HEATED OXYGEN SENSOR			ON CATALYZER	O 90
HEADLIGHT VERTICAL AIM CONTROL	10eR	10eK	IN THE HANDBRAKE COVER	A4, A 6,7
HEADLIGHT WASHING FLUID PUMP	6cL	6cL	IN WHEEL HOUSING FRONT RIGHT	D 11
INFO SWITCH			ON STEERING WHEEL	E 30
INSIDE TEMP. SENSOR	7cN	7cO	IN THE CENTER CONSOLE, NEXT TO THE VENTILATION	B 32,33
INSIDE LIGHTS ROOF	10aN-0	10aN-0	CLOSE TO SUN VISOR	P 99,100
INSIDE LIGHTS TAILGATE I			ON TAILGATE	O 99,100
INSIDE LIGHTS TAILGATE II			ON TAILGATE	N 99,100
INSTRUMENT CLUSTER				A-C 22-30
INDICATOR SWITCH BRAKE FLUID			IN BRAKE FLUID RESERVOIR	F 21,22
IGNITION FINAL STAGE	1dP	1dP	ON HEADLIGHT LEFT	F 82,83
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82
KICKDOWN SOLENOID VALVE			ON GEARBOX	AB 86
KICK-DOWN SWITCH			ON ACCELERATOR PEDAL	BC 86,87
KNOCK SENSOR			ON ENGINE	LM 81
LICENSE PLATE LIGHTS	18dN-0	18dN-0	IN THE REAR BUMPER	P 6,7
LIGHTS CENTRAL ELECTRIC	6dM	6dP	UNDER THE GLOVE BOX	LM 93
LOCK CYLINDER FOR PASSENGER'S DOOR			IN PASSENGER'S DOOR	C 91,92
LOCK CYLINDER FOR DRIVER'S DOOR			ON DRIVER'S DOOR	A 91,92
M F I JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
MASS AIR FLOW SENSOR	6cN-0	6cN-0	BEFORE THE INTAKE MANIFOLD	OP 84,85
MEMORY SWITCH RIGHT	9cK	9cR	IN PASSENGER'S DOOR	A 51,52
MEMORY SWITCH LEFT	9cR	9cK	ON DRIVER'S DOOR	A 59,60
MICRO SWITCH CENTRAL NOZZLE	8c-bN-0	8c-bN-0	IN THE CENTER CONSOLE, ABOVE THE RADIO	AB 37
MOTOR POWER WINDOW PASSENGER'S SIDE			IN PASSENGER'S DOOR	N 11
MOTOR POWER WINDOW DRIVER'S SIDE			ON DRIVER'S DOOR	F 11
MOTOR SUN ROOF	11aN-0	11aN-0	IN ROOF	E 11
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	D 52-57
MIRROR ADJUSTMENT SWITCH	9cR	9cK	ON DRIVER'S DOOR	AB 46,47, A 55,56
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
OUTSIDE TEMP. SENSOR	8cR	8cK	IN OUTSIDE MIRROW DRIVER'S SIDE	D 21
OIL PRESSURE SENSOR	4dP	4dP	ON ENGINE BLOCK BELOW OIL FILTER	P 27
OIL LEVEL SWITCH	3eN-0	3eN-0	ON OIL PAN, FRONT	P 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 36
ODOMETER RESET SWITCH			UNDER THE INSTRUMENT SCUTTLE	JKL 21,22
POTENTIOMETER INSTRUMENT LIGHT	8cQ		BY STEERING COLUMN LEFT	DE 2
POTENTIOMETER IDLE SPEED CO	6dL	6dQ	IN PASSENGER'S FOOTWELL	OP 88
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL	11eR	11eK	LEFT TO PARKING BRAKE	D 1
POTENTIOMETER FOR WIPING/WASHING	8cO	8cL	UNDER THE IGNITION LOCK	B 16
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM	13dN-0	13dN-0	ON SUPPLEMENTARY AIR CONDITIONING	F 37,38
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
PUSH BUTTON SWITCH FOR POWER WINDOW	11dN-0	11dN-0	IN CENTRE CONSOLE	G 11, L 11
PUSH BUTTON SUN ROOF	11dO	11dO	IN CENTRE CONSOLE	E 14,15
PARKING BRAKE CONTACT	11dQ	11dL	ON PARKING BRAKE	E 21,22
PRESSURE SWITCH FRIGEN	1dM	1dM	ON RADIATOR	L 40
PRESSURE SWITCH COOLANT	6cM	6cM	ON EXPANSION TANK	MN 30
ROOF ANTENNA	12aN-0	12aN-0	ON THE ROOF	EF 61,62
REAR WINDOW DEFOGGER			AT EVERY WHEEL	P 31,32
REAR WINDOW WIPER MOTOR	18cO	18cO	IN LUGGAGE COMPARTMENT AT END-PANEL	P 18,19
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE TOOL KIT COVER	OP 17
RADIATOR FAN	3dN-0	3dN-0	ON RADIATOR	P 38,39
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
RESISTANCE GROUP FOR BLOWER	7cM	7cP	LEFT TO WIPER MOTOR	KL 31,32
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING LEFT	HJ 37,38
STARTER INTERLOCK			ON IGNITION LOCK	L1,2, H21, A85
STOP LIGHT TAILGATE			ON TAILGATE	J 9,10
STOP LIGHT SWITCH	6dP	6dM	AT THE BRAKE PEDAL	C 2,3
SPEED SENSOR			AT EVERY WHEEL	E-H 79,80
SUPPRESSOR FOR RADIO	8dO	8dO	IN CENTRE CONSOLE IN FRONT OF R ADD	DE 61
SWITCHING UNIT Ex (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
SHIFT VALVE RESONANCE FLAP	5cO	5cO	IN ENGINE COMPARTMENT	OP 86
SEAT BELT				O 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
SOLENOID CLUTCH COMPRESSOR	3eN	3eN	ON ENGINE	P 33
SOLENOID VALVE ABS	2cP	2cP	ON HEADLIGHT LEFT	C 72
SOLENOID VALVES AIR CONDITIONING	7cN-0	7cN-0	IN HEATER BOX	B 37-40

A | B | C | D | E | F | G | H | J | K

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
HAZARD LIGHT SWITCH	8cO	8cL	ABOVE IGNITION LOCK	HJ 1
HEATED OXYGEN SENSOR			ON CATALYZER	O 90
HEADLIGHT VERTICAL AIM CONTROL	10eR	10eK	IN THE HANDBRAKE COVER	A4, A 6,7
HEADLIGHT WASHING FLUID PUMP	6cL	6cL	IN WHEEL HOUSING FRONT RIGHT	D 11
INFO SWITCH			ON STEERING WHEEL	E 30
INSIDE TEMP. SENSOR	7cN	7cO	IN THE CENTER CONSOLE, NEXT TO THE VENTILATION	B 32,33
INSIDE LIGHTS ROOF	10aN-O	10aN-O	CLOSE TO SUN VISOR	P 99,100
INSIDE LIGHTS TAILGATE I			ON TAILGATE	O 99,100
INSIDE LIGHTS TAILGATE II			ON TAILGATE	N 99,100
INSTRUMENT CLUSTER				A-C 22-30
INDICATOR SWITCH BRAKE FLUID			IN BRAKE FLUID RESERVOIR	F 21,22
IGNITION FINAL STAGE	1dP	1dP	ON HEADLIGHT LEFT	F 82,83
IGNITION CIRCUIT CONTROL CONTROL UNIT	7dL	7dQ	ON CONTROL UNIT CONSOLE	HJ 81,82
KICKDOWN SOLENOID VALVE			ON GEARBOX	AB 86
KICK-DOWN SWITCH			ON ACCELERATOR PEDAL	BC 86,87
KNOCK SENSOR			ON ENGINE	LM 81
LICENSE PLATE LIGHTS	18dN-O	18dN-O	IN THE REAR BUMPER	P 6,7
LIGHTS CENTRAL ELECTRIC	6dM	6dP	UNDER THE GLOVE BOX	LM 93
LOCK CYLINDER FOR PASSENGER'S DOOR			IN PASSENGER'S DOOR	C 91,92
LOCK CYLINDER FOR DRIVER'S DOOR			ON DRIVER'S DOOR	A 91,92
M F I JETRONIC CONTROL UNIT	7dL	7dQ	IN PASSENGER'S FOOTWELL ON CONTROL UNIT CONSOLE	J 87-89
MASS AIR FLOW SENSOR	6cN-O	6cN-O	BEFORE THE INTAKE MANIFOLD	OP 84,85
MEMORY SWITCH RIGHT	9cK	9cR	IN PASSENGER'S DOOR	A 51,52
MEMORY SWITCH LEFT	9cR	9cK	ON DRIVER'S DOOR	A 59,60
MICRO SWITCH CENTRAL NOZZLE	8c-bN-O	8c-bN-O	IN THE CENTER CONSOLE, ABOVE THE RADIO	AB 37
MOTOR POWER WINDOW PASSENGER'S SIDE			IN PASSENGER'S DOOR	N 11
MOTOR POWER WINDOW DRIVER'S SIDE			ON DRIVER'S DOOR	F 11
MOTOR SUN ROOF	11aN-O	11aN-O	IN ROOF	E 11
MIRROR MEMORY CONTROL UNIT	7cQ	7cL	IN DRIVER'S FOOTWELL ON SIDE	D 52-57
MIRROR ADJUSTMENT SWITCH	9cR	9cK	ON DRIVER'S DOOR	AB 46,47, A 55,56
OUTSIDE TEMP. SENSOR	2-3dQ	2-3dQ	IN AIR DUCT TO GENERATOR	G 31
OUTSIDE TEMP. SENSOR	8cR	8cK	IN OUTSIDE MIRROWDRIVER'S SIDE	D 21
OIL PRESSURE SENSOR	4dP	4dP	ON ENGINE BLOCK BELOW OIL FILTER	P 27
OIL LEVEL SWITCH	3eN-O	3eN-O	ON OIL PAN, FRONT	P 26
OIL TEMPERATURE SWITCH (M249)	13eO	13eO	ON TORQUE CONVERTER LEFT SIDE	P 36
ODOMETER RESET SWITCH			UNDER THE INSTRUMENT SCUTTLE	JKL 21,22
POTENTIOMETER INSTRUMENT LIGHT	8cQ		BY STEERING COLUMN LEFT	DE 2
POTENTIOMETER IDLE SPEED CO	6dL	6dQ	IN PASSENGER'S FOOTWELL	OP 88
POTENTIOMETER FOR HEADLIGHT VERTICAL AIM CONTROL	11eR	11eK	LEFT TO PARKING BRAKE	D 1
POTENTIOMETER FOR WIPING/WASHING	8cO	8cL	UNDER THE IGNITION LOCK	B 16
POTENTIOMETER EXTRA AIR CONDITIONING SYSTEM	13dN-O	13dN-O	ON SUPPLEMENTARY AIR CONDITIONING	F 37,38
PUMP LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THR LH REAR WHEEL	B 77,78
PUMP RELAIS LOCK DIFFERENTIAL	16dO	16dO	UNDER THE SPARE WHEEL COVER	B 79,80
PUSH BUTTON SWITCH FOR POWER WINDOW	11dN-O	11dN-O	IN CENTRE CONSOLE	G 11, L 11
PUSH BUTTON SUN ROOF	11dO	11dO	IN CENTRE CONSOLE	E 14,15
PARKING BRAKE CONTACT	11dQ	11dL	ON PARKING BRAKE	E 21,22
PRESSURE SWITCH FRIGEN	1dM	1dM	ON RADIATOR	L 40
PRESSURE SWITCH COOLANT	6cM	6cM	ON EXPANSION TANK	MN 30
ROOF ANTENNA	12aN-O	12aN-O	ON THE ROOF	EF 61,62
REAR WINDOW DEFOGGER			AT EVERY WHEEL	P 31,32
REAR WINDOW WIPER MOTOR	18cO	18cO	IN LUGGAGE COMPARTMENT AT END-PANEL	P 18,19
REAR WINDOW WIPER RELAY	18cO	18cO	UNDER THE TOOL KIT COVER	OP 17
RADIATOR FAN	3dN-O	3dN-O	ON RADIATOR	P 38,39
RESISTOR INSTRUMENT LIGHTS	7eP	7cM	UNDER THE STEERING CONSOLE	DE 21,22
RESISTANCE GROUP FOR BLOWER	7cM	7cP	LEFT TO WIPER MOTOR	KL 31,32
RESISTANCE GROUP FOR ADD. AIR CONDITIONER	12dO	12dO	ON SUPPLEMENTARY AIR CONDITIONING, LEFT	HJ 37,38
STARTER INTERLOCK			ON IGNITION LOCK	L1,2, H21, A85
STOP LIGHT TAILGATE			ON TAILGATE	J 9,10
STOP LIGHT SWITCH	6dP	6dM	AT THE BRAKE PEDAL	C 2,3
SPEED SENSOR			AT EVERY WHEEL	E-H 79,80
SUPPRESSOR FOR RADIO	8dO	8dO	IN CENTRE CONSOLE IN FRONT OF RADIO	DE 61
SWITCHING UNIT EX (M193)	8dN		IN CENTRE CONSOLE BELOW RADIO	P 28-30
SHIFT VALVE RESONANCE FLAP	5cO	5cO	IN ENGINE COMPARTMENT	OP 86
SEAT BELT				O 22
SEAT MEMORY CONTROL UNIT LEFT	10dP	10dP	IN SEAT	K-O 57
SEAT MEMORY CONTROL UNIT RIGHT	10dM	10dM	IN SEAT	K-O 53,54
SOLENOID CLUTCH COMPRESSOR	3eN	3eN	ON ENGINE	P 33
SOLENOID VALVE ABS	2cP	2cP	ON HEADLIGHT LEFT	C 72
SOLENOID VALVES AIR CONDITIONING	7cN-O	7cN-O	IN HEATER BOX	B 37-40

DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
SOLENOID VALVE LOCK DIFFERENTIAL	17dQ	17dQ	BEHIND THE LH REAR WHEEL	C 72
SOLENOID VALVE (ADDITIONAL AIR CONDITIONER)	10eM	10eM	UNDER THE RIGHT SEAT	F 38
STEERING IGNITION LOCK			ON STEERING COLUMN	B 14-16
SPEAKER				F-J 66-69
TRAILER COUPLING	18dN-O	18dN-O	UNDER THE REAR BUMPER	Q75
TURN SIGNAL / DIMMER SWITCH	9cP	9cN	ON STEERING COLUMN	JK 1,2
THROTTLE VALVE SWITCH			ON ENGINE	JK 90
TWO-TONE HORNS				CD 20
TRANSMISSION PROTECTION SWITCH			ON GEARBOX (ONLY AUTOMATIC)	D 84,85
TAILGATE UNLOCKING SWITCH	10eR	10eK	IN THE HANDBRAKE COVER	KL 99,100
TAILGATE UNLOCKING DRIVE	18cO	18cO	UNDER THE TOOL KIT COVER	M 99.100
TAILGATE LOCK	18bN-O	18bN-O	UNDER THE REAR SPOILER	E 91
TANK VENTING VALVE	4cN	4cN	IN ENGINE COMPARTMENT NOT APPLICABLE WITH R-PROGRAM	OP 86,87
TIRE PRESSURE CONTROL CONTROL UNIT	7cP	7cM	ON INTRUMENT PANEL	K 76-78
TEMPERATURE SENSOR DOUBLE NTC	4cN	4cN	ON ENGINE	OP 87,88
TEMPERATURE SENSOR COOLING WATER	2eP	2eP	ON RADIATOR	K 40
TEMPERATURE SWITCH SUCTION TUBE	6cO	6cO	AT THE INTAKE MAINFOLD	K 40
THERMO ELEMENTS CATALYTIC CONVERTER	8eN-O	8eN-O	ON CATALYZER	O 28,29
THERMO ELEMENTS IGNITION CIRCUIT			IN THE EXHAUST MANIFOLD,RIGHT AND LEFT SIDE	JK 82
TOOTHED BELT TENSION SWITCH	3dN	3dN	ON ENGINE	N 22
TIME RELAY	8dN		IN CENTRE CONSOLE BELOW RADIO	P 23-25
WARNING BUZZER	8cP	8cM	ON STEERING PROTECTIVE TUBE	D 29,30
WASHING JETS	6bN-O	6bN-O	ON THE ENGINE HOOD	B 11,12
WASHING FLUID LEVEL SWITCH	6cL	6cL	ON WINDSHIELD WASHER TANK	MN 28,29
WIPE/WASH SWITCH	8cO	8cO	ON STEERING COLUMN	AB 18-20
WINDSHIELD WASHING FLUID PUMP	6cL	6cL	IN WHEEL HOUSING FRONT RIGHT	D 11



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PLUG CONNECTIONS, GROUND POINTS

PLUG CONNECTIONS

CODE	NUMBER OF PINS	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE	FIELD IN WIRING DIAGRAM
T1	3	GLOVE BOX LAMP	7cL	7cQ	ABOVE DI MFI CONTROL UNIT	CD98
T2	2	ENGINE COMPARTMENT LIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	B97
T3	26	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C55-60,D22,A93,94,K92,93
T4	26	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	B42,C51-54,C93,94,K92,93
T5	30	INSTRUMENT SCUTTLE	7cQ	7cL	AT SUPPORTING TUBE ON STEERING COLUMN	C3-H3, K23,H33
T6	12	DOOR DRIVER'S SIDE	7cQ	7cL	ON DRIVER'S DOOR	C44,C60,FG65,G14,B93,94,N93
T7	2	TRANSMISSION BACKUP LIGHT SWITCH	16dO	16dO	UNDER THE SPARE WHEEL COVER	P5
T8	2	LICENSE PLATE LIGHTS	18cN	18cO	UNDER THE TOOL KIT COVER	P6
T9	2	DOOR CONTACT SWITCH TAILGATE	18cO	18cO	UNDER CARPET IN FRONT OF TOOL KIT	F98
T10	6	REAR WIRING LOOM / B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	LM10,N31-32,097
T11	8	B-PILLAR / TAILGATE	13aN	13aO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	K10,N031,32,098
T12	2	SIDE MARKER LIGHT LEFT REAR	18cO		UNDER THE TOOL KIT COVER	D10
T13	2	SIDE MARKER LIGHT RIGHT REAR	18cN		UNDER THE TOOL KIT COVER	02
T14						
T15						
T16						
T17						
T18	14	FRONT END / ENGINE WIRING LOOM	3cM	3cM	IN ENGINE COMPARTMENT AT RADIT WHEEL HOUSING	026,27,...3,JK39,D83
T19	26	INSTRUMENT PANEL - / REAR WIRING LOOM	7dL	7dL	NEAR CENTRAL ELECTRIC	EF13,GH28,HJ23,M4,F96,97,J97
T20	14	SEAT DRIVER'S SIDE	10eO	10eL	UNDER THE SEAT, ADVANCE SEAT	F58-60,HJ46,K43-44
T21	14	SEAT PASSENGER'S SIDE	10eL	10eO	UNDER THE SEAT, ADVANCE SEAT	H42,F51-53
T22	12	DOOR PASSENGER'S SIDE	7cL	7cQ	IN PASSENGER'S DOOR	C42,C51,H65,L14,D93,94,093
T23	21	ABS	7dQ	7dQ	FOOTWELL AT LEFT SIDE PANEL	K73-76,F30
T24	6	TRAILER COUPLING	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	OP75,76
T25	1	WIRE CONNECTOR	L4	L4	IN ENGINE COMPARTMENT RIGHT	C85
T26	2	HEATED SPRAY JET LEFT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C12
T27	2	HEATED SPRAY JET RIGHT	6cO	6cO	UNDER THE WIPER SYSTEM COVER	C11
T28						
T29	4	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33
T30	6	AIR CONDITIONING SYSTEM	8cN	8cN	IN CENTRE CONSOLE	F33-34
T31	4	INSIDE TEMP. SENSOR FOR AIR CONDITIONER	8cN	8cN	IN CENTRE CONSOLE	BC33
T32	3	AUTOMATIC TRANSMISSION	16dO	16dO	UNDER THE SPARE WHEEL COVER	036,086
T33	6	FRONT END / INSTRUMENT PANEL WIRING LOOM	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	C2,A98
T34	8	ADDITIONAL AIR CONDITIONER	12dN	12dN	ON SUPPLEMENTARY AIR CONDITIONING, RIGHT	G39
T35	1	ADDITIONAL AIR CONDITIONER	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	F36
T36	6	MIRROR PASSENGER'S SIDE				B41-42
T37	15	MIRROR DRIVER'S SIDE				CD48, C21
T38	15	MIRROR PASSENGER'S SIDE WITH MEMORY				A52-54
T39	15	MIRROR DRIVER'S SIDE WITH MEMORY				A57-58
T40						
T41						
T42	6	WL INSTRUMENT PANEL / WL B-PILLAR	13dL	13dQ	UNDER THE PASSENGER SIDE REAR TRIM PANEL	E13,E93,94
T43						
T44	3	WIRING LOOM B-PILLAR / TAILGATE LOCK	13aN	13aO	UNDER TAILGATE TRIM PANEL CLOSE TO SUN VISOR	E92
T45	2	IGNITION FINAL STAGE / CONTROL UNIT	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	KL83,84
T46	19	DIAGNOSTIC CONNECTOR	11eK	11eR	UNDER THE COVER ON PASSENGER'S SIDE SILL	JK30
T47	8	CODING ELEMENT FOR IGNITION SYSTEM AND LH-JETRONIC	7dL	7dQ	ON CONTROL UNIT CONSOLE	N...
T48	3	HEATED OXYGEN SENSOR	6dL	6dQ	UNDER THE CENTRAL ELECTRIC	089
T49	2	FRESH AIR BLOWER	7cL	7cL	ON BLOWER HOUSING	LM32
T50	6	AUTOM. TRANSM. COUPLING TO GEARBOX WIRING LOOM	16dO	16dO	UNDER THE SPARE WHEEL COVER	HJ22
T51	6	AUTOM. TRANSMISSION, COUPLING TO REAR WIRING LOOM	16dO	16dO	UNDER THE SPARE WHEEL COVER	BC85,86,M2
T52	6	AIRBAG	8dN		IN CENTRE CONSOLE	M73
T53	2	AIRBAG	8dN		IN CENTRE CONSOLE	M73

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	POSITION IN VEHICLE RHD	NOTE
GP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
GP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
GP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
GP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
GP V	FIREWALL	8dM	8dP	ABOVE CENTRAL ELECTRIC
GP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
GP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
GP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
GP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
GP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
GP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
GP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT

ABBREVIATIONS

CODE	MEANING	CODE	MEANING
ABS	ANTILOCK BRAKING SYSTEM	PIN	PIN
AC	AIR CONDITIONING SYSTEM	POT	POTENTIOMETER
DEF	DEFROST	PSD	PORSCHE LIMITED SLIP DIFFERENTIAL
SS	SPEED SENSOR	RDK	TIRE PRESSURE CONTROL
ESO	ENGINE-SPEED SENSOR OUTPUT	ROW	REST OF WORLD
MFI + DI	DIGITAL ENGINE ELECTRONICS	RHD	RIGHT-HAND DRIVE
DI	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	CL	CLOSE
FCU	FREQUENCY CONVERTER UNIT	SA	SAUDI ARABIA
RA	REAR AXLE	CU	CONTROL UNIT
HF	HIGH FREQUENCY	WP	WELD POINT
RL	REAR LEFT	HCS	HEADLIGHT CLEANING SYSTEM
RR	REAR RIGHT	PL	PLUG
IC	INSTRUMENT CLUSTER	DP	DISCONNECTING POINT
TE	TERMINAL	USA	USA
SCS	COMBINED STEERING COLUMN SWITCH	FA	FRONT AXLE
WL	WIRING LOOM	FL	FRONT LEFT
LED	LIGHT-EMITTING DIODE	FR	FRONT RIGHT
LHD	LEFT-HAND DRIVE	CP	CONNECTING POINT
GP	GROUND POINT	WW	WORLWIDE
LF	LOW FREQUENCY	CE	CENTRAL ELECTRIC
FOG	FOG LIGHT	ADL	ADDITIONAL DRIVING LIGHTS
NO	NUMBER	CLS	CENTRAL LOCKING SYSTEM
RFL	REAR FOG LIGHT		
NTC	NEGATIVE TEMPERATURE COEFFICIENT		
OP	OPEN		

FIELD IN WIRING DIAGRAM
C098
B97
C44,C55-60,D22,A93,94,K92,93
B42,C51-54,C93,94,K92,93
C3-H3, K23,H33
C44,C60,FG65,G14,B93,94,N93
P5
P6
F98
LM10,N31-32,097
K10,N031,32,098
010
02
026,27,...3,JK39,083
EF13,GH28,HJ23,M4,F96,97,J97
FS8-60,HJ46,K43-44
H42,F51-53
C42,C51,H65,L14,D93,94,093
K73-76,F30
0P75,76
C85
C12
C11
F33
F33-34
BC33
036,086
C2,A98
G39
F36
B41-42
CD48, C21
A52-54
A57-58
E13,E93,94
E92
KL83,84
JK30
HJ...
089
LM32
HJ22
BC85,86,M2
M73
M73

GROUND POINTS

CODE	DESIGNATION, FUNCTION	POSITION IN VEHICLE LHD	RHD	NOTE
GP I	BODY FRONT LEFT	1cO	1cO	IN ENGINE COMPARTMENT AT FRONT END PANEL
GP II	BODY FRONT RIGHT	2cM	2cM	IN ENGINE COMPART. NEAR AIR CONDITIONING CONDENSER
GP III	WHEEL HOUSING WALL FRONT RIGHT	3cM	3cM	IN ENGINE COMPARTM. RIGHT SIDE ABOVE IGNITION COIL
GP IV	STEERING CONSOLE	8cP	8cM	ON STEERING CONSOLE, BELOW LEFT
GP V	FIREWALL	8dM	8dP	ABOVE CENTRAL ELECTRIC
GP VI	BODY REAR	16dO	16dO	UNDER THE SPARE WHEEL COVER
GP VII	GROUND STRAP BATTERY	18dO	18dO	UNDER THE TOOL KIT COVER
GP VIII	ENGINE POWER	6cO	6cO	ON UPPER CRANKCASE, REAR LEFT
GP IX	ENGINE ELECTRONICS	6cN	6cN	ON UPPER CRANKCASE, REAR RIGHT
GP X	WHEEL HOUSING LEFT OUTER	3dQ	3dQ	BEHIND ABS HYDRAULIC UNIT
GP XI	WHEEL HOUSING RIGHT INNER	5cM	5cM	IN ENGINE COMPART. ON RIGHT SUSPENSION STRUT MOUNT
GP XII	WHEEL HOUSING LEFT INNER	5cP	5cP	IN ENGINE COMPARTM. ON LEFT SUSPENSION STRUT MOUNT

ABBREVIATIONS

CODE	MEANING	CODE	MEANING
ABS	ANTILOCK BRAKING SYSTEM	PIN	PIN
AC	AIR CONDITIONING SYSTEM	POT	POTENTIOMETER
DEF	DEFROST	PSD	PORSCHE LIMITED SLIP DIFFERENTIAL
SS	SPEED SENSOR	RDK	TIRE PRESSURE CONTROL
ESO	ENGINE-SPEED SENSOR OUTPUT	ROW	REST OF WORLD
MFI + DI	DIGITAL ENGINE ELECTRONICS	RHD	RIGHT-HAND DRIVE
D I	ELECTRIC IGNITION SYSTEM WITH KNOCK CONTROL	CL	CLOSE
FCU	FREQUENCY CONVERTER UNIT	SA	SAUDI ARABIA
RA	REAR AXLE	CU	CONTROL UNIT
HF	HIGH FREQUENCY	WP	WELD POINT
RL	REAR LEFT	HCS	HEADLIGHT CLEANING SYSTEM
RR	REAR RIGHT	PL	PLUG
IC	INSTRUMENT CLUSTER	DP	DISCONNECTING POINT
TE	TERMINAL	USA	USA
SCS	COMBINED STEERING COLUMN SWITCH	FA	FRONT AXLE
WL	WIRING LOOM	FL	FRONT LEFT
LED	LIGHT-EMITTING DIODE	FR	FRONT RIGHT
LHD	LEFT-HAND DRIVE	CP	CONNECTING POINT
GP	GROUND POINT	WW	WORLDWIDE
LF	LOW FREQUENCY	CE	CENTRAL ELECTRIC
FOG	FOG LIGHT	AOL	ADDITIONAL DRIVING LIGHTS
NO	NUMBER	CLS	CENTRAL LOCKING SYSTEM
RFL	REAR FOG LIGHT		
NTC	NEGATIVE TEMPERATURE COEFFICIENT		
OP	OPEN		

M - NUMBERS

M 061	ENGLAND VERSION
M 139	ADJUSTABLE SEAT HEATING SEAT LEFT
M 193	JAPAN VERSION
M 195	TELEPHONE PREPARATION CELLULAR (MOTOROLA)
M 208	TRAILER COUPLING
M 215	SAUDI-ARABIA VERSION
M 249	AUTOMATIC TRANSMISSION
M 261	OUTSIDE MIRROR FLAT PASSENGER'S SIDE
M 340	ADJUSTABLE SEAT HEATING SEAT RIGHT
M 383	SPORT SEAT LEFT
M 387	SPORT SEAT RIGHT
M 479	AUSTRALIAN VERSION
M 481	TRANSMISSION
M 484	USA VERSION
M 513	LUMBAR SUPPORT SEAT RIGHT
M 525	ALARM SYSTEM WITH CONTINUOL...JS TONE (SWITZERLAND)
M 528	OUTSIDE MIRROR KONVEX PASSE...NGER'S SIDE
M 537	SEATING POSITION CONTROL COM...FORT SEAT LEFT
M 538	SEATING POSITION CONTROL COM...FORT SEAT RIGHT
M 553	USA - CANADA VERSION
M 562	AIRBAG
M 570	ADD. AIR CONDITIONER (INCREAS...D COOLING CAPACITY)
M 576	REAR FOG LIGHT
M 586	LUMBAR SUPPORT SEAT LEFT
M 602	HIGH MOUNTED STOP LIGHT
M 612	TELEPHONE PREPARATION C-NE...WORK (PHILIPS)
M 650	ELECTRIC SUN ROOF

